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A new species of Ameroseius Berlese from Brazil, redescriptions of Ameroseius plumosus (Oudemans) and Ameroseius plumigera (Oudemans) (Acari: Mesostigmata: Ameroseiidae) based on the examination of type material

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# A new species of *Ameroseius* Berlese from Brazil, redescriptions of *Ameroseius plumosus* (Oudemans) and *Ameroseius plumigera* (Oudemans) (Acari: Mesostigmata: Ameroseiidae) based on the examination of type material

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*Ameroseius* Berlese is the most numerous genus of family Ameroseiidae Evans (in Hughes 1961). Species of this genus have been reported from many regions around the world. A few species of this genus are known from Brazil. *Ameroseius mineiro* Narita, Bernardi and Moraes, sp. nov. is described based on the morphology of adult females and males collected from guano in caves of Minas Gerais State, Brazil. This is the second *Ameroseius* species described from Brazil. The holotypes of *Ameroseius plumosus* (Oudemans) and *Ameroseius plumigera* (Oudemans) were examined, given their close similarity with the species described in this paper, and they are here redescribed. A key is provided to separate these and other most similar species.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:17A7D831-EC49-4D65-B06B-5E13EF52C696

Keywords: cave; morphology; neotropics; taxonomy

# Introduction

Halliday (1997) considered Ameroseiidae Evans to consist of eight genera, without including a genus that had been described by Bai et al. (1995). *Ameroseius* Berlese is the most numerous among the genera included in this family, comprising about 98 of a total of about 154 species for the family. Except for Antarctica, species of this genus have been reported from all continents.

There are few reports of *Ameroseius* in Brazil. *Ameroseius dendrovagans* Flechtmann and Flechtmann, 1985 was described from a bark beetle collected in Minas Gerais State; this is the only species of this genus described from that country. Sousa et al. (2005) reported *Ameroseius plumigera* (Oudemans) from stored food in Pernambuco State, whereas other undetermined species of this genus were reported from other habitats by Ferreira and Martins (1999); Ferreira et al. (2000); Bernardi et al. (2009) and Mineiro et al. (2009).

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Specimens reported as *Ameroseius plumosus* (Oudemans) and *Ameroseius plumigera* have been reported from many countries around the world, from poultry litter, stored food and on mould developing indoors (Hughes 1961; Rack 1963, 1971; Brady 1970). Of particular interest to the present work, *A. plumosus* was originally described from bats, and was reported on bat guano in caves of Australia (Bellati et al. 2003).

The objective of this work is to present a description of a new species of *Ameroseius*, redescriptions of *A. plumosus* and *A. plumigera* based on the holotypes, and a key to separate the species most similar to the species here described.

#### Material and methods

Samples of bat guano from two caves located in Minas Gerais State, Brazil were collected to look for associated arthropods, in accordance with biological licences IBAMA-02015.02006.212003-55 and ICMbio/Sisbio-2656.1. The samples were taken to a laboratory where the arthropods were extracted using a Berlese–Tullgren funnel. The mites were mounted in Hoyer's medium for the identification, which was done with a phase contrast microscope and a differential interference contrast microscope. For comparison with the collected mites, the holotypes of *A. plumosus* and *A. plumigera* were loaned and also examined.

In the following descriptions, idiosomal setal notation is based on that of Lindquist and Evans (1965). For each structure, the measurements are given in micrometres. In the description of the new species, the average measurement of each structure is given for the specimens examined, followed in each case (in parentheses) by the corresponding ranges (if the measurements varied).

## **Results and discussion**

# Ameroseius Berlese

Ameroseius Berlese, 1904: 258.
Type species: Seius echinatus Koch, 1839.
Kleemannia Oudemans, 1930: 135, synonymy by Westerboer and Bernhard (1963): 479.
Type species: Zercon pavidus Koch, 1839.
Primoseius Womersley, 1956: 116, synonymy by Hughes (1961): 246.
Type species: Zercoseius macauleyi Hughes, 1948.

# Diagnosis of genus

Palp apotele and corniculi two- or three-tined. Dorsal shield reticulate or ornamented with pit-like depressions; usually with 28 to 29 pairs of setae, rarely fewer than 28 pairs. Seta *j1* usually leaf-shaped; other dorsal shield setae usually leaf-shaped and serrated, occasionally stout, setiform, smooth or pilose Sternal shield usually with two pairs of setae, rarely with three pairs. Opisthogaster with five or six pairs of setae in addition to circumanal setae, rarely with four pairs, of which at most two pairs on ventrianal shield. All legs with pulvilli and claws.

# Ameroseius mineiro Narita, Bernardi and Moraes sp. nov. (Figures 1–2)

# Diagnosis of adults

Palp apotele and corniculus three-tined. Dorsal shield with 28 pairs of setae, all leafshaped and serrate. Distance between the bases of setae J4 about 1.3 times as long as distance between J4 and Z4 of each side. Many dorsal setae reach the bases of the subsequent setae of each series. Seta st3 on a platelet, opisthogaster with six pairs of setae, two of which on the ventrianal shield (in addition to circumanal setae). Seta Jv5about five times as long as mid-width and about 0.7 times as long as distance between its base and the base of the postanal seta. Genu of leg III and tibia of leg IV with 10 setae each.

# Adult female (Figure 1A–H) (three specimens measured)

*Gnathosoma* (Figure 1A–C). Fixed cheliceral digit 21 long, with four relatively large teeth near the base of the digit; movable cheliceral digit 19 long, with two small teeth near the apex. Antiaxial and dorsal lyrifissures distinct. Epistome with an elongate, acute and smooth central projection. Palp apotele and corniculus three-tined. Deutosternum narrow; transverse rows of denticles not discernible. Lengths of hypostomal setae: h1 22–23; h2 19 (18–20); h3 17–18; sc 22–23.

*Dorsal idiosoma* (Figure 1D–F). Dorsal shield entire, totally reticulate; reticula formed by simple lines; 373 (370–325) long and 230 wide at level of *s*6; apparently with two pairs of pores (posteromediad of *r4*, anteromediad of *S4*) and six pairs of lyrifissures (anterolaterad of *j3*, posteromediad of *r4*, anterolaterad of *J2*, laterad of *J4*, anteromediad of *S4*, posteromesad of *S5*). Lengths of dorsal setae: *j1* 22 (20–23); *j2* 34 (30–35); *j3* 34; *j4* 35; *j5* 45 (43–47); *j6* 52; *J2* 58 (56–60); *J4* 57; *z2* 32 (30–33); *z4* 32 (30–33); *z5* 44 (43–45); *Z1* 32 (30–33); *Z2* 40; *Z4* 52; *Z5* 54; *s1* 31; *s2* 26 (24–28); *s4* 34 (32–36); *s5* 29; *s6* 35 (34–36); *S2* 40; *S3* 44 (42–45); *S4* 47 (45–49); *S5* 46; *r2* 32; *r3* 30; *r4* 36; *r5* 27. Distance between the bases of setae *J4* about 1.3 times as long as distance between the bases of setae *J4* and *Z4* of each side. Many dorsal setae reach the bases of the subsequent setae of each series. All setae leaf-shaped and serrate (Figure 1E, F); seta *j1* wider distally than other setae.

*Ventral idiosoma* (Figure 1G). Base of tritosternum six long and six wide, laciniae fused along distal half of their total length (54 long). Sternal shield scantly reticulate over most of its extension, smooth posterocentrally; 59 (57–60) long at midline and 68 (63–70) wide at widest level, bearing setae *st1* and *st2*. Seta *st3* on a platelet and seta *st4* on unsclerotized cuticle. Genital shield reticulate, bearing *st5*, 75 (70–80) wide at widest level, sided posteriorly by a pair of lyrifissures. Ventrianal shield reticulate, with reticula much wider than long anteriorly to the anal opening and roughly longer than wide or as long as wide posteriorly, 109 (105–112) long at the midline and 126 (115–123) wide at the widest level, bearing *Jv2* and *Jv3*, a pair of lyrifissure posteromediad of *Jv5*. Unsclerotized cuticle of opisthogaster with setae *Jv1*, *Jv5*, *Zv1* and *Zv2*, three pairs of lyrifissures (posterolaterad of *Zv1*, posterolaterad of *Zv2*, anterolaterad



Figure 1. *Ameroseius mineiro* Narita, Bernardi and Moraes sp. nov., female. (A) Chelicera; (B) epistome; (C) ventral view of gnathosoma; (D) dorsal view of idiosoma; (E) detail of seta j1; (F) detail of seta j6; (G) ventral view of idiosoma; (H) genu, tibia and basitarsus IV.

of Jv5) and a pair of elongate metapodal platelets. Lengths of ventral setae: st1 24 (23–25); st2 23; st3 19 (18–20); st4 19 (17–20); st5 18 (17–19); Jv1 15; Jv2 15 (14–16); Jv3 12; Jv5 44 (42–45); Zv1 12; Zv2 16 (15–17). Seta Jv5 about five times as long as wide and about 0.7 times as long as the distance between its base and the base of the



Figure 2. *Ameroseius mineiro* Narita, Bernardi and Moraes, sp. nov. male. (A) Chelicera and spermatodactyl; (B) ventral view of idiosoma.

postanal seta. This seta and postanal seta leaf-shaped and serrate, other ventral setae setiform and smooth. Endopodal shield fused to sternal shield except for a triangular remnant platelet between coxae II and III. Exopodal shield distinguishable as a narrow band with projections between coxae II and III and coxae III and IV.

*Peritreme and peritremal shield.* Peritreme reaching level between *j2* and *j3* (about level of anterior margin of coxa I). Peritremal shield fused to exopodal shield behind stigma; with a large pore at level between coxae II and III (*gd3* of Athias-Henriot 1975; *gp2* of Lindquist and Moraza 2009).

*Legs* (Figure 1H). All legs with pulvilli and claws. Lengths of the legs: I – 290, II – 193 (190–195), III – 213 (210–215), IV – 280. Chaetotaxy of legs I–IV: coxae: 2, 2, 2, 1; trochanters: 6, 5, 5, 5; femora: 12 (2-3/1-2/2-2), 10 (2-2/2-2/1-1), 5 (1-2/0-1/0-1), 8 (1-2/1-3/0-1); genua: 12 (2-3/2-2/1-2), 11 (2-3/1-2/1-2), 10 (2-2/1-2/1-2), 9 (2-2/1-3/0-1); tibiae: 12 (2-3/2-2/1-2), 10 (2-2/1-2/1-2), 9 (2-1/1-2/1-2), 10 (2-2/1-2/1-2); tarsi: not counted, 17, 17, 17.

# Adult male (Figure 2A, B) (one specimen measured)

*Gnathosoma* (Figure 2A). Fixed cheliceral digit 25 long, with four relatively large teeth near the base of the digit (the most distal one distinctly smaller) and apparently a tiny tooth near the apex; movable cheliceral digit 18 long, toothless, with the tip turning abruptly upward at almost 90° in relation to the base of the digit and with a distal pointed projection. Epistome and apotele similar to adult female. Spermatodactyl almost straight for most of its extension, slightly curved downward near the apex, 20 long. Lengths of hypostomal setae: h1 19; h2 18; h3 20; sc 22.

*Dorsal idiosoma.* Dorsal shield entire, ornamented as in adult female, 288 long and 188 wide at level of *s*6. Lengths of dorsal setae: *j*1 20, *j*2 23, *j*3 25, *j*4 25, *j*5 32, *j*6 35, *J*2 45, *J*4 45, *z*2 27, *z*4 29, *z*5 30, *Z*1 27, *Z*2 27, *Z*4 35, *Z*5 45, *s*1 25, *s*2 27, *s*4 30, *s*5 28, *s*6 28, *S*2 32, *S*3 32, *S*4 37, *S*5 40, *r*2 24, *r*3 25, *r*4 30, *r*5 22. Shape of dorsal setae similar to female.

*Ventral idiosoma* (Figure 2B). Sternogenital shield ornamented with scanty simple lines, 128 long at midline and 95 wide at the widest level, bearing setae st1-st5. Ventrianal shield with reticulation similar to that of adult female, 112 long at midline and 135 wide at widest level, bearing setae JvI-Jv3 and ZvI. Lengths of ventral setae: st1 11, st2 13, st3 15, st4 16, st5 15, JvI 12, Jv2 10, Jv3 12, Jv5 35, ZvI 12. Shape of ventral setae as in adult female. Endopodal shield totally fused to sternal shield. Exopodal shield similar to adult female.

*Peritreme and peritremal shield.* Similar to female, but without a large pore at level between coxae II and III.

Legs. All legs with pulvilli and claws. Chaetotaxy of legs similar to adult female.

# Material examined

All specimens were collected from bat guano. Holotype female and three paratype females from "Lapa do Mosquito" cave (18°37'34″ S, 44°24'45.03″ W), Curvelo, Minas Gerais State, Brazil, collected by L.F.O. Bernardi, September 2004; one paratype female and one paratype male from "Lapa Nova" cave (17°59'57.68″ S, 46°53'25.16″ W), Vazante, Minas Gerais State, collected by T.G. Pellegrini, 7 April 2009; one paratype female from "Lapa do Taquaril" cave (15°24'56.4″ S 46°13'01.5″ W), Arinos, Minas Gerais State, collected by L.F.O. Bernardi, September 2010; holotype and mentioned paratypes deposited at Departamento de Entomologia e Acarologia, Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo, Piracicaba, State of São Paulo, Brazil. One paratype female (acession number: 1903) and one paratype male (acession number: 1904) from "Lapa Nova" cave, collected by T.G. Pellegrini, 7 April 2009, deposited at Coleção de Invertebrados, Setor de Zoologia, Departamento de Biologia, Universidade Federal de Lavras, Lavras, Minas Gerais.

# Etymology

The specific designation *mineiro* refers to "from Minas Gerais", Brazilian State from which the type specimens were collected.

# Remarks

Evans (1963) reported the adult female of Ameroseiidae to have nine setae on tibia IV: 2-2/1-2/1-1. This is different from what was observed for this new species, and from what had been reported in the original description of *Ameroseius potchefstroomensis* (Kruger and Loots, 1980). Unfortunately, the original description of *A. potchefstroomensis* is not sufficiently detailed, and despite the effort of E. Ueckermann (ARC-PPRI, South Africa) and P. Theron (Potchefstroom University, South Africa), the type specimens could not be examined in this study.

The adult female of A. mineiro sp. nov. is similar to Ameroseius eumorphus Bregetova 1977 and A. potchefstroomensis. However, adult females of these species have dorsal setae only lightly serrate, the distance between the bases of their setae J4is about as long as the distance between the bases of setae J4 and Z4 of each side, while their Jv5 is at least eight times as long as wide and almost as long as the distance between its base and the base of the postanal seta. In addition, female A. eumorphus has sternal shield centrally smooth. Nothing was mentioned in the original description of A. eumorphus in relation to leg chaetotaxy.

The female of the new species here described is also similar to that of *A. plumosus*. However, although with larger idiosoma, most of the dorsal setae of the latter species are shorter (few setae reaching the bases of the subsequent setae of each series) and more lightly serrate; the distance between the bases of its J4 setae is much shorter than the distance between the bases of its J4 setae of each side; and its sternal shield has an inverted "U"-shaped, anteromedial structure.

#### Ameroseius plumosus (Oudemans, 1902b)

Seiulus plumosus Oudemans, 1902b: 17. Kleemannia plumosus, Oudemans (1930): 138. Zercoseius macauleyi Hughes, 1948: 146, synonymy by Hughes (1961): 246. Primoseius macauley, Womersley (1956): 116. Kleemania [sic] plumosus, Hughes (1961): 246. Ameroseius plumosus, Westerboer and Bernhard (1963): 491. (Figure 3)

#### Diagnosis of adult

Palp apotele and corniculus three-tined. Dorsal shield with 28 pairs of setae, all leafshaped and lightly serrate. Distance between the bases of setae J4 about 0.7 times as long as distance between J4 and Z4 of each side. A few setae reach the bases of the subsequent setae of each series. Sternal shield with an inverted "U"-shape, seemingly sub-superficial anteromedian structure. Seta *st3* on a platelet, opisthogaster with six



Figure 3. *Ameroseius plumosus* (Oudemans) female. (A) Dorsal view of idiosoma; (B) detail of seta *j1*; (C) detail of seta *j6*; (D) ventral view of idiosoma.

pairs of setae, two of which on the ventrianal shield (in addition to circumanal setae). Genu of leg III and tibia of leg IV with 10 setae each.

# Adult female (Figure 3A–D)

*Gnathosoma*. Fixed cheliceral digit 23 long, with four relatively large teeth near the base of the digit and apparently two tiny teeth near the apex; movable cheliceral digit 15 long, teeth not discernible. Antiaxial and dorsal lyrifissures not distinct. Epistome with an elongate, acute and smooth central projection. Palp apotele three-tined. Deutosternum narrow, transverse rows of denticles not discernible. Corniculi three-tined.

*Dorsal idiosoma* (Figure 3A–C). Dorsal shield entire, totally reticulate; reticula formed by simple lines; 410 long and 260 wide at level of *s*6; apparently with four pairs of lyrifissures (posteromediad of *r*5, posterior of *J*2, posteromediad of *S*3, mediad of *S*5). Lengths of dorsal setae: *j1* 22; *j2* 25; *j3* 23; *j4* 24; *j5* 30; *j6* 32; *J2* 45; *J4* 47; *z2* 27; *z4* 30; *z5* 30; *Z1* 32; *Z2* 32; *Z4* 46; *Z5* 50; *s1* 27; *s2* 35; *s4* 30; *s5* 32; *s6* 35; *S2* 35; *S3* 35; *S4* 35; *S5* 45; *r2* 29; *r3* 24; *r4* 30; *r5* 23. Distance between the bases of setae *J4* about 0.7 times as long as distance between *J4* and *Z4* of each side. A few setae reach the bases of the subsequent setae of each series. All setae leaf-shaped; most very lightly serrate, except *j1*, distinctly serrate and wider distally than other setae.

Ventral idiosoma (Figure 3D). Base of tritosternum six long and six wide, laciniae fused along distal half of their total length (49 long). Sternal shield reticulate over most of its extension, smooth centrally; 82 long at midline and 105 wide at widest level, bearing setae st1 and st2; with an inverted "U"-shaped, seemingly sub-superficial anteromedian structure. Seta st3 on a platelet and seta st4 on unsclerotized cuticle. Genital shield with scanty striae, bearing st5, 80 wide at widest level, sided posteriorly by a pair of lyrifissures. Ventrianal shield reticulate, with reticula much wider than long anteriorly to the anal opening and roughly longer than wide or as long as wide posteriorly, 118 long at the midline and 155 wide at the widest level, bearing Jv2 and Jv3. Unsclerotized cuticle of opisthogaster with setae Jv1, Jv5, Zv1 and Zv2, a pair of lyrifissures (anterior of Jv2) and a pair of elongate metapodal platelets. Lengths of ventral setae: st1 23; st2 23; st3 17; st4 16; st5 15; Jv1 9; Jv2 15; Jv3 8, Jv5 50, Zv1 10, Zv2 13. Seta Jv5 and postanal seta leaf-shaped and serrate, other ventral setae setiform and smooth. Endopodal shield fused to sternal shield except for a triangular remnant platelet between coxae II and III. Exopodal shield distinguishable as a narrow band with projections between coxae II and III and coxae III and IV.

*Peritreme and peritremal shield.* Peritreme reaching level of *j2*. Peritremal shield fused to exopodal shield behind stigma; with a large pore at level between coxae II and III (*gd3* of Athias-Henriot 1975; *gp2* of Lindquist and Moraza 2009).

*Legs.* All legs with pulvilli and claws. Lengths of the legs: I - 330, II - 270, III - 250, IV - 310. Chaetotaxy of legs I–IV: coxae: 2, 2, 2, 1; trochanters: 6, 5, 5, 5; femora: 12, not discernible, 5, 6 (determination of chaetotaxy was not possible for any of the femora, because of the unfavourable position of the legs in the holotype); genua: 12

(2-3/2-2/1-2), 11 (2-3/1-2/1-2), 10 (2-2/1-2/1-2), 9 (2-2/1-3/0-1); tibiae: 12 (2-3/2-2/ 1-2), 10 (2-2/1-2/1-2), 9 (2-1/1-2/1-2), 10 (2-2/1-2/1-2); tarsi: not counted, 17, 17, 17.

# Material examined

Holotype female collected from *Vespertilio dasycneme* (Boie) (Chiroptera: Vespertilionidae), in Sneek, the Netherlands, by A.C. Oudemans, July 1896, deposited at The Netherlands Centre for Biodiversity Naturalis, Leiden, the Netherlands (RMNH Acari P4303).

# Remarks

Oudemans (1930) stated that in July 1896 he collected three mites with lanceolate- or feather-like setae from *Vespertilio dasycneme* (Chiroptera: Vespertilionidae) at Sneek, the Netherlands and that in November 1896 he collected another mite with feather-like setae on *Sciurus vulgaris* (Rodentia: Sciuridae) at Arnhem, the Netherlands. These findings were reported by Oudemans (1902a), when the mites were referred to as *Seiulus plumosus* [nomen nudum]. In the same year, the mites were described under the same name (Oudemans 1902b).

In the original description, Oudemans (1902b) referred to certain variations he could observe between the specimens at hand in relation to the number of dorsal shield setae, stating that he could observe a transversal row of setae on the dorsal shield between legs III and IV; in most specimens the row was composed of eight setae, whereas in a single specimen (most certainly the specimen examined in this study) it was composed of only six setae (in his words "no. 3 and 6 being absent"). He was most probably referring to setae j6, z6, s5 and r5 (according to the terminology used in this paper) for the full complete specimens and to the absence of z6 in one specimen.

According to Oudemans (1930), three different species were included under *Seiulus* plumosus in its original description. He then referred that name to a female specimen collected from V. dasycneme (examined in this study), that in the original description was mentioned as a female deutonymph [figs 18, 19 of plate 1, and fig. 20 of plate 2 of Oudemans (1902b)]. The remaining specimens collected from V. dasycneme [referred in the original description as protonymphs, figs 15–17 of plate 1 of Oudemans (1902b)] were re-identified in the same publication as Kleemannia pavidus (Koch, 1839), whereas the single specimen collected from S. vulgaris [referring to fig. 21 of plate 2 of Oudemans (1902b)] was then described as Kleemannia plumea.

In the redescription of *K. plumosus* by Oudemans (1930), the author was ambiguous in relation to the number of dorsal shield setae, stating first that there were 29 pairs, and immediately afterward that there were 28 pairs. Our examination of the specimen studied by Oudemans confirmed the presence of only 28 pairs.

Some morphological differences were observed between our examination of the holotype of *A. plumosus* and redescriptions provided by different authors based on specimens from other countries.

Hughes (1948) described and illustrated Zercoseius macauleyi, based on specimens collected in the UK. Womersley (1956) illustrated a specimen from Australia identified as belonging to that same species, but placing it in Primoseius, a monotypic genus he then described. Hughes (1961) presented the same illustrations given in the original description of the species, synonymizing Z. macaulevi under A. plumosus, which she then placed in *Kleemannia* (mentioned as *Kleemania*). Halliday (1997) provided a brief diagnosis of A. plumosus, taking into account specimens identified as *P. macaulevi* by Womersley (1956) and other specimens also from Australia. The following characteristics illustrated in those papers suggest Z. macauleyi to be distinct from A. plumosus: dorsal shield setae slightly curved and spear-shaped (except (1), and setae (1-J2) reaching or almost reaching base of the respective closest setae behind. There are some discrepancies in the literature in relation to other characteristics. In the original description of Z. macaulevi and in the redescription of that species by Womersley (1956), the fixed cheliceral digit is mentioned to have and is illustrated as having four teeth (as observed in our examination of the holotype), differing from Halliday (1997) who mentioned the species (referred to as A. plumosus) to have only three teeth. In the original description of Z. macaulevii and in the redescription by Hughes (1961) the corniculus is described as two-tined, whereas Womersley (1956) describes it as three-tined. We suppose that Hughes (1948, 1961) could have overlooked the third tine, located around the mid length of the corniculus. Also in the original description of Z. macauleyi the sternal shield is mentioned as having a central crescentic-shaped space with a crenulate edge, whereas Hughes (1961) mentioned that some specimens she had available were as originally described, but others did not have that pattern on the sternal shield, and Womersley (1956) made no reference to that pattern, suggesting it to be absent in the specimens he examined. In addition, the illustrations in Hughes (1948, 1961) show the presence of 28 pairs of dorsal shield setae, although Hughes (1961) mentioned the presence of 29 pairs. Hence, Z. macauleyi seems to be different from A. plumosus. However, to prevent mistakes, the holotype of Z. macaulevi should be examined before a definitive conclusion.

Westerboer and Bernhard (1963) redescribed *A. plumosus* based on specimens collected in Germany, indicating that their podosoma was ornamented with pit-like depressions and that setae j1, j3, j4 and j6 reached the subsequent setae of their series. These characteristics differ from our observation of the holotype, suggesting that this species could also be different from *A. plumosus*.

#### Ameroseius plumigera (Oudemans, 1930)

*Kleemannia plumigera* Oudemans, 1930: 140. *Primoseius gracei* Hughes, 1948: 149, synonymy by Hughes (1961): 244. (Figure 4)

#### Diagnosis of adult

Dorsal shield with 29 pairs (seta z6 present) of setae, all leaf-shaped and serrate. Most dorsal setae reaching the base of the subsequent seta. Setae J2 and J4 long, 100 and 123 long, respectively. Sternal shield longer than wide. Seta st3 on a platelet, opisthogaster with six pairs of setae, two of which on the ventrianal shield. Nothing can be said about leg chaetotaxy from the examination of the holotype, because the legs are broken.



Figure 4. *Ameroseius plumigera* (Oudemans) female. (A) Dorsal view of idiosoma; (B) detail of seta *j1*; (C) detail of seta *j4*; (D) ventral view of idiosoma.

# Adult female (Figure 4A–D)

Gnathosoma. Fixed cheliceral digit 29 long, apparently with four relatively large teeth near the base of the digit and apparently one tiny tooth near the apex; movable

cheliceral digit 25 long, teeth not discernible. Antiaxial and dorsal lyrifissures not distinct. Epistome, palp apotele, deutosternum and corniculi not distinct, because the gnathosoma is damaged.

*Dorsal idiosoma* (Figure 4A–C). Dorsal shield entire, totally reticulate; reticula formed by simple lines; 450 long and 295 wide at level of *s6*; apparently with two pairs of pores (posteromediad of *r4*, posterolaterad of *S3*) and seven pairs of lyrifissures (anterolaterad of *j3*, posteromediad of *r4*, laterad of *j6*, posteromediad of *s6*, posteromediad of *S3*, laterad of *j4*, posteromediad of *S4*). Lengths of dorsal setae: *j1* 29; *j2* 41; *j3* 55; *j4* 50; *j5* broken; *j6* broken; *J2* 100; *J4* 123; *z2* 45; *z4* 53; *z5* 53; *z6* broken; *Z1* 65; *Z2* broken; *Z4* 95; *Z5* broken; *s1* 49; *s2* 60; *s4* broken; *s5* 63; *s6* 55; *S2* 70; *S3* 70; *S4* 75; *S5* broken; *r2* 50; *r3* 50; *r4* 65; *r5* 55. Distance between the bases of setae *J4* about 0.8 times as long as distance between *J4* and *Z4* of each side. All setae leaf-shaped and serrate, *j1* wider distally than other setae.

Ventral idiosoma (Figure 4D). Base of tritosternum 13 long and 9 wide, total length was not possible to measure, because this structure is damaged. Sternal shield reticulate; 90 long at midline and 69 wide at widest level, bearing setae st1 and st2. Seta st3 on a platelet and seta st4 on unsclerotized cuticle. Genital shield reticulate, bearing st5, 108 wide at widest level, sided posteriorly by a pair of lyrifissures. Ventrianal shield reticulate, with reticula much wider than long anterior to the anal opening and roughly longer than wide or as long as wide posteriorly, 130 long at the midline and 180 wide at the widest level, bearing Jv2 and Jv3, with a pair of lyrifissures posteromediad of Jv5. Unsclerotized cuticle of opisthogaster with setae Jv1, Jv5, Zv1 and Zv2, two pairs of lyrifissures (anteromediad of Zv2, anterolaterad of Jv5) and a pair of elongate metapodal platelets sided posteriorly by other two pairs of lyrifissures. Lengths of ventral setae: st1 14: st2 broken: st3 8: st4 6: st5 25: Jv1 10: Jv2 10: Jv3 10: Jv5 broken; ZvI 10; Zv2 17. Unbroken ventral setae setiform and smooth. Endopodal shield fused to sternal shield except for a triangular remnant platelet between coxae II and III. Exopodal shield distinguishable as a narrow band with projections between coxae II and III and coxae III and IV.

*Peritreme and peritremal shield.* Peritreme reaching level of *j2*. Peritremal shield fused to exopodal shield behind stigma; with a large pore at level between coxae II and III (*gd3* of Athias-Henriot 1975; *gp2* of Lindquist and Moraza 2009).

Legs. Broken in the examined specimen.

# Material examined

Holotype female collected from seagrass, in Helder, the Netherlands, by Dr Redeke misit [sic; sent by Dr Redeke], September 1910, deposited at The Netherlands Centre for Biodiversity Naturalis, Leiden, the Netherlands (RMNH Acari P4301).

# Remarks

In the original description of *A. plumigera*, Oudemans (1930) reported the corniculus to be three-tined, and the dorsal shield to bear 30 pairs of setae. The number of

tines of the corniculus could not be determined in our examination of the holotype, because the gnathosoma is damaged; however, the number of dorsal shield setae is clearly 29 pairs rather than 30. Specimens from Germany redescribed by Rack (1963) also had 29 pairs of dorsal shield setae; the author made no reference to the number of tines of the corniculus. Hughes (1961) redescribed *A. plumigera* based on specimens from the UK, reporting the corniculus to be two-tined and the dorsal shield to bear 28 pairs of setae (apparently missing one *S* seta). In the same publication, she synonymized *Zercoseius gracei* Hughes, 1948 under *A. plumigera*. Hughes (1976) showed the same illustrations as in her publication of 1961, but mentioned in the text the presence of 29 pairs of setae on the dorsal shield. A re-examination of the specimens studied by Hughes would be necessary to confirm the identity of the specimens that she identified as *A. plumigera* and to confirm whether *Z. gracei* is really a synonym of *A. plumigera*.

# Key to species of the "plumosus" group based on adult females

In addition to the similarity of the new species to *A. plumosus*, *A. potchefstroomensis* and *A. eumorphus* mentioned previously, the new species here described is also similar to four other species that have corniculus bifurcate or trifurcate; dorsal shield reticulate and without pit-like depressions; 26 or 28 pairs of dorsal shield setae, most of which are lanceolate to leaf-shaped; and five or six pairs of opisthogastric setae, two pairs of which are on ventrianal shield. All of these species are here referred to as the *plumosus* species group.

The following key is provided to help their separation. It was constructed taking into account our examination of the holotypes previously mentioned in this paper and the original descriptions of the other species. *Ameroseius lanceosetis* Livshitz and Mitrofanov (1975) was not included in the key because of the controversial information concerning the number of dorsal shield setae in this species; while 28 pairs are shown in the illustration, 29 pairs are mentioned in the text. It is assumed that a pair of setae is missing in the illustration.

#### Key to separate the species of the *plumosus* species group

- 3. Seta *z6* present and *s6* absent; *j1* with about triangular contour; metapodal shield subtriangular . . . *A. reticulatus* (Kruger and Loots, 1980), South Africa

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#### References

- Athias-Henriot C. 1975. Nouvelles notes sur les Amblyseiini, 2. Le relevé organotaxique de la face dorsal adulte (Gamasides, Protoadiniques, Phytoseiidae). Acarologia. 17:20–29.
- Bai XL, Gu YM, Fang L. 1995. A new genus and species of Ameroseiidae. Acta Zootaxonomica Sin. 20:435–438.
- Bellati J, Austin AD, Stevens NB. 2003. Arthropod diversity of a guano and non-guano cave at the Naracoorte caves world heritage area, South Australia. Rec S Aust Mus Monogr Ser. 7:257–265.
- Berlese A. 1904. Acari nuovi. Manipulus 2us. Redia. 1:258-280.
- Bernardi LFO, Zacarias MS, Souza-Silva M, Ferreira RL. 2009. Ácaros cavernícolas do Brasil: uma observação preliminar sobre a ocorrência e distribuição das famílias. Mundos Subterr. 20:5–13.
- Brady J. 1970. The mites of poultry litter: observations on the bionomics of common species, with a species list for England and Wales. J Appl Ecol. 7(2):331–348.
- Bregetova NG. 1977. Family Ameroseiidae (Berlese, 1919) Evans 1961. In: Gilyarov MS, Bregetova NG, editors. Key to the soil inhabiting mites. Mesostigmata. Akademia Nauka: Leningrad; p. 148–169.

- Evans GO. 1963. Observations on chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata). Bull Br Mus (Natl Hist) Zool. 10:277–303.
- Ferreira RL, Martins RP. 1999. Trophic structure and natural history of the bat guano invertebrate communities, with special reference to Brazilian caves. Trop Zool. 12:231–252.
- Ferreira RL, Martins PR, Yanega D. 2000. Ecology of the bat guano arthropod communities in a brazilian dry cave. Ecotrop. 6:105–116.
- Flechtmann CHW, Flechtmann CAH. 1985. A new species of *Ameroseius* (Acari: Mesostigmata, Ameroseiidae) from Brasil. Rev Bras Zool. 2(6):393–396.
- Halliday RB. 1997. Revision of the Australian Ameroseiidae (Acarina: Mesostigmata). Invertebr Taxon. 10:179–201.
- Hughes AM. 1948. The mites associated with stored food products. London: Ministry of Agriculture, Fisheries and Food. His majesty's Stationery Office; p. 168.
- Hughes AM. 1961. The mites of stored food. 1st ed. London: Technical Bulletin 9, Ministry of Agriculture, Fisheries and Food. Her majesty's Stationery Office; p. 287.
- Ibrahim GA, Abdel-Samed MA. 1992. *Kleemania wahabi* n. sp., a new ameroseiid mite from Egypt (Acari Mesostigmata). Bull Entomol Soc Egypt. 70:137–140.
- Koch CL. 1839. Deutschlands Crustaceen, Myriapoden und Arachniden. Regensburg: Friedrich Putset; Heft 24. Fasc. 27
- Kruger AJ, Loots GC. 1980. Two new species of *Kleemannia* (Ameroseiidae: Mesostigmata) from Southern Africa. Wetenskaplike Bydraes van die pu vircho. Reeks, B: Natuurwetenskappe, n. 103. p. 6.
- Lindquist EE, Evans GO. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). Mem Entomol Soc Can. 47:1–64.
- Lindquist EE, Moraza ML. 2009. Anystipalpus, Antenoseius and Vitzthunia: a taxonomic and nomenclatural conundrum of genera (Acari: Mesostigmata: Dermanyssina), with description of four species of Anystipalpus. Zootaxa. 2243:1–39.
- Livshitz IZ, Mitrofanov VI. 1975. New species of Ameroseiidae from Crimea. Zool Zhurnal. 54:462–465.
- Mineiro JLC, Raga A, Sato ME, Lofego AC. 2009. Ácaros associados ao cafeeiro (*Coffea* spp.) no estado de São Paulo, Brasil. Parte 1. Mesostigmata Biota Neotrop. 9(1):37–46.
- Nasr AK, Abou-Awad BA. 1987. Four new species of family Ameroseiidae from Egypt (Acari: Mesostigmata). Bull Soc Entomol Egypt. 66:75–83.
- Oudemans AC. 1902a. Report of the thirty-fifth winter meeting of the Nederlandsche Entomologische Vereeniging. Tijdschr voor Entom. 45:10.
- Oudemans AC. 1902b. New list of Dutch Acari. Second Part. Tijdschr Entomol. 45:1-52.
- Oudemans AC. 1930. Acarologische Aanteekeningen CIV. Entomol Ber. 8:135-140.
- Rack G. 1963. Kleemannia (Acarina, Ameroseiidae) ein neuer wohnunslästling. Ent Mitt Zool Mus Hamburg. 2:1–7.

Rack G. 1971. Milben in Neubauten. Prakt SchädlBekämpf. 23(11):149–152.

- Sousa JM, Gondim MGC Jr, Barros R, Oliveira JV. 2005. Ácaros em produtos armazenados comercializados em supermercados e feiras livres da cidade de Recife. Neotrop Entomol. 34(2):303–309.
- Westerboer I, Bernhard F. 1963. Die familie Phytoseiidae Berlese 1916. In: Stammer, H, editor. Beitrage zur Systematik und Onkologie mitteleuropaischer Acarina. Band II, Mesostigmata I. Leipzig: Akademische Verlagsgesellschaft; p. 451–791.
- Womersley H. 1956. Some additions to the Acarina Mesostigmata of Australia. T Roy Soc South Aust. 79:104–120.