Two new species of Amblyseiinae Muma (Acari: Mesostigmata: Phytoseiidae) from southwest China

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Abstract

Amblyseiinae is the largest subfamily of Phytoseiidae with 196 recorded species from China. Two new species, Amblyseius basaensis sp. nov. and Transiueus guangheensis sp. nov., were found by examining the specimens collected from two southwest provinces in China, both near to Vietnam border. Herein, they are described and illustrated based on the female specimens.

Key words: Amblyseius, Transeius, taxonomy, description

Introduction

Phytoseiid mites (Acari: Phytoseiidae) are diverse and widespread arthropods, playing important ecological role, and some of them have been used widely for controlling phytophagous mites and small insects (Kostiainen & Hoy 1996; Wu et al. 2009; McMurtry et al. 2013). Amblyseiinae is the largest subfamily in the family Phytoseiidae, with 1816 nominal species in the world, included in 66 genera (Demite et al. 2019). So far 196 species belonging to 15 genera of phytoseiid mites have been recorded in China (Wu et al. 2009; Fang et al. 2017; Liao et al. 2017, 2018; Demite et al. 2019).

Guangxi Zhuang Autonomous Region and Yunnan Province are both located in southwest China, mountainously and inhabited by many ethnic minorities. Their geographical position are border on Vietnam, belonging to East Palaearctic (Cox 2001), among which, Guangxi is karst landform in most areas and Yunnan is relatively higher altitude, located in the Yunnan-Guizhou plateau. Currently, the phytoseiid species recorded in Guangxi and Yunnan is 52 and 57 species respectively. Among them 37 and 39 species belong to the subfamily Amblyseiinae, respectively (Wu et al. 2010). This study presents two new species Amblyseius basaensis sp. nov. and Transeius guangheensis sp. nov. from the above two sites.

Materials and Methods

Mite specimens examined in this study were collected from Guangxi and Yunnan provinces during May to June in 2016, with a particular focus on the two southwest provinces in China, Guanghe Village, Zuozhou Town, Chongzuo City, Guangxi Zhuang Autonomous Region and Basa Village, Hekou Town, Honghe Hani and Yi Autonomous Prefecture, Yunnan Province. Mites were mounted in Hoyer's medium and examined, measured, illustrated, and photographed under an optical microscope (Leitz®512836) and picture pick-up system (NIS-Elements D 4.50.00 64-bit edition).
Measurements are presented in micrometers (μm). Holotype measurements are shown in bold type for the new species, followed by their mean and range in parentheses. Morphological features of adult mites were measured according to descriptions in Fang et al. (2018): dorsal shield length and width were taken from the anterior to posterior margins of the shield along the midline and from the lateral margins at s4 level; for all ventral shields, lengths were measured along their midline from the anterior to posterior margins; widths were taken from the lateral margins at st2, st5 and ZV2 level respectively; cheliceral fixed digit length was measured from dorsal poroid to anterior tip and movable digit length measured from the basal articulation to the tip. The general terminology used for morphological descriptions in this study follows that of Chant & McMurtry (2007), idiosomal seta terminology follows those by Rowell et al. (1978) and Chant & Yoshida-Shaul (1991, 1992), adenotaxy and poroidotaxy terminology followed that of Beard (2001), and chaetotaxy of legs follows that of Evans (1963).

**Taxonomy**

*Amblyseius hasaensis* Fang & Wu sp. nov.  
(Figures 1–7)

**Diagnosis.** Dorsal shield surface smooth. All dorsal shield setae smooth, except Z4, Z5 long, whip-like, serrate. With seven pairs of solenostomes on dorsal shield (gd1–gd2, gd4–gd6, gd8–gd9), and 15 pairs of lyrifissures (id1a, id1–id2, id4, id6, id8, idl2–idl4, idm1–idm6) on dorsal shield. Length of setae: j1 24 (28–30), j3 48 (45–50), j4 5 5 (3–5), j5 4 4 (3–6), j6 5 5 (5–7), J2 5 6 (5–7), J5 7 7 (5–8), z2 10 10 (9–12), z4 7 7 (6–9), z5 5 4 (3–6), Z1 6 7 (5–7), Z4 129 119 (110–131), Z5 363 344 (332–370), s4 119 114 (110–120), S2 9 8 (6–9), S4 8 8 (7–10), S5 8 8 (7–10), r3 12 14 (11–15), RI 7 7 (6–9).

**Female**  
(n=8)

**Dorsal idiosoma** (Figures 1, 2). Dorsal setal pattern 10A: 9B. Dorsal shield smooth. Dorsal shield 323 310 (299–323) long and 231 196 (182–231) wide, distances between setae j1–J5 310 296 (280–311) and s4–s4 175 166 (157–175), shield nearly oval, very slightly constricted at level of R1. Setae r3 and R1 on soft membranous cuticle laterad dorsal shield, r3 at level of z4, R1 at level of shield incisions. All setae smooth, except Z4 and Z5 long, whip-like, serrate. With seven pairs of solenostomes (gd1–gd2, gd4–gd6, gd8–gd9), and 15 pairs of lyrifissures (id1a, id1–id2, id4, id6, id8, idl2–idl4, idm1–idm6) on dorsal shield. Length of setae: j1 24 28 (24–30), j3 48 48 (45–50), j4 5 5 (3–5), j5 4 4 (3–6), j6 5 5 (5–7), J2 5 6 (5–7), J5 7 7 (5–8), z2 10 10 (9–12), z4 7 7 (6–9), z5 5 4 (3–6), Z1 6 7 (5–7), Z4 129 119 (110–131), Z5 363 344 (332–370), s4 119 114 (110–120), S2 9 8 (6–9), S4 8 8 (7–10), S5 8 8 (7–10), r3 12 14 (11–15), RI 7 7 (6–9).

**Ventral idiosoma** (Figure 3). Ventral setal pattern JV-3: ZV. All ventral setae smooth. Steranal shield smooth, anterior margin convex, posterior margin almost flat, 81 77 (75–81) long, 74 73 (70–76) wide, length longer than width, with three pairs of setae st1 33 31 (29–34), st2 34 29 (28–34), st3 28 26 (24–28), and two pairs of lyrifissures (pst1–pst2), distance between st1–st3 62 61 (58–64) and st2–st2 67 66 (64–69). Metasternal platelets drop-shaped, each with one metasternal seta, std 24 24 (22–26) and one lyrifissure (pst3). Genital shield smooth, width at level of genital setae (st5) 69 67 (65–69), with one pair of thin genital setae st5 20 22 (19–23), traiing edge flat; one pair of associated poroids on soft cuticle near posterior corners of shield. Ventrianal shield smooth, sub-rectangular, 114 107 (105–114) long, 83 78 (76–83) wide at level of ZY2, with three pairs of thin pre-anal setae JVI 18 18 (17–21), Jv2 19 18 (15–19), ZV2 17 15 (14–17); Pa 19 17 (15–20), Pst 19
16 (14–19) long. Pre-anal pores crescent-shaped, posteromedian to JV2, distance between pores 21 (19–21). Opisthogastric soft cuticle with four pairs of setae, ZV1 12 (12–16), ZV3 8 (7–10), JV4 7 8 (7–10), JV5 86 83 (80–88) long. All ventral setae thin, except JV5, thicker. Two pairs of metapodal platelets, primary platelets 27 22 (20–27) long, 7 6 (5–7) wide, secondary ones 11 11 (9–12) long, 2 3 (2–3) wide.

TABLE 1. Differences in diagnostic characters between *Amblyseius basaensis* Fang & Wu sp. nov. and similar species.

<table>
<thead>
<tr>
<th>Character</th>
<th>basaensis&lt;sup&gt;a&lt;/sup&gt;</th>
<th>cessator&lt;sup&gt;b&lt;/sup&gt;</th>
<th>tamatavensis&lt;sup&gt;c&lt;/sup&gt;</th>
<th>supercaudatus&lt;sup&gt;d&lt;/sup&gt;</th>
<th>longisaccatus&lt;sup&gt;e&lt;/sup&gt;</th>
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<tr>
<td>Dorsal setae</td>
<td>Z5=3Z4, Z5=3x4</td>
<td>Z5=1.5Z4, Z5=2x4</td>
<td>Z5=2Z4, Z5=2.5x4</td>
<td>Z5=2Z4, Z5=2.5x4</td>
<td>Z5=2.5Z4, Z5=3x4</td>
</tr>
<tr>
<td>Posterior margin of</td>
<td>straight</td>
<td>straight</td>
<td>straight</td>
<td>concave</td>
<td>straight</td>
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<tr>
<td>sternal shield</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventrianal shield</td>
<td>sub-rectangular (length &gt; width)</td>
<td>sub-rectangular (length &lt; width)</td>
<td>sub-rectangular (length &gt; width)</td>
<td>pentagonal</td>
<td></td>
</tr>
<tr>
<td>No. of teeth on</td>
<td>12/4</td>
<td>11-13/3</td>
<td>11/4</td>
<td>10/1</td>
<td>14/4</td>
</tr>
<tr>
<td>FD/MD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spermatheca</td>
<td>calyx tubular, flaring distally, atrium incorporated with calyx, major duct narrower than calyx</td>
<td>calyx tubular-fundibular, atrium directly connected with base of calyx, major duct as wide as calyx</td>
<td>calyx tubular, flaring distally, atrium incorporated with calyx, major duct as wide as calyx</td>
<td>calyx long saccular, atrium directly connected with base of calyx, major duct narrower than calyx</td>
<td></td>
</tr>
<tr>
<td>Constriction at</td>
<td>with constriction</td>
<td>with constriction</td>
<td>without constriction</td>
<td>with constriction</td>
<td></td>
</tr>
<tr>
<td>level of R1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-anal pore</td>
<td>crescent-shaped, postero-median to JF2</td>
<td>round-shaped, postero-median to JF2</td>
<td>crescent-shaped, behind and slightly mediad JF2</td>
<td>crescent-shaped, mesad JF2, almost in a line with JF2</td>
<td></td>
</tr>
</tbody>
</table>

* from eight specimens, † from De Leon, 1962, ‡ from Blommers, 1974, † from Döker et al., 2018, † from Karg, 1994, † from Wu et al., 2009

**Peritreme.** Peritreme extending anteriorly beyond j1. Posterior margin of peritremal shields truncate (Figure 4)

**Chelicera** (Figure 5). Fixed digit 29 29 (27–31) long, with 12 teeth and pilus dentilis, movable digit 33 32 (31–34) long, with four teeth.

**Spermatheca** (Figure 6). Calyx of spermatheca 15 15 (14–17) long, 3 3 (3–3) wide at middle region, tubular, distal flaring; atrium 2 2 (1–2) wide, small, knobbed, incorporated with calyx; major duct narrow, very short, directly attached to calyx, without neck, and minor duct invisible.

**Legs.** Genua formula for leg I 2-2-2, 2/1-1, leg II 1-2/1, 2/0-1, leg III 2-2/0, 1/1-1, leg IV 2-1/1, 2/0-1. Genua I–III each with one macroseta, Sge I 57 54 (52–58), Sge II 36 38 (35–40), Sge III 72 70 (68–74). Leg III with one macroseta on tibia, Sti III 57 55 (52–59). Leg IV with three long, whip-like macrosetae on genu, tibia and basitarsus (Figure 7), Sge IV 153 154 (149–158), Sti IV 105 108 (101–110) and St IV 74 76 (70–78), Sge IV > St IV > St IV.

**Male.** Unknown

**Material examined.** Holotype: ♀, Basa Village, Hekou Town, Hekou Yao Autonomous County, Honghe Hani and Yi Autonomous Prefecture, Yunnan Province (accession no. YN-0204), *Ageratum conyzoides* L. May 25, 2016, Fang X.D. coll. Paratypes: 7♀ (accession no. YN-0021, YN-0041, YN-0191, YN-0192, YN-0201, YN-0632, YN-0642), same locality, host, date and collector as holotype.

**Etymology.** The name *basaensis* refers to the type locality Basa Village, where the type specimens were collected.

**Remarks.** Due to the spermatheca with length/width of calyx at mid-point > 3.4: 1.0, this species belongs to the *aerilalis* or *nicola* species subgroups (Chant & McMurtry 2004). By having similar shape of dorsal shield, smooth quadrangular ventrianal shield, elongated spermatheca and presence of a macroseta on genu, tibia and basitarsus of leg IV (*Sge IV > St IV > St IV*), *A. basaensis* sp. nov. is similar to *A. cessator* De Leon, 1962, *A. tamatavensis* Blommers, 1974 and *A. longisaccatus* Wu, Lan & Liu, 1995. By having similar shape of ventrianal shield and spermatheca, the new species is
similar to *A. supercaudatus* Karg, 1994. Differences between *A. basaensis* sp. nov. and the related species are given in Table 1.

**Transeius guangheensis** Fang & Wu sp. nov.  
(Figures 8–13)

**Diagnosis.** Dorsal shield surface mostly smooth, with anterolateral reticulation. All dorsal shield setae smooth, except Z4, Z5 thick, serrate. With seven pairs of solenostomes on dorsal shield (*gd1–gd2, gd4–gd6, gd8–gd9*). Sternal shield length and width similar, with three pairs of setae. One pair of solenostomes mesad *JV2*, almost in a line with setae *JV2*. Peritreme extending to *j1* level. Fixed and movable digits of chelicera with nine and three teeth, respectively. Calyx of spermatheca bell-shaped, atrium small-knobbed, incorporated with calyx. Genu, tibia and basitarsus of leg IV each with a macroseta. Genua of legs I–III each with one macroseta.

**Female** (*n=7*)

**Dorsal idiosoma** (Figure 8). Dorsal setal pattern 10A?9B. Dorsal shield 300 296 (289–303) long and 179 182 (172–193) wide, distances between setae *j1–j5* 292 284 (275–292) and *s4–s6* 151 151 (150–155), shield nearly oval, slightly constricted at level of *R1*; shield surface mostly smooth, with anterolateral reticulation, *r3* and *R1* on soft membranous cuticle laterad dorsal shield, *r3* at level of *z4, R1* at level of shield incisions. Dorsal setae *j1, j3, s4, Z4* and *Z5* relatively longer (> 15), other setae shorter. All dorsal shield setae smooth and setiform, except *Z4, Z5* thick, serrate. With seven pairs of solenostomes on dorsal shield (*gd1–gd2, gd4–gd6, gd8–gd9*), and 14 pairs of lyrifissures (*id1a, id2, id4, id6, idx, idl2–idl4, idm1–idm6*) on dorsal shield. Length of setae: *j1 15* (15–20), *j3 24* 22 (20–25), *j4 7* 7 (5–9), *j5 7* 7 (5–9), *j6 7* 7 (5–9), *Z2 10* 9 (7–10), *J5 7* 7 (5–7), *z2 13* 12 (11–14), *z4 10* 10 (10–12), *z5 7* 7 (5–8), *Z1 8* 9 (7–10), *Z4 39* 37 (35–40), *Z5 72* 70 (69–74), *s4 25* 27 (24–28), *S2 13* 13 (11–15), *S4 9* 10 (7–10), *S5 8* 8 (7–9), *r3 7* 8 (7–9), *R1 8* 8 (7–10).

**Ventral idiosoma** (Figure 9). Ventral setal pattern *JV-3: ZV*. All ventral setae smooth. Sternal shield smooth, anterior margin convex, posterior margin of shield almost flat, 58 57 (55–60) long, 65 64 (63–67) wide, width longer than length, with three pairs of setae *st1 20* (17–22), *st2 15* 18 (14–19), *st3 15* 17 (14–18), and two pairs of lyrifissures (*pst1–pst2*), distance between *st1–st3* 52 51 (47–52) and *st2–st2* 58 57 (56–58). Metasternal platelets drop-shaped, each with one metasternal seta, *srt 15* 17 (14–18), and one lyrifissure (*pst3*). Genital shield smooth, width at level of genital setae (*st5*) 58 62 (58–63), with one pair of thin genital setae *st5 17* 17 (15–19), trailing edge flat; one pair of associated poroids on soft cuticle near posterior corners of shield. Ventrianal shield lightly striate, pentagonal, 100 99 (95–102) long, 89 88 (86–91) wide at level of *JV2*, with three pairs of thin pre-anal setae *JV1 14* 15 (14–17), *JV2 13* 14 (12–15), *JV2 15* 14 (14–17); *Pa 11* 13 (10–14), *Pst 14* 12 (10–14) long. Pre-anal pores round-shaped, mesad *JV2*, almost in a line with setae *JV2*, distance between pores 33 31 (29–33). Opisthogastric soft cuticle with four pairs of setae, *ZV1 12* 14 (12–16), *ZV3 10* 10 (9–12), *JV4 9* 9 (7–11), *JV5 33* 33 (29–35) long. All ventral setae thin, except *JV5*, thick. Two pairs of metapodal platelets, primary ones 17 16 (14–17) long, 5 5 (4–6) wide, secondary ones 10 10 (10–12) long, 2 2 (2–3) wide.

**Peritreme.** Peritreme extending to *j1* level. Peritrematal shields with posterior termination curved at tip (Figure 10).

**Chelicera** (Figure 11). Fixed digit 18 19 (17–21) long, with nine teeth, *pilus dentilis* not visible; movable digit 23 21 (19–24) long, with three teeth.
Spermatheca (Figure 12). Calyx of spermatheca 11 (9–13) long, 7 (5–7) wide at middle region, bell-shaped; atrium 2 (2–2) wide, small, knobbed, incorporated with calyx; major duct narrow, without neck, and minor duct not visible.


Legs. Genua formula for leg I 2-2/2, 2/1-1, leg II 1-2/1, 2/1-1, leg III 1-2/2, 1/1-1, leg IV 2-1/1, 2/0-1. Genua of legs I–III each with one macroseta, Sge I 25 (23–27), Sge II 19 21 (18–23), Sge
III 24 26 (23–27). Leg III with one macroseta on tibia, Sti III 20 21 (18–23). Genu, tibia and basitarsus IV each with one macroseta (Figure 13), Sge IV 47 49 (45–50), Sti IV 31 32 (29–33) and St IV 48 49 (45–50), St IV > Sge IV > Sti IV.

Male. Unknown.


Etymology. The name guangheensis refers to the type locality Guanghe Village, where the type specimens were collected.

Remarks. This new species belonging to bellottii species group and bellottii species sub-group by having bell-shaped calyx of spermatheca and short z4 (Chant & McMurtry 2004).

By having very similar shape of dorsal shield, straight posterior margin of sternal shield, pentagonal ventrianal shield; similar shape of calyx of spermatheca and one macroseta on genu, tibia and basitarsus of leg IV, T. guangheensis sp. nov. is similar to T. volgini (Wainstein & Begljarov, 1971), T. fulvus Ehara & Toyoshima, 2006 and T. jujae El-Banhawy & Knapp, 2011. Differences between T. guangheensis sp. nov. and the related species are given in Table 2.

TABLE 2. Differences in diagnostic characters between Transeius guangheensis Fang & Wu sp. nov. and similar species.

<table>
<thead>
<tr>
<th>Character</th>
<th>guangheensis</th>
<th>volgini</th>
<th>fulvus</th>
<th>jujae</th>
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<tr>
<td>Body size</td>
<td>289–303</td>
<td>400</td>
<td>405–490</td>
<td>350</td>
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<tr>
<td>Dorsal shield</td>
<td>reticulate</td>
<td>entire</td>
<td>entire</td>
<td>entire</td>
</tr>
<tr>
<td>Dorsal setae</td>
<td>Z5=2.5x4</td>
<td>Z5=2.5x4</td>
<td>Z5=2.5x4</td>
<td>Z5=2.5x4</td>
</tr>
<tr>
<td>Z4 Z5 both serrate</td>
<td>smooth</td>
<td>serrate</td>
<td>smooth</td>
<td>serrate</td>
</tr>
<tr>
<td>Ventrianal shield</td>
<td>striate</td>
<td>smooth</td>
<td>smooth</td>
<td>smooth</td>
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<tr>
<td>Spermatheca</td>
<td>bell-shaped</td>
<td>directly</td>
<td>saccular</td>
<td>saccular</td>
</tr>
<tr>
<td>Pre-anal pore</td>
<td>round-shaped</td>
<td>behind</td>
<td>round-shaped</td>
<td>behind</td>
</tr>
<tr>
<td>Macrosetae</td>
<td>St IV &gt; Sge IV &gt; Sti IV</td>
<td>St IV &gt; Sge IV &gt; Sti IV</td>
<td>St IV &gt; Sge IV &gt; Sti IV</td>
<td>St IV &gt; Sge IV &gt; Sti IV</td>
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* from seven specimens, † from Wainstein & Begljarov, 1971, ‡ from Ehara & Toyoshima, 2006, † from El-Banhawy & Knapp, 2011

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References


