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Previous volumes (2010-2020): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

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A new species of *Amblydromalus* Chant & McMurtry (Acari: Phytoseiidae), with notes on occurrence of genus in South America

Peterson Rodrigo Demite, José Marcos Rezende, Priscila Carvalho Dahmer, Ana Cristina C. Cavalcante, Antonio Carlos Lofego

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**ABSTRACT**

A new species, *Amblydromalus amazonicus* n. sp. is described and illustrated based on adults of both sexes. Individuals were found in association with plants in natural vegetation (Amazon Forest), on uncultivated plants in guarana crops, and on exotic fruit (residential area), in states of Amazonas and Mato Grosso, Brazil. The type material of *A. akiri* Nuvoloni, Lofego, Rezende & Feres was re-examined and the number of setae as well as the chaetotaxy of genu III is corrected. Notes on the occurrence of *Amblydromalus* in South America and a key to species of genus for this subcontinent is provided.

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**Keywords**  Amazon Biome; Amblyseiinae; Euseiini; South America

**Zoobank**  http://zoobank.org/0C03B33C-20A4-47E1-AB84-509B598E10A2

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**Introduction**

The genus *Amblydromalus* Chant & McMurtry (Acari: Phytoseiidae) belongs to the tribe Euseiini Chant & McMurtry, subtribe Typhlodromalina Chant & McMurtry, with 23 valid species, the majority recorded in the Neotropical Region (Chant and McMurtry 2005, 2007, Demite et al. 2021). To date, all species of this genus are characterized by having 33 pairs of setae, with female idiosomal setal pattern 10A:9B/JV-3:ZV, the most common for Amblyseiinae (Chant and McMurtry 2005). Twelve species have been recorded from Brazil, being six of them recorded from the Brazilian Amazon region, namely *Amblydromalus akiri* Nuvoloni, Lofego, Rezende & Feres, *A. insolitus* Nuvoloni & Lofego, *A. itacoatiarensis* Demite, Cavalcante & Lofego, *A. manihoti* (Moraes), *A. villacarmelensis* (Moraes) and *A. zannoui* Famah Sourassou, Sarmento & Moraes (Moraes et al. 1994, Navia et al. 2005, Nuvoloni et al. 2015a, b, Vasconcelos and Silva 2015, Cruz et al. 2019, Demite et al. 2019). Additionally, Gondim Jr. et al. (2012) identified two morphospecies (*Amblydromalus* aff. *arawak* and *Amblydromalus* sp.) in the state of Roraima, however, their observation based on a few specimens. This study aims to describe a new species of the genus *Amblydromalus*, the first of its kind which presents *J1* setae, associated with plants in the states of Amazonas and Mato Grosso, Brazil.
Material and methods

Mites were collected from leaf samples from six native plants and one exotic fruit (rambutan) in two states from Brazil (Amazonas and Mato Grosso). In the state of Amazonas, the samplings were carried out in municipalities of Itacoatiara, Maués, Parintins, and Sílves (east region of the state). Natural vegetation and residential area were sampled in the first three municipalities and in the last, respectively. In the state Mato Grosso, the samplings were carried out in Cotriguaçu municipality (north region of the state) in natural vegetation. All areas are within the domain of the Amazon Forest biome.

The phytoseiid specimens were sorted under a stereomicroscope (40x) and subsequently mounted on microscope slides in Hoyer’s medium. They were examined under phase-contrast microscopy (Zeiss Axio Imager M3). The new species was illustrated using a drawing tube attached to the microscope; the images were processed with the software Adobe Illustrator CS6. Measurements of taxonomically relevant structures were done with the use of a graded eye-piece. The measurements of the holotype (female) are given in bold, followed by the average measurement and then by minimum and maximum values (in parentheses) for the holotype and paratypes.

The setal nomenclature adopted was that of Lindquist and Evans (1965) and Lindquist (1994), as adapted by Rowell et al. (1978) for the dorsum and by Chant and Yoshida-Shaul (1991) for the venter of the phytoseiids. The idiosomal setal pattern follows Chant and Yoshida-Shaul (1992). The notation of gland pores (solenostomes) or lyrifissures (poroids) is based on Athias-Henriot (1975). Terminology for the spermathecal apparatus follows that described by Beard (2001).

The analyses on *A. akiri* were done studying specimens of the type series, deposited in the collection of Acari of the Departmento de Zoologia e Botânica, da UNESP, Campus de São José do Rio Preto, São Paulo, Brazil.

The studies that report the occurrence of *Amblydromalus* species in South America (previous records) were obtained from the Phytoseiidae Database (Demite et al. 2021; http://www.lea.esalq.usp.br/phytoseiidae/). Records of species of the genus that contained “cf.” or “af.” were not considered for this study. The records of *A. horatii* (De Leon) in Brazil, Guyana, and Suriname by Byrne et al. (1983) and Murphy (1984) were considered as *Amblydromalus arawak* (De Leon), since that this species is a junior synonym of *A. arawak* (Denmark et al. 1999).

**Sytematics**

*Amblydromalus amazonicus* n. sp. Demite, Rezende & Lofego

[Zoobank: 6F1500CC-5935-41BA-A5F3-AA18B70EFD0F](http://www.zoobank.org/6F1500CC-5935-41BA-A5F3-AA18B70EFD0F) (Figure 1)

**Diagnosis**

Female with dorsal shield smooth, only with some striae, mainly in anterolateral region; all dorsal setae smooth and pointed, except *Z5* slightly serrated; with seta *J1* present. Sternal shield smooth, with lateral striae, with posterior margin trilobate; genital and ventrianal shields smooth; ventrianal shield vase-shaped, with a pair of crescentic preanal pores; all ventral setae smooth. Calyx tubular; atrium widening next to major duct and with forked aspect; major duct with thick wall next to the atrium. Macrosetae smooth with knobbed tips, present on genua of all legs, tibiae of legs III and IV and basitarsus of leg IV.

**Female (n= 14)**

**Dorsum** — (Figure 1A). Idiosomal setal pattern 10A: 10B/JV-3:ZV. Dorsal shield mostly smooth, only with some striae, mainly in the anterolateral region; 320 302 (280–323) long...
**Figure 1** *Amblydromalus amazonicus* n. sp., female: A – Dorsal idiosoma; B – Ventral idiosoma; C – Spermatheca; D – Chelicera; E – Genu, tibia and basitarsus of leg IV. Male: F – Ventrianal shield; G – Spermatodactyl.
from anterior to posterior margins along midline, 195 198 (190–210) wide at level of s4; with 18 pairs of setae on dorsal shield; setae r3 and R1 inserted in the unsclerotized cuticle; with 11 pairs of lyrifissures and seven pairs of gland pores; setae lengths: j1 20 (17–23), j3 25 (21–26), j4 10 9 (7–10), j5 8 (7–9), j6 10 9 (8–10), J1 11 10 (8–11), J2 12 10 (9–12), J5 7 (5–7), z2 12 10 (9–12), z4 10 (8–11), z5 9 8 (6–9), Z1 12 11 (10–12), Z4 11 10 (9–12), Z5 60 57 (53–62), s4 26 22 (20–26), S2 14 13 (10–15), S4 14 12 (10–14), S5 10 10 (9–10), r3 15 13 (11–15), R1 10 9 (8–10). All dorsal setae smooth, except Z5 slightly serrated; in some specimens Z5 and s4 with tips ending in a small membrane (Figure 1’).

**Venter** — (Figure 1B). Sternal shield smooth, except lateral striae, with three pairs of setae and two pairs of lyrifissures (iv1 and iv2); distances between st1–st3 52 52 (49–60), st2–st2 64 63 (59–68); s4 and one lyrifissure (iv3) on metasternal plate. Genital shield smooth, distance between st5–st5 70 65 (59–73). With two pairs of metapodal plates. Ventrianal shield v-shaped, smooth; 49 91 (83–98) long, 50 50 (45–54) wide at level of JV2 and 60 57 (52–64) at level of anus; with three pairs of pre-anal setae (JV1, JV2 and JV2) and a pair of crescentic pores (gv3) posterior to JV2. Four pairs of opisthogastric setae on unsclerotized cuticle (JV4, JV5, ZVI1 and ZVI3). Seta JV5 40 35 (30–40). All ventral setae smooth.

**Peritreme** — Extending to level of j1.

**Spermatheca** — (Figure 1C). Calyx tubular, 27 23 (18–27) (for some mounted specimens the calyx is visually bent); atrium widening next to major duct and with forked aspect; major duct with thick wall next to atrium.

**Chelicera** — (Figure 1D). Fixed digit 26 26 (23–30) long, with 9 9 (8–10) teeth in addition to apical hook and pilus dentilis; movable digit, 28 24 (23–28), with 3 4 (3–5) teeth in addition to apical hook.

**Legs** — (Figure 1E). Macrosetae smooth with knobbed tips; lengths: Sgel 27 27 (25–28), Sgel 27 27 (25–30), SgelIII 36 36 (34–39), StIi 23 23 (21–25), SgelIV 53 53 (51–55), StIV 27 28 (24–30), StIV 63 61 (55–63). Chaetotactic formula of genu II: 2-2/0-2/0-1 and genu III: 1-2/1-2/0-1.

**Male (n= 4)**

**Dorsum** — Dorsal shield ornamentation as in female, 224 (220–225) long, 155 (146–170) wide at level of s4; setae lengths: j1 17 (16–18), j3 21 (19–22), j4 8 (8–9), j5 6 (6–7), j6 8 (7–8), J1 8 (7–10), J2 9 (8–10), J5 5 (5–6), z2 8, z4 9 (8–9), z5 7 (6–7), Z1 9 (8–10), Z4 9 (8–10), Z5 42 (40–45), s4 17 (17–18), S2 10 (9–10), S4 9 (8–10), S5 7 (7–8), r3 9 (8–10), R1 7 (7–8). Setae r3 and R1 on dorsal shield. All dorsal setae smooth, except Z5 serrate.

**Venter** — (Figure 1F). Sterigmogenital shield smooth; ventrianal shield subtriangular, with striation anteriorly and laterally to pores; 94 (87–97) long and 128 (120–132) wide at anterior corners, with three pairs of pre-anal setae (JV1, JV2 and JV2), two pairs of lyrifissures and one pair of pores postero-mesad of JV2; JV5 23 (22–24). All ventral setae smooth.

**Peritreme** — Extending to level of z2.

**Chelicera** — Fixed digit 20 long, with nine teeth in addition to hook and pilus dentilis; movable digit 17 long, with four teeth in addition to hook. *Spermatodactyl* (Figure 1G) with shaft 18 (16–19) long.

**Legs** — Macrosetae smooth with knobbed tips, except Sgel smooth and pointed; lengths: Sgel 20, Sgel 19 (18–20), SgelIII 22 (20–23), StIi 18, SgelIV 36 (34–37), StIV 22 (21–24), StIV 45 (43–47). Chaetotactic formulae of genu II and genu III as female.

**Type specimens**

Holotype female, three paratype females and three paratype males on *Nephelium lappaceum* L. (Sapindaceae), in Silves (02°54′49″S, 58°26′15″W), Amazonas state, 27 October 2019, R.B. Souza collector; two paratype females and one paratype male on *Hymenaea* sp. (Leguminosae) in Contriguacu (09°51′00″S, 58°14′00″W), Mato Grosso state, 15 January 2015, J.M. Rezende
Demite P. R. et al. (2021), *Acarologia* 61(3): 527-537; DOI 10.24349/acarologia/20214445

& A.C. Lofego collectors; one paratype female on *Pauroma guianensis* Aubl. (*Urticaceae*), Itacoatiara (3°5′37″ S, 58°27′31″ W), Amazonas state, 24 November 2017, P.R. Demite & A.C.C. Cavalcante collectors; one paratype female on *Hevea brasiliensis* (Willd. ex A.Juss.) Müll.Arg. (*Euphorbiaceae*), Itacoatiara (2°59′41″ S, 58°27′12″ W), Amazonas state, 25 June 2019, A.C.C. Cavalcante, P.C. Dahmer & R.B. Souza collectors; one paratype female on *Pouteria caimito* (Ruíz & Pav.) Radlk. (*Sapotaceae*), Itacoatiara (2°59′41″ S, 58°27′12″ W), Amazonas state, 26 September 2019, R.B. Souza collector; one paratype female on *Bertholletia excelsa* Bonpl. (*Lecythidaceae*), Parintins (2°40′06″ S, 56°46′24″ W), Amazonas state, 2 January 2020, M.P. Duque collector; three paratype females, one paratype male and one deutonymph on *Leguminosae* unidentified, Itacoatiara (03°00′46.8″ S, 58°26′58.9″ W), Amazonas state, 06 January 2020, P.C. Dahmer collector; one paratype female on *Oenocarpus bacaba* Mart. (*Arecaceae*), Maués (3°26′06″ S, 57°50′51″ W), Amazonas state, 08 March 2020, P.C. Dahmer collector. All type specimens are deposited in the collection of Acari of the Departamento de Zoologia e Botânica, da UNESP, Campus de São José do Rio Preto, São Paulo, Brazil.

**Differential diagnosis**

*Amblydromalus amazonicus* n. sp. is more similar to *Amblydromalus akiri* Nuvoloni, Lofego, Rezende & Feres, 2015b, by the atrium format, widening next to major duct and macroseta Sgel IV knobbed. Also is similar to *A. insolitus* Nuvoloni & Lofego in Nuvoloni et al (2015a), *A. itacoatiarensis* Demite, Cavalcante & Lofego, 2019 and *A. zannoui* Famah Sourassou, Sarmento & Moraes, 2017 by atrium shape. In addition, *A. akiri* differs from *A. amazonicus* n. sp. by having s4 about 45% longest and Sti IV and Sti IV with blunt tips; *A. insolitus* differs by having j3 and s4 about 40% and 70% longest, respectively; *A. itacoatiarensis* by having j3, s4, Sgel and Sti IV about 50%, 150%, 50% and 40% longest, respectively; *A. zannoui* by having j1, j3, s4, Sgel, Sgel II, Sti IV and Sti IV about 40%, 65%, 70%, 40%, 40%, 40%, 200% and 65%, respectively. Additionally, *A. insolitus*, *A. itacoatiarensis* and *A. zannoui* differs of *A. amazonicus* n. sp. by having all macrosetae pointed. *Amblydromalus amazonicus* n. sp. differs from all species of genus by the presence of seta J1.

**Etymology**

The specific name “amazonicus” refers to Amazon Forest biome.

**Remarks**

According to Chant and McMurtry (2005) mites of the genus *Amblydromalus* have the ratio s4: Z1 > 3: 1. The ratio between these two setae in *Amblydromalus amazonicus* n. sp. was lower, being the type series average 2: 1 (2.2: 1 in the holotype; 1.8–2.4 in the type series specimens), what could lead this species to be classified as *Ueckermannseius* according to the definition of Chant and McMurtry (2007). However, the s4: Z1 < 3: 1 ratio has also been observed in other species classified as *Amblydromalus: Amblydromalus tigrus* (Denmark & Evans) (2.1: 1; holotype; Denmark et al. 1999); *Amblydromalus ntundu* (Pritchard & Baker) (2.1: 1; paratype; Moraes et al. 2006); *Amblydromalus manihoti* (Moraes) (2.7: 1; holotype; Moraes et al. 1994); *Amblydromalus akiri* (2.9: 1; type series; Nuvoloni et al. 2015b) and *Amblydromalus arawak* (De Leon) (2.9: 1; holotype; Moraes et al. 1994). In addition, in other populations of two of these species, different from what was observed in the type series, was observed ratio greater than 3: 1 between s4 and Z1. In material collected from *A. ntundu* from Cameroon and DR Congo the ratio was 3.1: 1 (Moraes et al. 2006). In the case of *A. manihoti*, a species frequently collected in South America, the s4: Z1 ratio ranged from 1.8: 1 (Rocha et al. 2015) to 4.1: 1 (Guanilo et al. 2008, Demite et al. 2017). In this way, the s4 / Z1 ration seems to be an unstable character and, therefore, would not be the best character to separate two genera. So, we consider this new species within the genus *Amblydromalus*, despite the s4: Z1 < 3: 1 ratio, due it be morphologically closer to some *Amblydromalus* species, as indicated in differential diagnosis, than any other *Ueckermannseius* species. We believe that molecular studies or even
integrative taxonomy should be performed to verify the phylogenetic relationships within the Typhlodromalina subtribe, and verify if Amblydromalus and Ueckermannseius are in fact two valid clades or if constitute a single natural group.

Within Amblydromalus, only for a single specimen, collected in Cameroon, was reported the presence of seta J1. This specimen was identified as A. swaga (Pritchard & Baker) by Moraes et al. (2006), although for others four specimens analyzed in the same study, including holotype, the presence of J1 was not observed, indicating that the presence of this seta may be an anomaly in A. swaga. Differently in A. amazonicus n. sp. the presence of J1 is a stable character, present in all specimens found, including females, males and deutonymph. Amblydromalus amazonicus n. sp. belongs to the limonicus species group, by having J4 much shorter than 40% of the distance between its base and that of seta Z3, and shorter than the distance between its base and that of seta S4 (Chant and McMurtry 2005). Despite the presence of seta J1 on dorsal shield we decided to include A. amazonicus n. sp. within the limonicus species group than creating a new one. Within of Euseinini tribe, the seta J1 is recorded in Typhlodromalus fragosoi (Yoshida-Shaul and Chant 1991).

New morphological information on Amblydromalus akiri Nuvoloni, Lofego, Rezende & Feres

In the original description of A. akiri the chaetotactic formula annotate to genu III is 1-2/2-0/1, with a total of eight setae (Nuvoloni et al. 2015b). However, an observation on specimens of

| Table 1 Occurrence of Amblydromalus species in countries of South America. |
|---|
| **Species** | **BOL** | **BRA** | **COL** | **ECU** | **FGU** | **GUY** | **PAR** | **PER** | **SUR** | **VEN** |
| Amblydromalus amazonicus n. sp. | X¹ | | | | | | | | | |
| Amblydromalus akiri | X² | | | | | | | | | |
| Amblydromalus aravak | X³ | X⁴ | | X⁵ | | X⁶ | | | | |
| Amblydromalus congeae | X⁷ | | | | | | | | | |
| Amblydromalus insolitus | X⁸ | | | | | | | | | |
| Amblydromalus inacostairensis | X⁹ | | | | | | | | | |
| Amblydromalus laetus | X¹⁰ | | | | | | | | | |
| Amblydromalus limonicus | X¹¹ | X¹² | X¹³ | X¹⁴ | X¹⁵ | X¹⁶ | X¹⁷ | X¹⁸ | | |
| Amblydromalus macroatrium | X¹⁹ | | | | | | | | | |
| Amblydromalus manihoti | X²⁰ | X²¹ | X²² | X²³ | X²⁴ | X²⁵ | X²⁶ | X²⁷ | | |
| Amblydromalus rapax | X²⁸ | X²⁹ | X³⁰ | X³¹ | X³² | X³³ | | | | |
| Amblydromalus villacarmelensis | X³⁴ | | | | | | | | | |
| Amblydromalus zannoui | X³⁵ | | | | | | | | | |
types series (holotype and paratypes) revealed that the specimens actually have seven setae. The chaetotactic formula should be correct as 1-2/1-2/0-1. The same difference on chaetotaxy was observed also on another species, *A. insolitus* Nuvoloni & Lofego described with eight setae on genu III (Nuvoloni *et al.* 2015a) and then Demite *et al.* (in press) verified that in fact these species bear seven setae on this leg segment, as in type series as on specimens collected in the municipality of Poconé (Pantanal biome), Mato Grosso state, Brazil.

**Occurrences of *Amblydromalus* species in South America.**

With the description of *A. amazonicus* n. sp., the genus currently has 24 described species. Of these 13 are reported on the South American subcontinent (Table 1). All 13 species are registered in Brazil, five described in the last six years (Nuvoloni *et al.* 2015a, 2015b, Zannou *et al.* 2017, Demite *et al.* 2019 and this study). On the other hand, no species of this genus has been registered in Argentina, Chile and Uruguay. This difference in the number of records between countries is mainly due to the lack of surveys of mites in the countries. The last five described species of this genus were collected in regions hitherto little explored (Central-West, Northeast and North regions of Brazil). In addition, the records indicate a probable preference of these mites for regions of a warmer climate, which could explain the absence of these mites in regions further south of the continent.

**Key to *Amblydromalus* species (females) recorded from South America (updated from Demite *et al.* 2019)**

1. Seta *Z4* more than 70% as long as distance between its base and that of seta *Z5*, and distinctly longer than *S4* and/or *S5* ........................................... *congeae* species group ... 2
   — Seta *Z4* much shorter than 40% of distance between its base and that of seta *Z5*, and at most as long as *S4* and/or *S5* ....................................................... *limonicus* species group ... 4

2. Seta *Z4* relatively shorter, at most as long as distance between its base and base of *Z5*; insertion of *S4* almost in transverse line with insertion of *Z4* .......................................................... *A. laetus* (Chant & Baker, 1965)
   — Seta *Z4* relatively longer, longer than distance between its base and base of *Z5*; insertion of *S4* well posterior to insertion of *Z4* ........................................... 3

3. Seta *S2* longer than distance between its base and base of *Z1* .......................................................... *A. congeae* (De Leon, 1965)
   — Seta *S2* about 0.5 as long as distance between its base and base of *Z1* .......................................................... *A. macroatrium* Moraes, Barbosa & Castro, 2013

4. Seta *J1* present .......................................................... *A. amazonicus* n. sp.
   — Seta *J1* absent .................................................................. 5

5. Macrosetae of leg IV capitate (*SgeIV* or blunt (*StIV* and *StIV*) .......................................................... *A. akiri* Nuvoloni, Lofego, Rezende & Feres, 2015b
   — Macrosetae of leg IV pointed .......................................................... 6

6. Dorsal shield covered mainly by roundish ornamentation (weak), with a few anterolateral striae .......................................................... *A. insolitus* Nuvoloni & Lofego in Nuvoloni *et al.* (2015a)
   — Dorsal shield mainly smooth, except a few anterolateral striae .......................................................... 7

7. Preanal seta *JV1* almost in straight line with setae *JV2* and *ZV2* *A. arawak* (De Leon, 1966)
   — Preanal seta *JV1* located anteriorly the setae *JV2* and *ZV2* (mainly) .......................................................... 8
8. Width of major duct when connecting to atrium greater than width of calyx when connecting to atrium. — Width of major duct when connecting to atrium equal to or less than width of calyx when connecting to atrium.

9. Calyx of spermatheca elongate, with a median narrowing, about 24 µm in length. — Calyx of spermatheca tubular, without a median narrowing, about 14 µm in length. A. zannoui Famah Sourassou, Sarmento & Moraes, 2017.

10. Setae Z4 about two times longer than J2 and Z1; insertion of J5 posterior to insertion of Z5. — Setae J2, Z1 and Z4 sub-equal in length; insertion of J5 in transverse or little anterior line.

11. Setae j3 and s4 sub-equal in length. — Seta j3 shorter than s4 in length.

12. Seta Z5 longer than s4; calyx of spermatheca 15–20 µm; macroseta of tibia IV (StiIV) about 45 µm. — Seta Z5 shorter than s4; calyx of spermatheca 25–40 µm; macroseta of tibia IV (StiIV) longer than 60 µm.

Acknowledgments

We thank Isabel Reis Guesdon (Universidade Federal do Amazonas, Itacoatiara, Amazonas) for plant identification. Antonio C. Lofego received a research productivity fellowship from CNPq [Proc. no. 310617/2018-9]. Peterson R. Demite receives a scholarship (PNPD) from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). Priscila C. Dahmer received a scholarship (POSGRAD) from the Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM).

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