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A new species of *Parabonzia* (Trombidiformes: Cunaxidae) based on adults and nymphs with a key to the world species

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Original research

ABSTRACT

A new species, namely *Parabonzia xinningensis* Chen & Jin **sp. nov.**, is described from China, based on female, male, tritonymph, deutonymph and protonymph. A key to adult females of *Parabonzia* species of the world is provided.

Keywords mites; Bdelloidea; taxonomy; China

Zoobank <http://zoobank.org/DB8185E9-4AB6-4A46-94AE-D5834E2BD67C>

Introduction

The genus *Parabonzia* was erected by Smiley (1975) for *Bonzia bdelliformis* Atyeo (1958) as the type species, belongs to the subfamily Bonziinae and the family Cunaxidae Thor (1902). Den Heyer (1975, 1977), Smiley (1992), Corpuz-Raros (1996) and Lin & Zhang (1998, 2002) added six species, namely, *P. marthae* (Den Heyer, 1975), *P. athiasae* Den Heyer (1977), *P. mumai* Smiley (1992), *P. mindanensis* Corpuz-Raros (1996), *P. trioxys* Lin & Zhang (1998), *P. zhangii* Lin & Zhang (2002). Recently, Khaustov (2020) described a species, *P. sibiriensis*, from Western Siberia, Russia which increased the known species to eight in this genus. Herein, we present the description of a new species of this genus collected from Shunhuangshan National Nature Reserve, Xinning County, Hunan Province, China.

Materials and methods

Samples of rotten wood were collected from Shunhuangshan National Nature Reserve, Xinning County, Hunan Province. Collected samples were placed into Berlese-Tullgren funnels for 8–12 hours, and mites were extracted from the samples, preserved in 75% alcohol and then mounted on slides in Hoyer's medium (Krantz and Walter 2009). Line drawings were prepared with the aid of a drawing tube attached to the microscope Nikon Ni E and photographs were taken using a camera (Nikon DS-Ri 2) attached to the microscope. All figures were edited with Adobe Photoshop CC 2019. Measurements (given in micron μm) were taken using the software Nikon NIS Elements AR 4.50 and provided for the holotype followed by measurements of the range of paratypes in parentheses. The dorsal and ventral setal notations follow Skvarla *et al.* (2014), and those of legs follow Den Heyer (1981).

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Abbreviations: *ag*—aggenital seta, *at*—anterior trichobothria, *asl*—attenuate solenidion, *bsl*—blunt rod-like solenidion, *dtsl*—dorsoterminal solenidion, *eu*—eugenital seta, *fam*—famulus (= peg organ), *hg*—hypognathal seta, *hgs*—hystergastral seta, *lps*—lateral proterosomal seta, *mps*—median proterosomal seta, *pa*—para-anal seta, *ppgs*—propodogastral seta, *ps*—pseudanal seta, *pt*—posterior trichobothria, *sts*—simple tactile seta, *T*—trichobothrium, *tsl*—terminal solenidion.

Results

Cunaxidae Thor, 1902

Bonziinae Den Heyer, 1977

Parabonzia Smiley, 1975

Parabonzia xinningensis Chen & Jin sp. nov. (Figures 1–21)

Zoobank: [2C380B60-BE0F-429B-A119-6E32063195EC](https://zoobank.org/2C380B60-BE0F-429B-A119-6E32063195EC)

Diagnosis — Hysterosomal median shield with four pairs of setae (*c1*, *c2*, *d1*, *e1*); palp telofemur with one branched (4 tines) seta; genital plates with eight pairs of genital setae; setal formula of coxal plates I–IV: 6-6-7-7 *sts*; genu III and genu IV with one and two *asl* setae respectively; tibia III with one *bsl* seta.

Description

Female (n = 21; Figures 1–7) Idiosoma 200 (200–246) long, 120 (108–150) wide (Figures 1–2).

Figure 1 *Parabonzia xinningensis* Chen & Jin sp. nov., female: A – dorsal of entire body; B – ventral of entire body. Scale represents 100 μm.

Figure 3 *Parabonzia xinningensis* Chen & Jin sp. nov., female: A – prodorsum; B – hysterosomal (median) shield; C – opisthosoma; D – coxae plates I and II; E – hysterosoma anterior part, venter; F – genital and anal region. Scale represents 50 µm.

Figure 4 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, female: A – one additional seta close to *lb* is present on the right coxa I; B – genital and anal region. Scale represents 50 μm.

Figure 5 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, female: A – palp; B – chelicerae; C – subcapitulum. Scale represents 100 μm.

Figure 6 *Parabonzia xinningensis* Chen & Jin sp. nov., female: A – palp telofemur branched (4 times) seta; B–D – subcapitulum, venter. Scale represents 50 µm.

25 (25–34), *cl-dl* 24 (24–32), *c2-dl* 29 (29–38), *dl-el* 25 (25–31), *el-fl* 25 (25–38), *el-f2* 26 (26–41), *fl-h1* 21 (21–36), *fl-h2* 29 (27–44), *f2-h1* 22 (18–35), *f2-h2* 23 (18–36), *fl-f2* 8 (8–12), *hl-h2* 10 (9–18).

Venter (Figures 1B, 2B, 3D–F, 4A–B) — Ventral area between the gnathosoma and coxae II, coxal plates I–IV, and genital plates with random papillae. Coxae I–II fused and coxae III–IV also fused. Area between coxae II and *ppgs* with transverse papillate striation; area between coxae III–IV groups with curved longitudinal papillate striation forming the shape of the letter "X"; area outside genital plates and anal region with slightly curved longitudinal papillate striation. Setal formula of coxal plates I–IV: 6-6-7-7 *sts*; one pair of propodogastral setae (*ppgs*), 7 (7–8) in length, and two pairs of hystergastral setae, *hgs1* and *hgs2*, 7 (7–8) and 7 (6–9) in length respectively. Genital plates long 35 (33–37), wide 20 (16–22), two pairs of visible genital papillae, eight pairs of genital setae (*gl*–*g8*), 7 (7–8), 6 (7–8), 7 (6–8), 6 (6–8), 7 (6–8), 7 (6–7), 6 (6–6), 6 (6–7) in length, respectively; one pair of eugenital setae (*eu*) 10 (10–11) in length; five pairs of aggenital setae (*agl*–*ag5*), 6 (7–8), 5 (5–10), 7 (7–10), 6 (6–8), 6 (6–9) in length, respectively. Anal region with one pair of pseudanal setae (*ps1*), 7 (7–10) in length, four pairs of para-anal setae (*pal*–*pa4*), 19 (17–20), 20 (12–20), 10 (10–13), 7 (7–10) in length, respectively, and one pair of lyrifissures (*ih*).

Gnathosoma (Figures 5A–C, 6A–D) — Palp (Figures 5A, 6A). Five-segmented, 118 (104–

Figure 7 *Parabonzia xinningensis* Chen & Jin sp. nov., female: A–D – leg I–IV respectively. Scale represents 100 μ m.

126) long, all segments with papillae. Palpal chaetotaxy: trochanter without setae; basifemur with two simple setae (one ventral and one dorsal); telofemur with one distally branched (4 times) seta; genu with four simple setae (two ventral and two dorsal); tibiotarsus with one smooth sigmoid seta, one rod-like solenidion and five smooth simple setae; terminal claw absent. Chelicera (Figure 5B) 117 (114–126) long, with papillae, and ended in a developed cheliceral digit 8 (6–12) in length; cheliceral seta short, 3 (2–3) in length, arising near the base of cheliceral digit. Subcapitulum (Figures. 5C, 6B–D) 96 (95–123) long, 51 (51–66) wide and without adoral setae; with six pairs of hypognathal setae (*hg*), *hg1* the longest and slightly curved; *hg1*–*hg6* 45 (40–46), 20 (18–22), 11 (10–13), 14 (14–19), 12 (10–12) and 10 (8–10) in length, respectively. Distances of *hg* setae: *hg1*–*hg1* 7 (4–8), *hg2*–*hg2* 7 (7–10), *hg3*–*hg3* 11 (11–14), *hg4*–*hg4* 48 (47–49), *hg5*–*hg5* 13 (13–16), *hg6*–*hg6* 46 (37–44), *hg1*–*hg2* 9 (9–11), *hg2*–*hg3* 19 (19–21), *hg3*–*hg4* 21 (18–21), *hg4*–*hg5* 14 (14–17), *hg5*–*hg6* 14 (12–14).

Legs (Figure 7A–D) — Lengths of leg I–IV: 124 (124–135), 113 (113–117), 128 (118–132), 135 (134–146). Lengths of tarsus I–IV: 43 (42–48), 40 (41–43), 40 (37–43), 40 (38–45). *T* plumose on tibia IV 64 (64–68) in length. Legs I–IV chaetotaxy: coxae I–IV 6-6-7-7 *sts*; trochanters I–IV 1-1-2-1 *sts*; basifemora I–IV 4-7-3-2 *sts*; telofemora I–IV 5-5-4-3 *sts*. Genu I 4 *asl*, 5 *sts*; genu II 2 *asl*, 5 *sts*; genu III 1 *asl*, 6 *sts*; genu IV 2 *asl*, 6 *sts*. Tibia I 1 *asl*, 1 *bsl*, 6 *sts*; tibia II 6 *sts*; tibia III 1 *bsl*, 6 *sts*; tibia IV 1 plumose *T*, 6 *sts*. Tarsus I 2 *asl*, 3 *bsl*, 1 *fam*, 1 *dtssl*, 2 *tsl*, 18 *sts*; tarsus II 1 *bsl*, 1 *dtssl*, 1 *tsl*, 18 *sts*; tarsus III 1 *dtssl*, 14 *sts*; tarsus IV 1 *dtssl*, 12 *sts*.

Male (*n* = 1; Figures 8–11) Idiosoma 160 long and 107 wide. (Figures 8A–B, 9A–B)

Dorsum (Figures 8A, 9A) — Resembling that of the female; propodosomal shield 53 long, 73 wide, median shield 48 long, 63 wide, cupules (*ia*, *im*, *ip*) invisible, setal lengths and

Figure 8 *Parabonzia xinningensis* Chen & Jin sp. nov., male: A – dorsal of entire body; B – ventral of entire body. Scale represents 100 μ m.

distances: *at* 72, *pt* 65, *lps* 26, *mps* 18, *c1* 19, *c2* 16, *d1* 18, *e1* 17, *f1* 17, *f2* 13, *h1* 18, *h2* 12; *at-at* 19, *pt-pt* 28, *lps-lps* 38, *mps-mps* 12, *lps-mps* 28, *at-lps* 17, *pt-mps* 8, *pt-lps* 24, *at-mps* 41, *at-pt* 36, *c1-c1* 20, *c2-c2* 63, *d1-d1* 32, *e1-e1* 21, *f1-f1* 9, *f2-f2* 20, *h1-h1* 8, *h2-h2* 22, *c1-c2* 24, *c1-d1* 21, *c2-d1* 25, *d1-e1* 20, *e1-f1* 13, *e1-f2* 14, *f1-h1* 17, *f1-h2* 20, *f2-h1* 16, *f2-h2* 17, *f1-f2* 5, *h1-h2* 9.

Venter (Figures 8B, 9B) — Eugenital setae (*eu*) and pseudanal setae (*ps*) absent; setal formula of coxal plates I–IV: 6-6-7-6 *sts*; propodogastral setae (*ppgs*) and hystergastral setae (*hgs1–hgs2*) equal 7 in length. Genital plates long 29, wide 14, six pairs of genital setae (*g1–g6*; only five setae on left plate), 6–7 in length; two pairs of aggenital setae (*ag1–ag2*), 6 and 5 in length, respectively. Three pairs of para-anal setae (*pa1–pa3*), 12, 12, 7 in length, respectively; lyrifissures (*ih*) invisible.

Gnathosoma (Figures 10A–C) — Resembling the female. Palp (Figure 10A) 105 long; trochanter without setae; basifemur with two simple setae (one ventral and one dorsal); telofemur with one distally branched (4 times) seta; genu with four simple setae (two ventral and two dorsal); tibiotarsus with one smooth sigmoid seta, one rod-like solenidion and five smooth simple setae. Chelicera (Figure 10B) 107 long; cheliceral seta short, 3 in length. Subcapitulum (Figures 10C) 110 long, 60 wide; *hg1–hg6* 40, 15, 10, 15, 9 and 8 in length, respectively. Distances of *hg* setae: *hg1–hg1* 7, *hg2–hg2* 9, *hg3–hg3* 11, *hg4–hg4* 47, *hg5–hg5*

Figure 9 *Parabonzia xinningensis* Chen & Jin sp. nov., male: A – dorsal idiosoma; B – ventral idiosoma. Scale represents 100 μ m.

13, hg6-hg6 34, hg1-hg2 9, hg2-hg3 21, hg3-hg4 15, hg4-hg5 14, hg5-hg6 8.

Legs (Figure 11A–D) — Resembling those of female; lengths of leg I–IV: 113, 98, 105, 118. Lengths of tarsus I–IV: 40, 33, 35, 38. *T* 57 in length. Legs I–IV chaetotaxy: coxae I–IV 6-6-7-6 *sts*; trochanters I–IV 1-1-2-1 *sts*; basifemora I–IV 4-7-3-2 *sts*; telofemora I–IV 5-5-4-3 *sts*. Genu I 4 *asl*, 5 *sts*; genu II 2 *asl*, 5 *sts*; genu III 1 *asl*, 6 *sts*; genu IV 2 *asl*, 6 *sts*. Tibia I 1 *asl*, 1 *bsl*, 6 *sts*; tibia II 6 *sts*; tibia III 1 *bsl*, 6 *sts*; tibia IV 1 plumed *T*, 6 *sts*. Tarsus I 2 *asl*, 3 *bsl*, 1 *fam*, 1 *dtsl*, 1 *tsl*, 17 *sts*; tarsus II 1 *bsl*, 1 *dtsl*, 1 *tsl*, 16 *sts*; tarsus III 1 *dtsl*, 14 *sts*; tarsus IV 1 *dtsl*, 13 *sts*.

Tritonymph ($n = 1$; Figures 12–14) Idiosoma 198 long, 130 wide.

Dorsum (Figure 12A) — Resembling the female; propodosomal shield 56 long, 69 wide; median shield 55 long, 74 wide; setal lengths and distances: *at* 79, *pt* 64, *lps* 27, *mps* 17, *c1* 17, *c2* 16, *d1* 18, *e1* 20, *f1* 22, *f2* 14, *h1* 22, *h2* 15; *at-at* 21, *pt-pt* 30, *lps-lps* 44, *mps-mps* 14, *lps-mps* 34, *at-lps* 18, *pt-mps* 8, *pt-lps* 29, *at-mps* 41, *at-pt* 42, *c1-c1* 22, *c2-c2* 67, *d1-d1* 32, *e1-e1* 28, *f1-f1* 14, *f2-f2* 25, *h1-h1* 11, *h2-h2* 30, *c1-c2* 22, *c1-d1* 21, *c2-d1* 25, *d1-e1* 20, *e1-f1* 32, *e1-f2* 36, *f1-h1* 25, *f1-h2* 36, *f2-h1* 23, *f2-h2* 32, *f1-f2* 7, *h1-h2* 13.

Venter (Figure 12B) — Setal formula of coxal plates I–IV: 5-5-6-5 *sts*; propodogastral setae (*ppgs*) and hystergastral setae (*hgs1*) equal 7 in length. Genital plates long 30, wide 14; five pairs of genital setae (*g1–g5*), 6–7 in length; one pairs of aggenital setae (*ag1*), 6 in length. Three pairs of para-anal setae (*pa1–pa3*), 15, 15, 7 in length, respectively.

Gnathosoma (Figures 13A–C) — Resembling the female. Palp (Figure 13A) 102 long; trochanter without setae; basifemur with two simple setae (one ventral and one dorsal); telofemur with one distally branched (4 times) seta; genu with four simple setae (two ventral and two dorsal); tibiotarsus with one smooth sigmoid seta, one rod-like solenidion and five

Figure 10 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, male: A – palp; B – chelicerae; C – subcapitulum. Scale represents 100 µm.

Figure 11 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, male: A–D – leg I–IV respectively. Scale represents 100 µm.

Figure 12 *Parabonzia xinningensis* Chen & Jin sp. nov., tritonymph: A – dorsal idiosoma; B – ventral idiosoma. Scale represents 100 μ m.

smooth simple setae. Chelicera (Figure 13B) 100 long; cheliceral seta short, 2 in length. Subcapitulum (Figures 13C) 98 long, 60 wide; *hg1*–*hg6* 34, 14, 9, 13, 8 and 8 in length, respectively. Distances of *hg* setae: *hg1*–*hg1* 7, *hg2*–*hg2* 10, *hg3*–*hg3* 12, *hg4*–*hg4* 44, *hg5*–*hg5* 15, *hg6*–*hg6* 38, *hg1*–*hg2* 9, *hg2*–*hg3* 22, *hg3*–*hg4* 15, *hg4*–*hg5* 14, *hg5*–*hg6* 11.

Legs (Figure 14A–D) — Resembling the female; lengths of leg I–IV: 110, 98, 105, 108. Lengths of tarsus I–IV: 38, 33, 35, 34. *T* 54 in length. Legs I–IV chaetotaxy: coxae I–IV 5-5-6-5 *sts*; trochanters I–IV 1-1-2-1 *sts*; basifemora I–IV 4-5-2-0 *sts*; telofemora I–IV 5-5-4-3 *sts*. Genu I 4 *asl*, 5 *sts*; genu II 2 *asl*, 5 *sts*; genu III 1 *asl*, 6 *sts*; genu IV 2 *asl*, 5 *sts*. Tibia I 1 *asl*, 1 *bsl*, 6 *sts*; tibia II 6 *sts*; tibia III 1 *bsl*, 6 *sts*; tibia IV 1 plumose *T*, 4 *sts*. Tarsus I 1 *asl*, 3 *bsl*, 1 *fam*, 1 *dtsl*, 1 *tsl*, 14 *sts*; tarsus II 1 *bsl*, 1 *dtsl*, 1 *tsl*, 13 *sts*; tarsus III 1 *dtsl*, 14 *sts*; tarsus IV 1 *dtsl*, 11 *sts*.

Deutonymph (*n* = 1; Figures 15–18) Idiosoma 190 long, 135 wide.

Dorsum (Figure 15A) — Resembling the female; propodosomal shield 72 long, 93 wide; median shield 59 long, 90 wide; setal lengths and distances: *at* 75, *pt* 67, *lps* 24, *mps* 17, *c1* 14, *c2* 13, *d1* 14, *e1* 17, *f1* 21, *f2* 14, *h1* 25, *h2* 17; *at*–*at* 24, *pt*–*pt* 40, *lps*–*lps* 50, *mps*–*mps* 15, *lps*–*mps* 37, *at*–*lps* 22, *pt*–*mps* 9, *pt*–*lps* 31, *at*–*mps* 50, *at*–*pt* 48, *c1*–*c1* 29, *c2*–*c2* 80, *d1*–*d1* 37, *e1*–*e1* 28, *f1*–*f1* 13, *f2*–*f2* 29, *h1*–*h1* 12, *h2*–*h2* 35, *c1*–*c2* 26, *c1*–*d1* 23, *c2*–*d1* 32, *d1*–*e1* 22, *e1*–*f1*

Figure 13 *Parabonzia xinningensis* Chen & Jin sp. nov., tritonymph: A – palp; B – chelicerae; C – subcapitulum. Scale represents 100 μ m.

Figure 14 *Parabonzia xinningensis* Chen & Jin sp. nov., tritonymph: A–D – leg I–IV respectively. Scale represents 100 μ m.

Figure 15 *Parabonzia xinningensis* Chen & Jin sp. nov., deutonymph: A – dorsal idiosoma; B – ventral idiosoma. Scale represents 100 µm.

26, *e1-f2* 27, *f1-h1* 25, *f1-h2* 38, *f2-h1* 23, *f2-h2* 33, *f1-f2* 8, *h1-h2* 16.

Venter (Figure 15B) — Setal formula of coxal plates I–IV: 4-3-4-2 *sts*; propodogastral setae (*ppgs*) and hystergastral setae (*hgs1*) equal 6 in length. Genital plates long 20, wide 10; three pairs of genital setae (*g1–g3*), each 6 in length; one pairs of aggenital setae (*ag1*), 6 in length. Three pairs of para-anal setae (*pa1–pa3*), 15, 12, 6 in length, respectively.

Gnathosoma (Figures 16A–C, 17A–B) — Palp (Figures 16A, 17B) 91 long; basifemur with only one seta, telofemur with one distally branched (3 times) seta; genu with four simple setae (two ventral and two dorsal); tibiotarsus with one smooth sigmoid seta, one rod-like solenidion and five smooth simple setae. Chelicera (Figure 16B) 93 long; cheliceral seta 3 in length. Subcapitulum (Figures 16C, 17A) 90 long, 64 wide, four pairs of hypognathal setae (*hg*), *hg1–hg4*, 21, 11, 9, 11 in length, respectively. Distances of *hg* setae: *hg1–hg1* 8, *hg2–hg2* 9, *hg3–hg3* 15, *hg4–hg4* 43, *hg1–hg2* 11, *hg2–hg3* 22, *hg3–hg4* 15.

Legs (Figure 18A–D) — Resembling the female; all legs with basifemora and telofemora fused, lengths of leg I–IV: 118, 100, 110, 120. Lengths of tarsus I–IV: 37, 30, 39, 39. *T* 48 in length. Legs I–IV chaetotaxy: coxae I–IV 4-3-4-2 *sts*; trochanters I–IV 1-1-2-1 *sts*; basifemora I–IV 2-2-1-0 *sts*; telofemora I–IV 5-5-4-3 *sts*. Genu I 3 *asl*, 5 *sts*; genu II 2 *asl*, 5 *sts*; genu III 1 *asl*, 5 *sts*; genu IV 1 *asl*, 5 *sts*. Tibia I 1 *asl*, 1 *bsl*, 5 *sts*; tibia II 5 *sts*; tibia III 1 *bsl*, 5 *sts*; tibia IV 1 plumose *T*, 4 *sts*. Tarsus I 1 *asl*, 3 *bsl*, 1 *fam*, 1 *dtsl*, 1 *tsl*, 13 *sts*; tarsus II 1 *bsl*, 1 *dtsl*, 15 *sts*; tarsus III 14 *sts*; tarsus IV 12 *sts*.

Protonymph (*n* = 1; Figures 19–21) Idiosoma 152 long, 113 wide.

Dorsum (Figure 19A) — Resembling the female; propodosomal shield 60 long, 73 wide;

Figure 16 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, deutonymph: A – palp; B – chelicerae; C – subcapitulum. Scale represents 100 µm.

Figure 17 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, deutonymph: A – subcapitulum; B – palp telofemur branched (3 tines) seta. Scale represents 50 µm.

Figure 18 *Parabonzia xinningensis* Chen & Jin sp. nov., deutonymph: A–D – leg I–IV respectively. Scale represents 100 μ m.

median shield 48 long, 80 wide; setal lengths and distances: *at* 68, *pt* 57, *lps* 20, *mps* 15, *c1* 12, *c2* 10, *d1* 13, *e1* 15, *f1* 22, *f2* 12, *h1* 24, *h2* 14; *at-at* 22, *pt-pt* 35, *lps-lps* 46, *mps-mps* 16, *lps-mps* 32, *at-lps* 19, *pt-mps* 9, *pt-lps* 28, *at-mps* 43, *at-pt* 43, *c1-c1* 24, *c2-c2* 73, *d1-d1* 31, *e1-e1* 25, *f1-f1* 13, *f2-f2* 24, *h1-h1* 9, *h2-h2* 24, *c1-c2* 23, *c1-d1* 20, *c2-d1* 29, *d1-e1* 22, *e1-f1* 28, *e1-f2* 31, *f1-h1* 24, *f1-h2* 30, *f2-h1* 22, *f2-h2* 25, *f1-f2* 8, *h1-h2* 9.

Venter (Figure 19B) — Setal formula of coxal plates I–IV: 3-3-3-1 *sts*; propodogastral setae (*ppgs*) and hysterogastral setae (*hgs1*) equal, 6 in length; one pair of genital papillae. Genital plates long 15, wide 8; one pair of genital setae (*gl*); 5 in length; aggenital setae (*ag*) absent. Three pairs of para-anal setae (*pal-pa3*), 11, 11 and 6 in length, respectively.

Gnathosoma (Figure 20A–C) — Palp (Figure 20A) 74 long; trochanter without setae; basifemur with only one simple seta; telofemur with one distally branched (3 times) seta; genu with four simple setae (two ventral and two dorsal); tibiotarsus with one smooth sigmoid seta, one rod-like solenidion and five smooth simple setae. Chelicera (Figure 20B) 77 long; cheliceral seta short, 2 in length. Subcapitulum (Figure 20C) 79 long, 49 wide; four pairs of hypognathal setae (*hg*), *hg1-hg4*, 20, 8, 5 and 7 in length, respectively. Distances of *hg* setae: *hg1-hg1* 7, *hg2-hg2* 10, *hg3-hg3* 13, *hg4-hg4* 32, *hg1-hg2* 11, *hg2-hg3* 21, *hg3-hg4* 13.

Legs (Figure 21A–D) — Resembling the female; all legs with basifemora and telofemora fused; lengths of leg I–IV: 99, 91, 100, 90. Lengths of tarsus I–IV: 33, 30, 28, 28. *T* absent on tibia IV. Legs I–IV chaetotaxy: coxae I–IV 3-3-3-1 *sts*; trochanters I–IV 1-1-2-0 *sts*; basifemora I–IV 2-2-1-0 *sts*; telofemora I–IV 5-5-4-0 *sts*. Genu I 3 *asl*, 5 *sts*; genu II 1 *asl*, 5 *sts*; genu III 1 *asl*, 5 *sts*; genu IV 1 *asl*, 0 *sts*. Tibia I 1 *asl*, 1 *bsl*, 5 *sts*; tibia II 5 *sts*; tibia III 1 *bsl*, 5 *sts*; tibia

Figure 19 *Parabonzia xinningensis* Chen & Jin sp. nov., protonymph: A – dorsal idiosoma; B – ventral idiosoma. Scale represents 100 µm.

IV 0 sts. Tarsus I 2 bsl, 1 fam, 1 dtsl, 1 tsl, 14 sts; tarsus II 1 bsl, 1 dtsl, 15 sts; tarsus III 14 sts; tarsus IV 7 sts.

Larvae — Unknown.

Etymology — The new species name is derived from its collection place Xinning County, Hunan Province, P. R. China.

Remarks — In order to clearly understand the morphological differences among the life stages, chaetotaxy of palp, legs, coxae and genital papillae of protonymph, deutonymph, tritonymph, male and female are presented in Table 1.

Additional setae on legs, genital plates and subcapitulum were observed in some female paratypes: there is one additional seta close to *1b* present on the right coxa I in one female specimen (Figure 4A); one additional genital seta is present on the right side in another female specimen (Figure 4B); one additional seta posterior to *hg5* is present on the right side of the subcapitulum in one female specimen, while in another female, *hg6* is absent on the left side of the subcapitulum (Figures 6C–D).

The new species is close to *P. trioxys* (known only from adult female) but differs from it by following characteristics: (1) palp telofemur with one branched (four times) seta (vs. this seta with three times in *P. trioxys*); (2) setal formula of coxal plates I–IV: 6-6-7-7 sts (vs. 7-5-6-7 sts in *P. trioxys*); (3) eight pairs of genital setae (vs. seven in *P. trioxys*) (Lin & Zhang, 1998).

The new species also resembles *P. mindanensis* (known only from adult female) but differs from it by following characteristics: (1) palp telofemur with one branched (four times) seta

Figure 20 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, protonymph: A – subcapitulum; B – palp telofemur branched (3 times) seta. Scale represents 50 µm.

Figure 21 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, protonymph: A–D – leg I–IV respectively. Scale represents 100 µm.

Table 1 *Parabonzia xinningensis* Chen & Jin **sp. nov.**, morphological differences among the life stages protonymph, deutonymph, tritonymph, male and female.

Characters	Protonymph	Deutonymph	Tritonymph	Male	Female
palp basifemur	1	1	2	2	2
<i>hg</i>	4	4	6	6	6
<i>pa</i>	3	3	3	3	4
<i>ps</i>	0	0	0	0	1
<i>g</i>	1	3	5	6	8
<i>eu</i>	0	0	0	0	1
<i>hgs</i>	1	1	1	2	2
<i>ag</i>	0	1	1	2	5
genital papillae	1	2	2	2	2
coxae I–IV	3-3-3-1	4-3-4-2	5-5-6-5	6-6-7-6	6-6-7-7
trochanters I–IV	1-1-2-0	1-1-2-1	1-1-2-1	1-1-2-1	1-1-2-1
basifemora I–IV	2-2-1-0	2-2-1-0	4-5-2-0	4-7-3-2	4-7-3-2
telofemora I–IV	5-5-4-0	5-5-4-3	5-5-4-3	5-5-4-3	5-5-4-3
genu I	-3 <i>asl</i> , 5	3 <i>asl</i> , 5	4 <i>asl</i> , 5	4 <i>asl</i> , 5	4 <i>asl</i> , 5
genu II	1 <i>asl</i> , 5	2 <i>asl</i> , 5	2 <i>asl</i> , 5	2 <i>asl</i> , 5	2 <i>asl</i> , 5
genu III	1 <i>asl</i> , 5	1 <i>asl</i> , 5	1 <i>asl</i> , 6	1 <i>asl</i> , 6	1 <i>asl</i> , 6
genu IV	1 <i>asl</i> , 0	1 <i>asl</i> , 5	2 <i>asl</i> , 5	2 <i>asl</i> , 6	2 <i>asl</i> , 6
tibia I	1 <i>asl</i> , 1 <i>bsl</i> , 5	1 <i>asl</i> , 1 <i>bsl</i> , 5	1 <i>asl</i> , 1 <i>bsl</i> , 6	1 <i>asl</i> , 1 <i>bsl</i> , 6	1 <i>asl</i> , 1 <i>bsl</i> , 6
tibia II	5	5	6	6	6
tibia III	1 <i>bsl</i> , 5	1 <i>bsl</i> , 5	1 <i>bsl</i> , 6	1 <i>bsl</i> , 6	1 <i>bsl</i> , 6
tibia IV	0	1 <i>T</i> , 4	1 <i>T</i> , 4	1 <i>T</i> , 6	1 <i>T</i> , 6
tarsus I	2 <i>bsl</i> , 1 <i>fam</i> , 1 <i>dtsl</i> , 1 <i>tsl</i> , 14	1 <i>asl</i> , 3 <i>bsl</i> , 1 <i>fam</i> , 1 <i>dtsl</i> , 1 <i>tsl</i> , 13	1 <i>asl</i> , 3 <i>bsl</i> , 1 <i>fam</i> , 1 <i>dtsl</i> , 1 <i>tsl</i> , 14	2 <i>asl</i> , 3 <i>bsl</i> , 1 <i>fam</i> , 1 <i>dtsl</i> , 1 <i>tsl</i> , 17	2 <i>asl</i> , 3 <i>bsl</i> , 1 <i>fam</i> , 1 <i>dtsl</i> , 2 <i>tsl</i> , 18
tarsus II	1 <i>bsl</i> , 1 <i>dtsl</i> , 15	1 <i>bsl</i> , 1 <i>dtsl</i> , 15	1 <i>bsl</i> , 1 <i>dtsl</i> , 1 <i>tsl</i> , 13	1 <i>bsl</i> , 1 <i>dtsl</i> , 1 <i>tsl</i> , 16	1 <i>bsl</i> , 1 <i>dtsl</i> , 1 <i>tsl</i> , 18
tarsus III	14	14	1 <i>dtsl</i> , 14	1 <i>dtsl</i> , 14	1 <i>dtsl</i> , 14
tarsus IV	7	12	1 <i>dtsl</i> , 11	1 <i>dtsl</i> , 13	1 <i>dtsl</i> , 12

Note: the number corresponding to *hg*, *pa*, *ps*, *g*, *eu*, *hgs* and *ag* indicates the number of pairs of setae; the number corresponding to genital papillae indicates the number of pairs of genital papillae.

(vs. unbranched in *P. mindanensis*); (2) genua III and IV with one and two *asl* respectively (vs. genua III and IV without *asl* in *P. mindanensis*); (3) tibia III with 1 *bsl* (vs. 0 *bsl* on this segment in *P. mindanensis*) (Corpuz-Raros, 1996).

Type series — Holotype, female was collected from rotten wood, Shunhuangshan National Nature Reserve (N26°14'2.76", E111°20'2.76", elevation 992 m), Xinning County, Hunan Province, China, on 27 August, 2017, by Mao-Yuan Yao and Yan Shen, slide No.: HN-CU-201708272601. Paratypes, 20 females, the same data as the holotype, slides No.: HN-CU-201708272601–HN-CU-201708272621; one male, one tritonymph, one deutonymph and one protonymph, the same data as the holotype, slides No.: HN-CU-201708272622–HN-CU-201708272625, respectively. All the slides are deposited in Institute of Entomology, Guizhou University, Guiyang, P. R. China (GUGC).

Key to world adult female *Parabonzia*

Modified from Skvarla *et al.* (2014)

1. Hysterosomal median shield with 2 pairs of setae ..... *P. sibiriensis* Khaustov, 2020
— Hysterosomal median shield with 3–4 pairs of setae 2
2. Hysterosomal median shield with 3 pairs of setae 3
— Hysterosomal median shield with 4 pairs of setae 7

3. Large spur-like process present on femora III ..... *P. mumai* Smiley, 1992
— Large spur-like process absent on femora III 4
4. Coxae II with 5 *sts* ..... *P. athiasae* Den Heyer, 1977
— Coxae II with 7 *sts* 5
5. Palpal tibiotarsal sigmoid setae lightly barbed ..... *P. marthae* Den Heyer, 1975
— Palpal tibiotarsal sigmoid setae smooth 6
6. Coxae III with 5 *sts* ..... *P. bdelliformis* (Atyeo, 1958)
— Coxae III with 7 *sts* ..... *P. zhangii* Lin & Zhang, 2002
7. Palpal telofemoral seta unbranched ..... *P. mindanensis* Corpuz-Raros, 1996
— Palpal telofemoral seta branched 8
8. Palpal telofemoral seta 4 times ..... *P. xinningensis* Chen & Jin **sp. nov.**
— Palpal telofemoral seta 3 times ..... *P. trioxys* Lin & Zhang, 1998

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