Zootaxa 470: 1–10 (2004)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

470

Rhodacarella, a new genus of Rhodacaridae mites from North America (Acari: Mesostigmata: Rhodacaridae)

MARIA LOURDES MORAZA

Departamento de Zoología y Ecología, Facultad de Ciencias, Universidad de Navarra, C/ Irunlarrea s/n, Pamplona 31080, (Navarra), Spain. mlmoraza@unav.es

Abstract

A new genus of mesostigmatic mites, *Rhodacarella,* is described on the basis of material from bat guano found in a cave in Arizona (U.S.A). *Rhodacarella cavernicola* **sp. nov**., is described as the type species of the genus. A key to genera of the subfamily Rhodacarinae is given.

Key words: Acari, Mesostigmata, Rhodacaridae, *Rhodacarella cavernicola* gen. nov., sp. nov., taxonomy

Introduction

The family Rhodacaridae is used in a variety of broader and narrower senses by different authors. For Lee (1970), the family Rhodacaridae Oudemans, 1902 includes six subfamilies (Rhodacarinae, Gamasiphinae, Laelaptonyssinae, Ologamasinae, Sessiluncinae and Tangaroellinae) although for other authors, Lee´s subfamilies have the taxonomic category of families. For Johnston (1968) and Krantz (1978), the family Rhodacaridae Oudemans, 1902 (Rhodacarinae of Lee (1970)) belongs, together with Digamasellidae and Ologamasidae, to the superfamily Rhodacaroidea.

Members of the Rhodacaridae are among the most common small- and medium-sized mesostigmatic predator mites found in a wide variety of soils, in humus, moss, hollows of trees, sea shores, associated with termites and, occasionally, in nests of small mammals. Their elongate idiosoma, divided dorsal shield, 3-tined palptarsal apotele, and enlarged and well-sclerotized dentate chelicerae allow members of this family to be readily identified.

Accepted by Z.-Q. Zhang: 17 Mar. 2004; published: 23 Mar. 2004

Five genera are included in the Rhodacarinae: *Rhodacarus* Oudemans recorded from North America, Africa, Europe, and European and Asiatic parts of Russia; *Rhodacarellus* Willmann from the Old and New World; *Rhodacaropsis* Willmann collected in Germany, eastern North America (Haq, 1965), South and northern Africa (Loots, 1969), Cuba (Petrova & Beron 1973) and Asia (Luxton 1992); *Minirhodacarellus* Shcherbak, 1980 from Central Europe, and *Pararhodacarus* Jordaan et al., 1988, from the Afrotropical region.

Material and methods

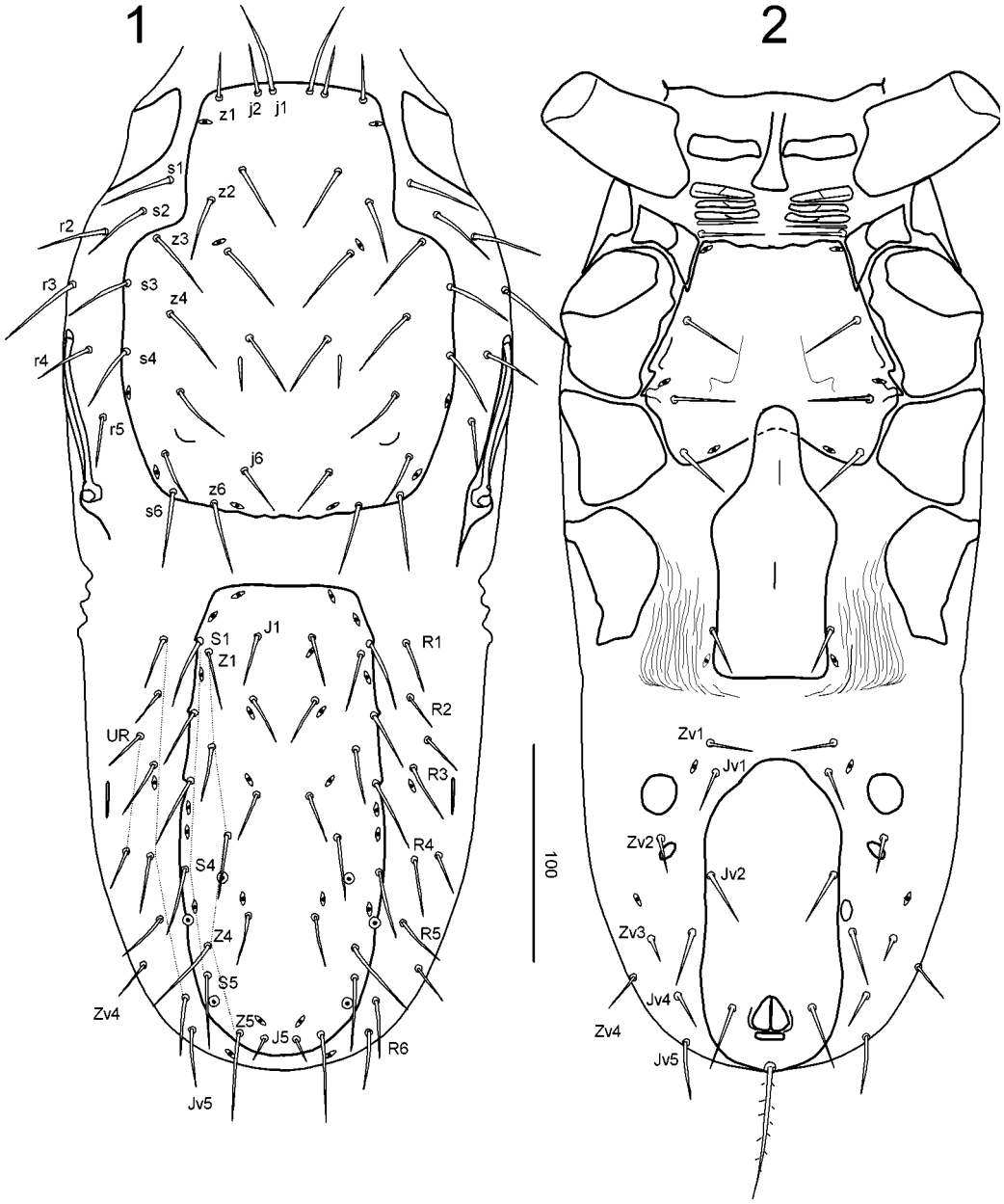
Mites were extracted from samples of bat feces taken from a cave, using Berlese Tullgren funnels. The two specimens were mounted individually in Hoyer´s medium and sealed with Glyptal® insulating varnish. Morphological observations, measurements (given in micrometers and made with stage-calibrated eyepiece micrometers) and illustrations were made using compound microscopes equipped with phase-contrast optical systems. Idiosomal setal notation follows Lindquist & Evans (1965), with modifications for the caudal region as given by Lindquist (1994) and Lindquist & Moraza (1999); leg chaetotxy follows Evans (1963). Idiosomal notation of glands and lyrifissures follows Johnston & Moraza (1991).

Rhodacarella gen. nov. (Figs 1–9)

Type species: *Rhodacarella cavernicola* new species. Genus based on adult female material representing one species.

Diagnosis. Small weakly sclerotized mites with character states of the family. Three pairs of dorsal setae (*j1, j2, z1*) on the anterior edge of podonotal shield; podonotum with 22 pairs of setae, including 16 pairs (*j1–j6, z1–z6, s3–s6*) on podonotal shield, and six pairs on soft marginal cuticle (*s1–s2, r2–r5*); on podonotal shield scleronoduli absent; opisthonotum with 23 pairs of setae, 15 pairs on opisthonotal shield (*J1–J5, Z1–Z5, S1–S5*) and eight pairs on the soft marginal cuticle (*R1–R6, UR1, UR2*); dorsal poroidotaxy and adenotaxy includes: *idj4 ,idj6, idz1, idz6, ids4 ids5, ids6, idJ1–J5, idS1, idS3, idS4, idR3, gdZ3* and *gdS4*. Pre-endopodal shields present, anterior to presternal elements; with free endopodals between coxae I and II; ventrianal shield narrow, with one pair of ventral setae; eight pairs of ventral setae in the soft opistogastric cuticle (*Jv1, Jv3–Jv5, Zv1–Zv4*); small metapodal shields present. Tectum with a medial pointed projection and serrate anterior margin; arthrodial process at the base of movable cheliceral digit is a simple coronet; subcapitulum with hypostomal seta 3 approximately level with *hyp2*. Pretarsus I present; legs I–IV with well-developed paired claws and lobulate pulvilli; coxa I with dorsal spine;

setation of trochanters of legs, respectively, 5-5-5-5; that of femora, 12-11-6-6; that of genua, 13-10-8-9; that of tibia, 12-10-8-9. Sperminduction pore in trochanter III.



FIGURES 1–2. *Rhodacarella cavernicola* **sp. nov.**, female. **1**. Idiosoma dorsal. **2**. Idiosoma ventral.

***Rhodacarella cavernicola* sp.nov. (Figs. 1–9)**

Diagnosis. Dorsal setae of idiosoma of moderate length and simple; podonotal and opistonotal chaetotaxy holotrichous (45 pairs of setae). Dorsal shields barely sclerotized, reduced and without ornamentation. Presternal shields present, nine pairs of ventral setae, *Jv2* on the ventrianal shield.

Measurements. Idiosomal length 486 μm; idiosomal width at level of seta *s4* including soft marginal cuticle 188 μm; podonotal shield length 207 μm, width 158 at level of seta *s3*; opisthonotal shield length 219 μm, width at level of setae *Z3*, 86 (2 specimens)

Description (Figures 1–9). Adult female (holotype).

Gnathosoma: Tectum (Figure 3) with a medial smooth pointed projection. Fixed digit of chelicera with well-developed pilus dentilis proximal to three subdistal teeth smaller than other four basal teeth; movable chela with two well-spaced teeth, the proximal smaller than basal; cheliceral seta and lyrifissures normal (Fig. 5). Corniculi long and parallel; internal malae with lateral margin piloses, with long and acute apex extending slightly beyond tips of corniculi. Salivary styli as in Figure 4. Deutosternal groove of subcapitulum (Fig. 4) with smooth anterior margin discernible between bases of *hp2* and with seven rows of denticles. Posterior pair of subcapitular setae similar to the other subcapitular setae; anterior pair of setae nearly twice as long as other pairs. Palpal chaetotaxy as described for the family; palgenu with seta *al*-1 smooth, stouter than other genual setae and spatulate.

Idiosoma dorsum (Figure1): Podonotum with 22 pairs of simple setae, including 16 pairs (*j1–j6, z1–z6, s3–s6*) on subpentagonal non-ornate podonotal shield, and six pairs (*s1, s2, r2–r5*) in soft marginal cuticle; *j1, j2* and *z1* on the anterior border of the shield; *j1* 43 μm and *j2, z1* half its length; other setae of similar moderate length; *z6, s3, s4* and *s6* on the border of the shield. Opisthonotum covered by a narrow opisthonotal shield with 15 pairs of simple setae (*J1–J5, Z1–Z5, S1–S5*) plus eight pairs of setae in the marginal soft cuticle (*R1–R6, UR1, UR2*); *J5* short (half the length of *J4*); *Z4* and *Z5* are the longest setae. Dorsal and lateral idiosomal pore-like structures positioned as in Fig. 1 and include: on the podonotal shield *idj3, idj6, idz1, ids4* and *ids5*; on the opisthonotal shield, *idz6, ids6, idJ1- idJ5, gidZ3, idS1,* two *idS3, idS4 gdS4, gdS5* and on the soft opisthonotal cuticle, *idR3* and *ivp*.

Idiosomal venter (Figure 2): Tritosternum with elongated base and paired barbed laciniae, which are free from each other along entire length. In front of tritosternum, there is a pair of smooth, well-sclerotized pre-endopodal shields. Presternal region with paired narrow punctate shields separated from the sternum by punctuated cuticle. Sternal shield weakly sclerotized, with almost straight anterior margin, punctate between anterior margin and *st2* setae. Length of shield at medial region level, 91 μm, width at level between coxa II and III, 113 μm; *st1* on the soft granulated cuticle; shield with three pairs of simple setae and three pairs of lyrifissures (*iv1* on the anterior border, *iv2* and *iv3* on the posterior margin of the shield); posterior margin, convex at level of coxa III. Endopodal sclerite

between coxae I and II well developed and free from the sternal shield. Genital shield long, length 128 µm, width 49 µm, with straight and punctuated posterior margin and a tongue-like epigynal margin overlapping posterior margin of sternal shield; genital setae on or off the shield and *iv5* in the soft, striated marginal cuticle, posterior to the genital setae. Peritreme length including the stigmata 84 µm and with a very abbreviated peritrematal plate which bears one lyrifissure and one gland on the antiaxial margin. Two pairs of conspicuous metapodal platelets, anterior pair rounded, other small, ventral sclerites present. Opisthogaster with nine pairs of simple ventral setae, including one pair (*Jv2*) on the margin of the long and narrow ventrianal shield and eight pairs (*Jv1*, *Jv3–Jv5*, *Zv1–Zv4*) in the soft cuticle; *Zv1* in front of *Jv1*, *Zv3* shorter (half other opisthogastric setae). Circumanal setae slightly pilose, paranal setae (length 34 µm) in front of anal opening and postanal twice their length (69 µm). Ventral pore-like structures positioned as in Fig. 2, include *ivo1*, *iv2* and posterior *ivp*.

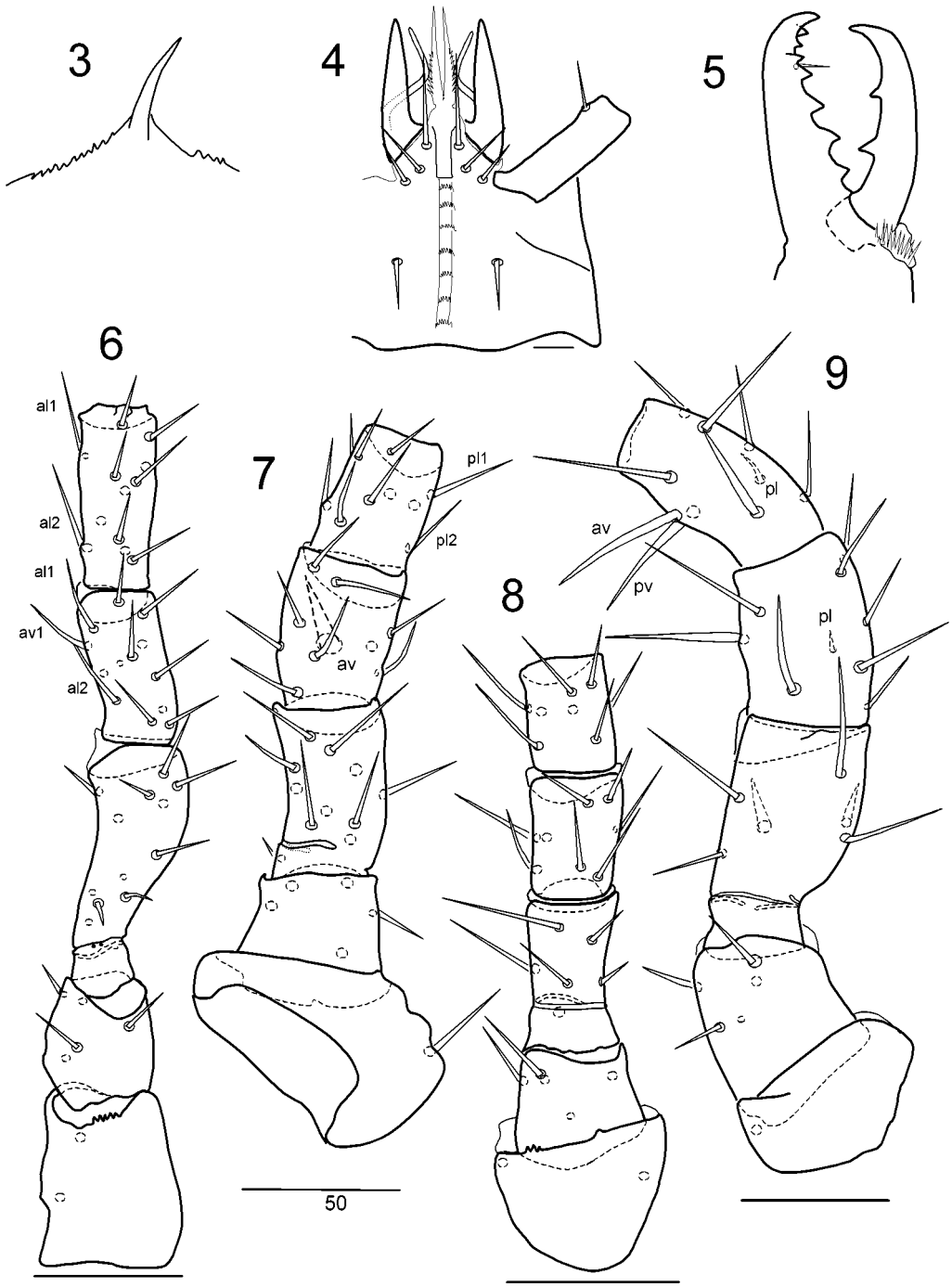
Legs (Figures 6–9). Excluding tarsus, length of leg I 331 µm (Fig. 6), leg II 251 µm (Fig.7), leg III 201 µm (Fig. 8) and leg IV 399 µm (Fig. 9). Coxa I and II with distal serrate margin behind condyle; coxae III and IV with distal margin smooth; coxa IV without second seta "*av*". Pretarsi of legs I–IV with well-developed claws. Setation of trochanters of legs, respectively, 5-5-5-5; that of femora, 12-11-6-6; that of genua, 2 3/2 3/1 2 (13), 2 3/1 2/1 1 (10), 1 2/0 2/1 2 (8), 2 2/1 3/0 1 (9); that of tibia, 2 3/1 3/2 1 (12), 2 2/1 2/1 2 (10), 1- 2/1 1/1 2 (8) – 2 2/1 2/1 1 (9). Genua II with *av1* spine-like, enlarged seta.; femora IV with two spine-like setae; genua IV with one ventral setae and one short and thin *pl*; the two ventral setae of tibia IV are stout and tibia IV with one *pl* seta short and thin. Basitarsus II–IV with four setae.

Etymology. The species epithet "cavernicola", is a reference to its habitat.

Material studied. Holotype adult female (mounted, permanent slide), 19 May 1990, W.C. Welbourn leg., ex bat guano ·15. Paratype, one adult female, with data same as for holotype.

Type-locality. U.S.A., Arizona, Cochise County, Kartchner Caverns State Park.
Material deposited. Florida State Collection of Arthropods, Division of Plant Industry, Grainesville.

Discussion. In addition to the five genera mentioned earlier, other genera of Rhodacaridae have been described and, although their systematic position has been incertaesedis, their inclusion in the subfamily is now considered. *Mediorhodacarus* Shcherbak, 1976 (*M. tetranodulosus*) may be placed in the genus *Rhodacarus* based on its dorsal and ventral chaetotaxy and because of the presence of presternal shields in some species of *Rhodacarus,* such as in *Rh. berrisforci*. Similarly, *Minirhodacarellus* Shcherbak, 1980 (type species *Rhodacarellus minimus* Krag, 1961) should remain in the genus *Rhodacarellus* as the presence of the transverse suture is not a constant characteristic within the same genus, as found in *Rhodacarus*.



FIGURES 3–9. *Rhodacarella cavernicola* **sp.nov.**, female. **3**. Tectum, **4**. Subcapitulum. **5**. Chelicera, antiaxial side. **6**. Right leg I, dorsal side, **7**. Right leg II, dorsal side, **8**. Right leg III, dorsal side, **9**. Right Leg IV, anterolateral side (dotted circles indicate ventral setae)

Afrogamasellus Loots & Ryke, 1968 and *Afrocarellus* Hurlbutt, 1974 from Africa (Loots & Ryke, 1968) display characteristics of Rhodacaridae. Both genera have three pairs of dorsal setae on the anterior margin of the podonotal shield (*j1, j2* and *z1*) and four arcuate scleronoduli as in *Rhodacarellus*. The presternal region has punctate sclerotization as in *Afrogamasellus mongii* and *Afrocarellus lupangaensis*, or well developed presternal jugular shields as in *Afrogamasellus lyamunguensis*. Basitarsus IV has three setae and the tectum has either a medial projection smooth or with apex dentate (*Afrogamasellus*), or three medial serrate branches (*Afrocarellus*). However, the arthrodial process at the base of the cheliceral digit in both genera is a brush (such as in *Pararhodacarus*), the shielding is more extensive and, except for one seta in the female, six ventral setae are included in the ventrianal shield. Lateral podonotal shields and a transverse suture are absent; 23 pairs of podonotal setae (all setae or 22 on the shield); 20 pairs of opisthonotal shield setae and seven pairs of ventral setae, of which six are on the ventrianal shield.

The weakly sclerotized new genus shares with *Rhodacarellus the* presence of three pairs of setae on the anterior margin of the podonotal shield, *hyp3* seta level with *hyp2* and similar cheliceral structure of the female. However, *Rhodacarellus* has more reduced dorsal and ventral chaetotaxy, with only 19 pairs of opistonotal setae (four *R* setae, setae *UR* are absent) and seven pairs of ventral setae (*Zv3* and *Zv4* absent).

The presence of presternal scutella is another characteristic that distinguishes *Rhodacarella* nov. from *Rhodacarus* and *Rhodacarellus*, both of which have the anterior margin of the sternal shield separated from the rest by punctate sclerotization. *Rhodacaropsis* has well-developed presternal shields separated from the sternal shield by striated cuticle and has sternal setae *st1* on the shield. Other genera of this family lack normal pre-endopodal shields and the endopodals between legs I and II are minute.

Krantz and Ainscough (1990) indicate the presence of 10 setae on genua and tibia IV (2 2/1 3/1 1) for the family Rhodacaridae and Krantz (1978) indicates tibia I with 13–14 setae (five or six dorsal and one or two *pv* setae 2 3/2 2(3)/1 2 or 2 3/2 3/2 2), genu IV 1 1/1 2/1 1 or 2 1/1 2/1 1) and tibia III 1 1/1 2/1 1 or 2 1/1 2/1 1. However, *Rhodacarella* nov. shows characteristics not found in the other genera included in the family such as 12 setae on tibia I (2 3/1 3/2 1) and nine setae on genu IV (2 2/1 3/0 1) and tibia IV (2 2/1 2/1 1). The reduced ventrianal shield with only one pair of ventral setae and scleronoduli absent may well represent characteristic feature of the genus.

Dorsal shielding and chaetotaxy resembles that of *Protogamasellus* (family Ascidae) except for the absence of the transverse line across surface at level of setae *z6* and *J1*. We have to remember that *Protogamasellus* has been considered a rhodacarid mite by several authors (genus *Rhodacaropsis* for Athias-Henriot, 1961; Bregetova & Shcherbak, 1977). The inclusion of this new genus in the Rhodacaridae is well established base on the following strong character states: 3-tined palp claw, coxa I with dorsal spine, sternal setae *st1* on desclerotised punctate cuticle, and female with setae *st4* on sternal shield.

Regarding generic character states, the opisthonotal chaetotaxy in *Rhodacarella* nov. (with 23 pairs of setae) and the ventral chaetotaxy (with nine pairs of ventral setae) may be considered primitive. The new genus exhibits the derivative characteristic of the absence of setae *r6* (present in the other genera of the family), and loss of two setae on tibia I and one seta on genu and tibia IV.

Key to genera of Rhodacarinae

Differences among the genera are highlighted in the following key to females:

1. Four pairs of setae (*j1, j2, z1, s1*) on anterior margin of podonotal shield. Third hypostomal seta approximately halfway between *hyp2* and capitular setae. On podonotal shield, 3–4 scleronoduli between *j5* and *j6* and 23 pairs of podonotal setae. When lateral podonotal shields are present, they bear one pair of setae..... 2
- Three pairs of setae (*j1, z1, s1*) on anterior margin of the podonotal shield. Third hypostomal setae approximately level with *hyp2*. 22–23 pairs of podonotal setae. When lateral podonotal shields are present, they do not bear podonotal setae 3
2. Pretarsus I absent. Anterior edge of sternal shield may be separated from rest by punctuate sclerotization and there may be separate punctate shields; *st1* always in the punctate cuticle *Rhodacarus* and *Mediorhodacarus*
- Pretarsus I present (paired sessile claws). Peritremes absent or reduced. Presternal shields normally present and separated from sternum by striated cuticle. Femur III with 4 setae..... *Rhodacaropsis*
3. Arthrodial process at the base of movable cheliceral digit is a simple coronet 4
- Arthrodial process at the base of movable cheliceral digit is a setal brush..... 5
4. Four arcuate or rounded scleronoduli present. Tectum with three serrated branches. Presternal shields absent. 23 pairs of podonotal setae; 19 pairs of opisthonotal setae (*R1–R4* present), 15 pairs of setae on the shield. Females with seven pairs of ventral setae ..... *Rhodacarellus* (*Minirhodacarellus*)
- Scleronoduli absent, anterior edge of sternal shield with multiple narrow paired shields separated from well-sclerotized sternal shield by punctate cuticle. With 22 pairs of podonotal setae and 23 pairs of opisthonotal setae (*R1–R6, UR1–UR2* present), 15 on the shield. Females with nine pairs of ventral setae, with one pair on the ventrianal shield (*Jv2*) ..... *Rhodacarella* gen. nov.
5. Basitarsus IV with three setae 6
- Basitarsus with four setae (*pl4* present). One pair of presternal shields present. Tectum with a smooth, single, medial projection. Pretarsus I absent ..... *Pararhodacarus*
6. Presternal region with presternal jugular shields well developed. Tectum with medial triangular smooth projection or with apex dentate..... *Afrogamasellus*
- Presternal region with punctuated sclerotization. Tectum with medial stalked Y-shape projection ..... *Afrodacarellus*

Acknowledgment

Special thanks to Dr. Cal Wellbourn for his generosity and confidence in providing me with the materials that made this publication possible.

References

Athias-Henriot, C. (1961) Mésostigmates (Uro. Excl.) édaphiques méditerranéens (Acaromorpha, Anactinotrichida). *Acarologia*, III (4), 381–509.

Bregetova, N.G. & Shcherbak, G.I. (1977) Family Rhodacaridae. *In*: Ghilyarov, M.S. & Bregetova, N.G. (Eds.) *A key to the Soil-Inhabiting Mites Mesostigmata*. Leningrad, Nauka, pp. 256–308.

Evans, G.O. (1963) Observations on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata). *Bulletin British Museum (Natural History) Zoology*, 10 (5) 275–303.

Haq, J. (1965) Records of some intertitial mites from Nobska Beach together with a description of the new genus and species *Psammonsella nobskae*, of the family Rhodacaridae. *Acarologia*, 1, 411–19.

Hurlbutt, H. W. (1974) The *Afrogamasellus* Loots and Ryke and *Afrodacarellus* n. gen. (Acarina: Rhodacaridae) of Tanzania. *Acarologia*, 15(4), 565–615.

Johnston, D.E. (1968) An Atlas of Acari I. The families of Parasitiformes and Opilioacariformes. Acarology Lab. Publ. 172. *Acarology Publ*., Columbus, pp. 110.

Johnston, D.E. & Moraza, M.L. (1991) The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina). *In:* Dusbäbek, F. & Bukva, V. (Eds.), *Modern Acarology.* Vol. 2. Academia, Prague, pp. 349–356.

Jordaan, L.C., Loots, G.C. & Theron P.D. (1988) A new genus and new species of Rhodacaridae (Acari) from the Afrotropical region.. *Journal of the Entomological Society-of Southern Africa*, 51(2), 275–281.

Krantz, G.W. (1978) A *Manual of Acarology.* Oregon University Book Stores, Inc. Corvallis, 509 pp.

Krantz, G.W & Ainscough, B.D. (1990) Acarina: Mesostigmata (Gamasina). *In*: Dindal, D.L. (Ed.) *Soil Biology Guide*, John Wilwy & Sons, Inc., pp. 256–308

Lee, D.C. (1970) The Rhodacarida (Acari: Mesostigmata); classification, external morphology and distribution of genera. *Records of the Australian Museum* (Adelaide) 16 (3), 1–219.

Lindquist, E.E. (1994) Some observations on the chaetotaxy of the caudal body region of gamasine mites (Acari: Mesostigmata), with a modified notation for some ventrocaudal body setae. *Acarologia*, 35 (4), 323–326.

Lindquist, E.E. & Evans, G.O. (1965) Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: MesostigmataMem. *Entomological. Society of Canada*, 47, 1–64

Lindquist, E.E. & Moraza, M.L. (1999) Observations on homologies of idiosomal setae in Zerconidae (Acari: Mesostigmata), with modified notation for some posterior body setae. *Acarología*, 39 (1998), 203–226.

Loots, (G.C. (1969) Notes on *Rhodacarus* and its related genera with description of new species from the Ethiopian Region. *Publicacoes culturias da campanhia de diamantes de Angola, Lisboa*, 81, 45–82.

Loots, G.C. & Ryke, P. (1968) Two new genera of rhodacarid mites (Mesostigmata: Acari) from soil in the Ethiopian Region. *Wetenskaplike Bydraes van die PU vir CHO, Reeks B: Natuurwet*, 1(1), 1–16.

Luxton, M. (1992) A new species of *Rhodacaropsis* (Acari: Mesostigmata) from intertitial coastal sand in Hong Kong. *In*: Morton, M. (Ed.), *The Marine Flora and Fauna of Hong Kong and Southern China III*. Hong Kong University Press, Hong Kong, pp. 237–242.

Petrova, A.D. & Beron, P. (1973) Deux nouveaux Rhodacaridae (Acari: Mesostigmata) des sables littoraux de Cuba. Résultats des expéditions biospéléologiques cubano-roumaines à Cuba, 1, 317–322, 5 figs.

Shcherbak, G.I. (1976) A new genus of the family Rhodacaridae (Parasitiformes, Gamasoidea). *Akademiï Nauk Ukraï RSR (Ser. B)*, 10, 949–952.

Shcherbak, G.I. (1980) *The Palearctic Mites of the Family Rhodacaridae*. Kiev, Naukova Dumka, 212 pp.

