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Phytoseiid mites of Ruyuan Yao Autonomous County, China (Acari: Mesostigmata, Phytoseiidae)

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Original research

ABSTRACT

The fauna of Phytoseiidae in Ruyuan Yao Autonomous County, in China is still poorly known. A survey of these mites was conducted in November 10–15, 2021, collecting 32 species, three of which are new to science. The species collected belong to nine genera of all three phytoseiid subfamilies. A checklist of the species collected is provided, including the description of the new species, named *Euseius hamiltonii* **sp. nov.**, *Phytoseius subcapitatus* **sp. nov.** and *Typhlodromus ruyuanensis* **sp. nov.**

Keywords fauna; survey; taxonomy; checklist; new species
Zoobank http://zoobank.org/DF17BEF3-034E-4F8A-AED1-A85F0F9B9967

Introduction

Phytoseiid mites are well-known for their value in biological control of phytophagous mites and small insects, such as thrips and whiteflies. They are considered to play an important ecological role under natural conditions (McMurtry *et al.*, 2013; Wu *et al*, 2009, 2021). Biodiversity surveys in poorly investigated areas is still an urgent need and might result in the discovery of additional species potentially useful for biological control as well as in the acquisition of information on the biodiversity of these areas (Kreiter *et al.*, 2020a; 2020b, 2020c; Kreiter and Douin, 2021).

Ruyuan Yao Autonomous County is located in the northeast of Guangdong Province, on the south side of Nanling Mountain. It includes Nanling National Nature Reserve and Tianjingshan National Forest Park, considered a biodiversity-rich area, but where the phytoseiid fauna is poorly known (Fang *et al.*, 2020a). The objective of this paper is to present a checklist of the species found in a recent survey in Ruyuan Yao Autonomous County, with the description of the three new species collected.

Material and methods

The survey was conducted in Ruyuan Yao Autonomous County, in Shaoguan City of Guangdong Province, China, in November 10–15, 2021. Collection sites included Nanling National Nature Reserve, Tianjingshan National Forest Park, Ruyuan Grand Canyon, Tongtianluo Virgin Forest, Nanshui Reservoir, Guikeng Village, Bibei Village, Banling Village and Yunxi Village. Table 1 shows the plant species onto which phytoseiid mites were collected in this study, and their respective families.

The mites were collected using the plant-beating method and transferred to vials containing 75% ethanol with a fine brush. They were mounted in Hoyer's medium and examined, measured

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and illustrated under a phase and DIC (differential interference contrast) microscope (Zeiss® Axio Imager A2) provided with the photographic system ZEN 2.3 (Blue edition) © Carl Zeiss Microscopy GmbH, 2011.

Measurements of the new species are presented in micrometers; for each structure, the measurement of the holotype is given in bold, followed by the mean, and range (in parentheses). Morphological features of adult mites were measured as follows: 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*, *s6* and *j6* 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

Table 1 Plant species and respective families onto which mites of the family Phytoseiidae were collected in this study.

Plant species	Family name
Ageratum conyzoides L.	Asteraceae
Artemisia lactiflora Wall. ex DC.	Asteraceae
Aster baccharoides (Benth.) Steetz.	Asteraceae
Bambusa eutuldoides McClure var. *eutuldoides*	Poaceae
Bambusa sp.	Poaceae
Bauhinia championii (Benth.) Benth.	Fabaceae
Boehmeria nivea (L.) Gaudich.	Urticaceae
Blumea megacephala (Randeria) Chang et Tseng	Asteraceae
Camellia cuspidata (Kochs) H. J. Veitch	Theaceae
Camellia oleifera Abel	Theaceae
Cinnamomum japonicum Sieb.	Lauraceae
Citrus maxima (Burm) Merr.	Rutaceae
Citrus reticulata Blanco	Rutaceae
Cryptocarya concinna Hance	Lauraceae
Cunninghamia lanceolata (Lamb.) Hook.	Taxodiaceae
Cyclobalanopsis myrsinifolia (Blume) Oersted	Fagaceae
Dendrocalamus hamiltonii Nees et Arn. ex Munro	Poaceae
Desmos chinensis Lour.	Annonaceae
Dicranopteris dichotoma (Thunb.) Berhn.	Gleicheniaceae
Elaeocarpus chinensis (Gardner & Champ.) Hook.f.	Elaeocarpaceae
Eriobotrya japonica (Thunb.) Lindl.	Rosaceae
Eupatorium chinense L.	Asteraceae
Euphorbia thymifolia Linn.	Euphorbiaceae
Ficus concinna Miq..	Moraceae
Ficus hispida L. f.	Moraceae
Helicia reticulata W. T. Wang	Proteaceae
Indocalamus tessellatus (Munro) Keng f.	Poaceae
Ipomoea cairica (L.) Sweet	Convolvulaceae
Ligustrum sp.	Oleaceae
Maesa perlarius (Lour.) Merr.	Myrsinaceae
Oplismenus compositus (L.) Beauv.	Poaceae
Oreocnide frutescens (Thunb.) Miq.	Urticaceae
Pellionia radicans (Sieb. et Zuc.) Wedd.	Urticaceae
Pinus wallichiana A. B. Jackson	Pinaceae
Praxelis clematidea (Griseb.) R. M. King et H. Rob.	Asteraceae
Pteris linearis Poir.	Pteridaceae
Quercus phillyraeoides A. Gray	Fagaceae
Rhododendron rivulare H&.-Mazz.	Ericaceae
Thyrostachys siamensis (Kurz ex Munro) Gamble	Poaceae

st2, st5 and *ZV2* level; cheliceral fixed digit length was measured from the dorsal poroid to the distal tip and movable digit length measured from the basal articulation to the tip. The generic concept adopted in this publication is that of Chant and McMurtry (2007). Idiosomal seta terminology follows that of Lindquist & Evans (1965) as applied to the phytoseiids by Chant & Yoshida-Shaul (1991) and Chant & Yoshida-Shaul (1992), respectively for dorsum and venter; adenotaxy and poroidotaxy terminology follows that of Athias-Henriot (1975), spermathecal apparatus terminology that of Beard (2001) and leg chaetotaxy that of Evans (1963).

All specimens collected, including the type specimens were deposited at IZGAS (Institute of Zoology, Guangdong Academy of Sciences, Guangzhou, China). The world distribution of these species is given according to the Phytoseiidae Database (Demite *et al.* 2022) and the distribution in China is given according to Wu *et al.* (2021).

The following abbreviation is used in this paper: asl = above sea level.

Results and discussion

A total of 32 species was found, belonging to nine genera and of the three phytoseiid subfamilies, as subsequently specified.

Subfamily Amblyseiinae Muma

Tribe Neoseiulini Chant & McMurtry

Genus *Neoseiulus* Hughes

Neoseiulus womersleyi (Schicha)

Amblyseius womersleyi Schicha, 1975: 101.
Amblyseius (*Neoseiulus*) *womersleyi*, Ehara & Amano, 1998: 30.
Neoseiulus pseudolongispinosus (Xin, Liang & Ke, 1981: 75) (synonymy according to Tseng, 1983).
Amblyseius (*Amblyseius*) *womersleyi*, Tseng, 1983: 54; Ehara *et al.*, 1994: 123.
Neoseiulus womersleyi, Moraes *et al.*, 2004: 152; Chant & McMurtry, 2007: 31; Wu *et al.*, 2021: 65.

World Distribution — China (Anhui, Fujian, Guangxi, Guizhou, Hebei, Jiangsu, Jiangxi, Shandong, Zhejiang, Taiwan), Australia, Japan, South Korea.

Specimens examined — 4 ♀♀ collected at **Ruyuan Grand Canyon** (495 m asl, 24°31′18″ N, 113°07′29″ E; 402 m asl, 24°31′14″ N, 113°07′28″ E); on *B. megacephala*, *O. compositus* and *O. frutescens*.

Tribe Amblyseiini Muma

Sub-tribe Amblyseiina Muma

Genus *Amblyseius* Berlese

Amblyseius eharai Amitai & Swirski

Amblyseius eharai Amitai & Swirski, 1981: 60; Wu *et al.*, 2021: 114.
Amblyseius (*Amblyseius*) *eharai*, Ryu, 1993: 101.

World Distribution — China (Fujian, Guangdong, Guangxi, Hainan, Hongkong, Hubei, Hunan, Jiangsu, Jiangxi, Shandong, Zhejiang, Taiwan), Japan, Malaysia, South Korea, Thailand.

Specimens examined — 6 ♀♀ and 2 ♂♂ collected at **Guikeng Village** (200 m asl, 25°01′03″ N, 113°18′24″ E; 210 m asl, 25°01′04″ N, 113°18′25″ E), on *C. reticulata* and *D. hamiltonii*; 1 ♀ collected at **Bibei Village** (218 m asl, 25°0′57″ N, 113°16′53″ E), on unknown plant.

Amblyseius herbicolus (Chant)

Typhlodromus (*Amblyseius*) *herbicolus* Chant, 1959: 84.
Typhlodromus herbicolus, Hirschmann, 1962: 23.
Amblyseius deleoni (Muma & Denmark, 1970: 68) (synonymy according to Denmark & Muma, 1989).
Amblyseius impactus (Chaudhri, 1968: 553) (synonymy according to Daneshvar & Denmark, 1982).
Amblyseius amitae (Bhattacharyya, 1968: 677) (synonymy according to Denmark & Muma, 1989).
Amblyseius herbicolus, Moraes *et al.*, 2004: 27; Chant & McMurtry, 2007: 78; Wu *et al.*, 2021: 115.
Amblyseius giganticus (Gupta, 1981: 33) (synonymy according to Gupta, 1986).

World Distribution — China (Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Heilongjiang, Henan, Hunan, Jiangsu, Jiangxi, Liaoning, Sichuan, Yunnan, Taiwan), Argentina, Australia, Benin, Brazil, Burundi, Chile (Easter Island), Colombia, Comoros Islands, Congo, Cook Islands, Costa Rica, Dominica, El Salvador, French oversea Islands (Guadeloupe, Les Saintes, Martinique, New Caledonia, Réunion), Ghana, Guatemala, Honduras, India, Iran, Kenya, Malawi, Malaysia, Mauritius (Mainland, Rodrigues Island), Papua New Guinea, Peru, Philippines, Portugal (Mainland, Azores), Rwanda, Senegal, Singapore, South Africa, Spain (Mainland, Canary Islands), Thailand, Turkey, Venezuela, Vietnam, the United States (Mainland, Puerto Rico, Hawaii), the West Indies.

Specimens examined — 37 ♀♀ collected at **Ruyuan Grand Canyon** (402 m asl, 24°31′14″ N, 113°07′28″ E; 427 m asl, 24°31′18″ N, 113°07′29″ E; 477 m asl, 24°31′10″ N, 113°07′35″ E; 493 m asl, 24°31′19″ N, 113°07′50″ E; 495 m asl, 24°31′18″ N, 113°07′29″ E; 547 m asl, 24°31′18″ N, 113°07′29″ E; 520 m asl, 24°31′14″ N, 113°07′28″ E), on *B. nivea*, *C. cuspidata*, *F. hispida*, *I. tessellatus*, *O. frutescens*, *P. radicans*, *P. linearis* and unknown plant; 9 ♀♀ and 1 ♂ collected at **Tianjingshan National Forest Park** (455 m asl, 24°41′09″ N, 112°59′32″ E; 467 m asl, 24°41′09″ N, 112°59′32″ E; 468 m asl, 24°41′10″ N, 112°59′30″ E; 485 m asl, 24°41′09″ N, 112°59′30″ E), on *Bambusa* sp., *H. reticulata*, *I. cairica*, *R. rivulare* and unknown plant; 15 ♀♀ and 1 ♂ collected at **Nanling National Nature Reserve** (730 m asl, 24°54′57″ N, 113°02′28″ E; 827 m asl, 24°35′00″ N, 113°02′03″ E; 831 m asl, 24°54′58″ N, 113°02′11″ E) on *E. chinensis*, *Q. phillyraeoides*, *T. siamensis* and unknown plant; 6 ♀♀ collected at **Bibei Village** (218 m asl, 25°0′57″ N, 113°16′53″ E) on *Ligustrum* sp.; one ♀ collected at **Banling Village** (305 m asl, 25°01′01″ N, 113°16′52″ E), on *C. oleifera*; 4 ♀♀ collected at **Yunxi Village** (692 m asl, 25°03′32′N, 113°08′07″ E), on unknown plant.

Amblyseius longisaccatus Wu, Lan & Liu

Amblyseius longisaccatus Wu, Lan & Liu, 1995: 299; Wu *et al.*, 1997a: 52; Wu & Ou, 2001: 106; Moraes *et al.*, 2004: 36; Chant & McMurtry, 2007: 78; Wu *et al.*, 2010: 291, 2021: 127.
Amblyseius (*Amblyseius*) *longisaccatus*, Wu *et al.*, 2009: 190.

World Distribution — China (Fujian, Guangdong).

Specimens examined — one ♀ collected at **Ruyuan Grand Canyon** (402 m asl, 24°31′14″ N, 113°07′28″ E), on *O. frutescens*; 2 ♀♀ and 1 ♂ collected at **Banling Village** (305 m asl, 25°01′01″ N, 113°16′52″ E), on *C. maxima*.

Amblyseius obtuserellus Wainstein & Begljarov

Amblyseius obtuserellus Wainstein & Begljarov, 1971: 1806; Wu *et al.*, 1980: 44, 1997a: 50, 2010: 291, 2021: 128; Moraes *et al.*, 1986: 24, 2004: 42; Chant & McMurtry, 2007: 80.
Amblyseius (*Amblyseius*) *obtuserellus*, Ehara & Yokogawa, 1977: 54.
Amblyseius obtuserellaus [sic], Chen *et al.*, 1980: 17.
Amblyseius (*Multiseius*) *obtuserellus*, Denmark & Muma, 1989: 24.

World Distribution — China (Jiangsu, Anhui, Fujian, Guangdong, Hunan, Jiangxi, Zhejiang), Japan, Russia, South Korea, Vietnam.

Specimens examined — 8 ♀♀ collected at **Banling Village** (305 m asl, 25°01′01″ N, 113°16′52″ E), on *C. oleifera*, *C. maxima* and *C. lanceolata*; 7 ♀♀ collected at **Guikeng Village** (200 m asl, 25°01′05″ N, 113°18′28″ E), on unknown plant; 4 ♀♀ collected at **Bibei Village** (222 m asl, 25°0′57″ N, 113°16′53″ E), on *E. thymifolia* and unknown plant.

Amblyseius strobocorycus Wu, Lan & Liu

Amblyseius strobocorycus Wu, Lan & Liu, 1995: 300; Wu *et al.*, 1997a: 42, 2010: 291, 2021: 129; Chant & McMurtry, 2004: 210, 2007: 81; Moraes *et al.*, 2004: 131.
Amblyseius (*Neoseiulus*) *strobocorycus*, Wu *et al.*, 2009: 131.

World Distribution — China (Fujian, Guangdong, Guangxi, Hainan, Sichuan, Guizhou).

Specimens examined — one ♀ collected at **Tianjingshan National Forest Park** (565 m asl, 24°41′35″ N, 112°59′39″ E), on *E. chinense*.

Amblyseius wuyiensis Wu & Li

Amblyseius (*Amblyseius*) *wuyiensis* Wu & Li, 1983: 171; Moraes *et al.*, 1986: 33; Wu *et al.*, 2009: 195, 2021: 131.
Amblyseius wuyiensis, Chant & McMurtry, 2004: 203, 2007: 81; Wu *et al.*, 1997a: 56, 2010: 291; Wu & Ou, 2001: 106; Moraes *et al.*, 2004: 55.

World Distribution — China (Fujian, Guangdong, Hunan, Jiangxi).

Specimens examined — one ♀ collected at **Tongtianluo Virgin Forest** (701 m asl, 24°59′22″ N, 113°06′46″ E), on *P. wallichiana*.

Sub-tribe Arrenoseiina Chant & McMurtry

Genus *Phytoscutus* Muma

Phytoscutus salebrosus (Chant)

Typhlodromus (*Amblyseius*) *salebrosus* Chant, 1960: 58.
Phytoscutella salebrosa, Muma, 1961: 275.
Typhlodromus salebrosus, Hirschmann, 1962: 17.
Amblyseius (*Amblyseius*) *salebrosus*, Ehara, 1966: 23; Tseng, 1983: 35; Chen *et al.*, 1984: 319; Wu, 1989: 202; Wu *et al.*, 1997a: 107, 2021: 143.
Phytoscutus taoi (Lo, 1970: 49) (synonymy according to Ehara & Bhandhufalck, 1977).
Amblyseius (*Phytoscutella*) *salebrosus*, Gupta, 1975: 26.
Amblyseius (*Phytoscutella*) *salebrosus*, Ehara & Bhandhufalck, 1977: 73.
Phytoscutus salebrosus, Moraes *et al.*, 2004: 166; Chant & McMurtry, 2007: 101; Wu *et al.*, 2009: 261, 2010: 296.

World Distribution — China (Guangdong, Hainan, Taiwan), India, Malaysia, the Philippines, Thailand.

Specimens examined — one ♀ collected at **Nanling National Nature Reserve**, on unknown plant.

Tribe Euseiini Chant & McMurtry

Sub-tribe Euseiina Chant & McMurtry

Genus *Euseius* Wainstein

Euseius ovalis (Evans)

Typhlodromus ovalis Evans, 1953: 458.

Typhlodromus (*Amblyseius*) *ovalis* Chant, 1959: 68.
Amblyseius (*Typhlodromalus*) *ovalis* Muma, 1961: 288.
Amblyseius ovalis, Wu, 1980: 46; Chen *et al.*, 1984: 327.
Euseius ovalis, Gupta, 1978: 335; Moraes *et al.*, 1986: 49, 2004: 77; Wu *et al.*, 1997a: 117, 2009: 235, 2021: 169; Ehara & Amano, 1998: 43; Chant & McMurtry, 2005: 215, 2007: 121; Fang *et al.*, 2019: 1928, 2020b: 261.

World Distribution — China (Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hongkong, Jiangsu, Jiangxi, Sichuan, Yunnan, Taiwan), Australia, Cook Islands, Fiji, India, Indonesia, Japan, Malaysia, Mauritius, Mexico, New Zealand, Papua New Guinea, the Philippines, Sri Lanka, the United States (Hawaii).

Specimens examined — 7 ♀♀ collected at **Ruyuan Grand Canyon** (305 m asl, 24°31′10″ N, 113°07′35″ E; 495 m asl, 24°31′18″ N, 113°07′29″ E), on *C. cuspidata* and *P. radicans*.

Euseius australis (Wu & Li)

Amblyseius (*Amblyseius*) *australis* Wu & Li, 1983: 172.
Euseius australis, Moraes *et al.*, 1986: 37, 2004: 62; Chant & McMurtry, 2005: 215, 2007: 120; Wu *et al.*, 1997a: 121, 2009: 227, 2010: 292, 2021: 176.

World Distribution — China (Fujian, Guangdong, Hainan, Yunnan).

Specimens examined — one ♀ collected at **Ruyuan Grand Canyon** (495 m asl, 24°31′18″ N, 113°07′29″ E), on *A. lactiflora*.

Euseius nicholsi (Ehara & Lee)

Amblyseius (*Amblyseius*) *nicholsi* Ehara & Lee, 1971: 67; Wu, 1980: 42; Chen *et al.*, 1984: 328; Wu, 1989: 203.
Amblyseius (*Amblyseius*) *guangxiensis* (Wu, 1982: 97) (synonymy according to Wu *et al.*, 2009: 217).
Euseius nicholsi, Moraes *et al.*, 1986: 49, 2004: 75; Wu *et al.* 1997: 115, 2009: 217, 2021: 160; Chant & McMurtry, 2005: 215, 2007: 121.

World Distribution — China (Chongqing, Fujian, Guangdong, Guizhou, Hainan, Hongkong, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Wuling Mountain Area), Thailand.

Specimens examined — one ♀ collected at **Ruyuan Grand Canyon** (520 m asl, 24°31′14″ N, 113°07′28″ E), on *I. tessellatus*; one ♀ collected at **Guikeng Village** (200 m asl, 25°01′05″ N, 113°18′28″ E), on *C. japonicum*; one ♀ collected at **Bibei Village** (239 m asl, 25°0′57″ N, 113°16′51″ E), on *P. clematidea*.

Euseius hamiltonii Fang & Wu sp. nov.

Zoobank: 68C9986E-D38D-4377-A1E4-83CA56BFE247

(Figures 1a–e)

Description

Female (n = 3)

Dorsum (Fig. 1a). Idiosomal setal pattern 10A: 9B/ JV-3: ZV. Dorsal shield most smooth, with anterolateral striae. Dorsal shield **315** 321 (304–321) long and **222** 218 (207–224) wide at level of *s4*, **233** 229 (221-234) wide at level of *j6*, distances between setae *j1–J5* **311** 304 (293–313) and *s4–s4* **180** 181 (180–183), shield nearly oval, constricted at level of *R1*; *r3* and *R1* on soft membranous cuticle laterad dorsal shield. All dorsal shield setae smooth and setiform, except Z5 slightly serrated. Dorsal shield with six pairs of solenostomes (*gd1*, *gd2*, *gd4*, *gd6*, *gd8*, *gd9*) and 14 pairs of lyrifissures (*idla*, *id1*, *id2*, *id4*, *id6*, *is1*, *idx*, *idl1*, *idl3*, *idl4*, *idm2, idm3*, *idm5*, *idm6*). Length of setae: *j1* **33** 31 (27–33), *j3* **22** 23 (21–24), *j4* **8** 8 (7–9), *j5*

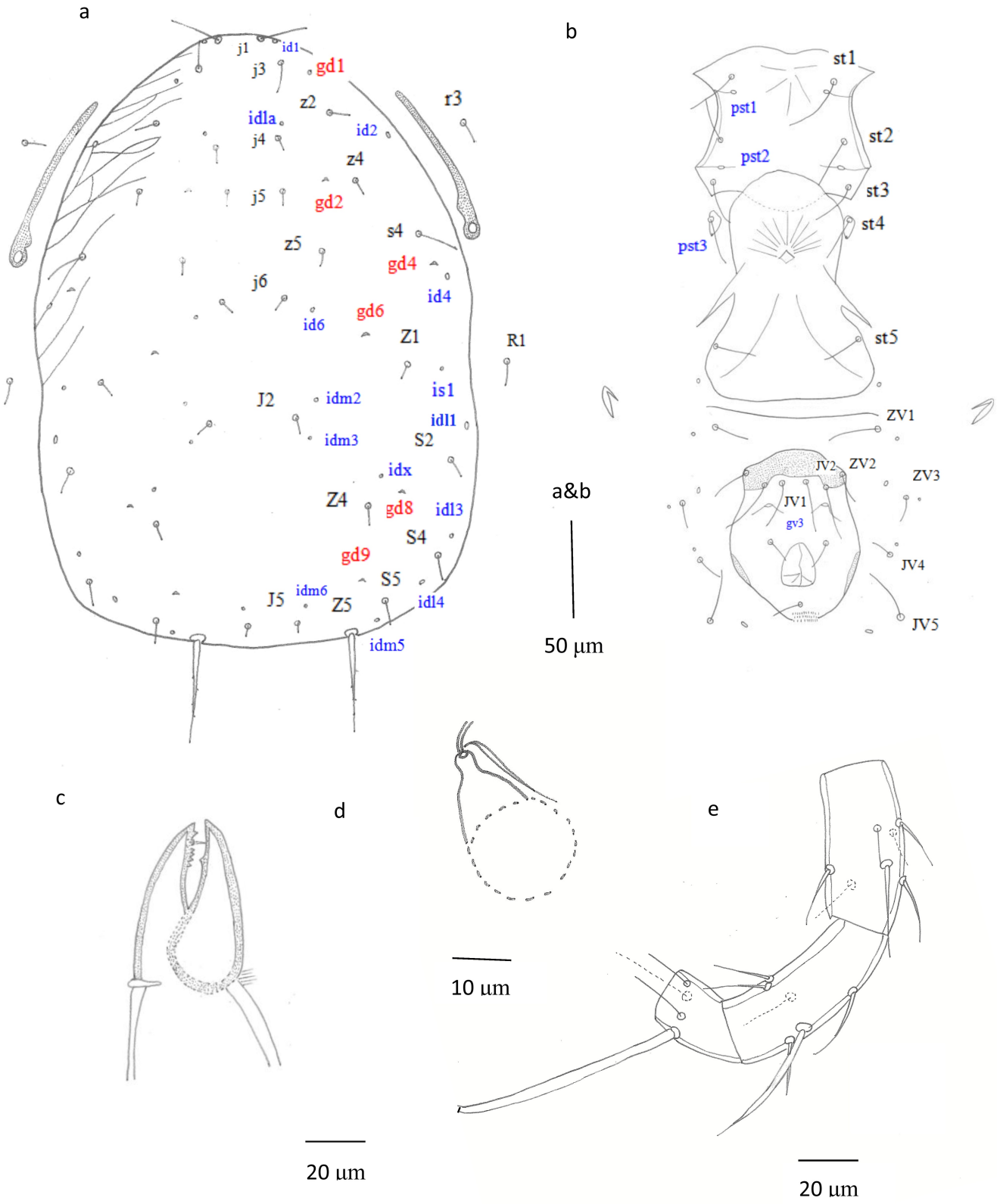


Figure 1 Female of *Euseius hamiltonii* **sp. nov.** a – Dorsal shield; b – Ventral idiosoma; c – Chelicera; d – Spermatheca; e – Leg IV, genu – basitarsus.

7 7 (7–8), *j6* **8** 9 (8–10), *J2* **11** 11 (11–12), *J5* **5** 5 (5–6), *z2* **13** 13 (11–15), *z4* **11** 11 (10–13), *z5* **9** 8 (7–9), *Z1* **10** 10 (9–11), *Z4* **12** 11 (9–13), *Z5* **56** 56 (52–57), *s4* **24** 23 (20–25), *S2* **13 13** (12–14), *S4* **17** 15 (13–18), *S5* **16** 15 (12–17), *r3* **11** 11 (10–12), *R1* **12** 13 (12–13).

Venter (Fig. 1b). All ventral setae smooth. Sternal shield **76** 76 (76–76) long, **85** 83 (80-85) wide, with scant anterior striation, posterior margin with medial projection lightly sclerotized, with three pairs of setae *st1* **29** 29 (28–30), *st2* **24** 25 (24–27), *st3* **25** 25 (24–25), and two pairs of lyrifissures (*pst1–pst2*), distance between *st1–st3* **55** 56 (55–58), *st2–st2* **64** 64 (63–64). Metasternal platelets ellipsoidal, each with one metasternal seta *st4* **23** 23 (22–24) and one lyrifissure (*pst3*). Genital shield smooth, **82** 78 (73–82) wide, with one pair of thin genital setae *st5* **28** 24 (22–28), distance between *st5–st5* **75** 73 (68–75); one pair of associated poroids on soft cuticle near posterior corners of shield. Ventrianal shield smooth, vase-shaped, anterior part strong sclerotized, **81** 81 (81–81) long, **49** 51 (49–52) wide at level of *ZV2*, **63** 67 (63–74) wide at level of anus, with three pairs of thin pre-anal setae *JV1* **27** 27 (26–31), *JV2* **26** 27 (25–28), *ZV2* **20** 20 (19–23); *Pa* **14** 14 (13–15), *Pst* **14** 14 (13–15). Pre-anal pores crescentic, posterior of *JV2*, distance between pores **30** 29 (29–29). Opisthogastric soft cuticle with four pairs of setae, *ZV1* **19** 19 (18–20), *ZV3* **11** 11 (9–12), *JV4* **10** 10 (9–11), *JV5* **27** 28 (24–30) long. All ventral setae thin, except *JV5* thick. One pair of metapodal platelets hook-like, **18** 18 (18–18) long, **5** 4 (4–5) wide.

Peritreme (Fig. 1a). Peritreme extending to the level of *z2*.

Chelicera (Fig. 1c). Fixed digit **22** 22 (21–24) long, with five teeth and *pilus dentilis*; movable digit **20** 21 (20–22) long, with one tooth.

Spermatheca (Fig. 1d). Calyx of spermatheca gourd-shaped, constricted in the middle obviously, flaring distally, **13** 12 (11–14) long, **10** 10 (10–11) wide at the opening, atrium small, knobbed, **1** 2 (1–2) wide, incorporated in calyx; major duct narrow, without neck, and minor duct visible.

Legs (Fig. 1e). Chaetotactic formulae of genua I 2-2/2, 1/1-2, II 2-2/2, 0/0-1, III 1-2/2, 1/0-1 and IV 1-2/2, 1/0-1. Tibia III with one macroseta, *Sti* III **23** 23 (22–24); genu, tibia and basitarsus IV each with one macroseta, *Sge* IV **25** 32 (25–39), *Sti* IV **39** 37 (32–40) and *St* IV **68** 69 (67–70).

Male. Unknown.

Specimens examined

Holotype: ♀ (accession no. RYNS-031), **Nanshui Reservoir** (223 m asl, 24°44′09″ N, 113°08′59′E), Ruyuan Yao Autonomous County, Shaoguan City, Guangdong Province, on *Dendrocalamus hamiltonii* Nees et Arn. ex Munro (Poaceae), 10/XI/2021, Fang X.D. coll. Paratype: 1 ♀ (accession no. RYNS- 032), same locality, host, date and collector as holotype; Paratype: 1 ♀ (accession no. RYBL-181), **Banling Village** (305 m asl, 25°01′01″ N, 113°16′52″ E), on *Bambusa eutuldoides* McClure var. *eutuldoides* (Poaceae), 13/XI/2021, Fang X.D. coll.

Etymology

This species is named after the plant species on which the holotype was found.

Remarks

By having similar shape of dorsal shield, vase-shaped ventrianal shield, relative length of dorsal setae, and three macrosetae on leg IV, *E. hamiltonii* is most similar to *E. nicholsi* (Ehara and Lee, 1971) and *E. oolong* Liao and Ho, 2008. Differences between *E. hamiltonii* **sp. nov.** and the related species are given in Table 2.

Tribe Typhlodromipsini Chant & McMurtry

Genus *Typhlodromips* De Leon

Typhlodromips ochii (Ehara & Yokogawa)

Amblyseius (*Amblyseius*) *ochii* Ehara & Yokogawa, 1977: 54; Chen *et al.*, 1984: 333; Wu *et al.*, 2009: 184.
Neoseiulus ochii, Moraes *et al.*, 1986: 91.
Amblyseius ochii, Wu *et al.*, 1997a: 94, 2010: 291; Moraes *et al.*, 2004: 44.
Typhlodromips ochii, Chant & McMurtry, 2007: 63; Wu *et al.*, 2021: 99.

World Distribution — China (Jiangxi, Henan, Shanxi), Japan.

Specimens examined — one ♀ collected at **Hongyun Village** (758 m asl, 25°03′46″ N, 113°07′23″ E), on *I. tessellatus*.

Typhlodromips syzygii (Gupta)

Amblyseius syzygii Gupta, 1975: 44.
Amblyseius (*Amblyseius*) *syzygii*, Ehara & Bhandhufalck, 1977: 58.
Amblyseius (*Typhlodromips*) *syzygii*, Gupta, 1985: 371.
Amblyseius (*Neoseiulus*) *syzygii*, Wu *et al.*, 2009: 90.
Typhlodromips syzygii, Moraes *et al.*, 1986: 150, 2004: 227; Chant & McMurtry, 2007: 63; Wu *et al.*, 2010: 299, 2021: 99.

World Distribution — China (Fujian, Guangdong, Guangxi, Guizhou, Jiangxi, Sichuan, Yunnan), India, Indonesia, Papua New Guinea, Thailand.

Specimens examined — one ♀ collected at **Banling Village** (305 m asl, 25°01′01″ N, 113°16′52″ E), on *C. maxima*.

Genus *Scapulaseius* Karg & Oomen-Kalsbeck

Scapulaseius okinawanus (Ehara)

Amblyseius (*Amblyseius*) *okinawanus* Ehara, 1967a: 72.
Amblyseius okinawanus, Lo, 1970: 47; Wu, 1980: 44; Wu *et al.*, 1991: 149, 1997a: 89; Jung *et al.*, 2003: 193.
Neoseiulus okinawanus, Moraes *et al.*, 1986: 91.
Amblyseius (*Neoseiulus*) *okinawanus*, Ehara & Amano, 1998: 37.
Scapulaseius okinawanus, Chant & McMurtry, 2007: 68; Wu *et al.*, 2010: 298, 2021: 105.

Table 2 Differences in diagnostic characters and measurements between *Euseius hamiltonii* Fang & Wu **sp. nov.** and similar species.

Species	*hamiltonii* [a]	*nicholsi* [b, c]	*oolong* [c]
Dorsal shield length	321 (304 – 321)	353 (350 – 360)	341 (324 – 361)
Dorsal shield width	218 (221 – 234)	250 (243 – 256)	246 (236 – 266)
Dorsal shield	anterolateral striation only	most surface reticulated	laterally reticulated
Peritreme anteriorly	to *z2* level	between *j3* and *z2*	near *j3* level
Calyx of spermatheca	gourd-shaped	funnel-shaped	cup-shaped
Atrium	incorporated within calyx	connected directly to calyx	incorporated within calyx
Setae *S4*	15 (13 – 18)	21 (18 – 25)	22 (17 – 27)
Setae *S5*	15 (12 – 17)	22 (19 – 26)	25 (22 – 29)
Macroseta *Sge IV*	32 (25 – 39)	50 (48 – 53)	44 (37 – 50)
Macroseta *Sti IV*	37 (32 – 40)	38 (38 – 39)	34 (27 – 37)
Macroseta *St IV*	69 (67 – 70)	68 (60 – 73)	58 (50 – 61)

[a] from three specimens, [b] from Wu *et al.* (2009), [c] from Liao *et al.* (2020).

World Distribution — China (Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hongkong, Hunan, Jiangsu, Jiangxi, Shandong, Yunnan, Zhejiang, Taiwan), South Korea, Japan, Thailand, Russia, Indonesia, Papua New Guinea, Vietnam.

Specimens examined — 38 ♀♀ and one ♂ collected at **Ruyuan Grand Canyon** (402 m asl, 24°31′14″ N, 113°07′28″ E; 414 m asl, 24°31′14″ N, 113°07′28″ E; 490 m asl, 24°31′18″ N, 113°07′29″ E), on *A. lactiflora*, *A. baccharoides*, *B. eutuldoides* var. *eutuldoides*, *B. megacephala*, *C. cuspidata*, *C. concinna*, *F. hispida*, *O. compositus*, *O. frutescens* and *P. linearis*; 2 ♀♀ collected at **Tianjingshan National Forest Park** (435 m asl, 24°41′09″ N, 112°59′30″ E; 684 m asl, 24°41′23″ N, 113°01′25″ E), on *A. conyzoides* and unknown plant; 2 ♀♀ collected at **Guikeng Village** (202 m asl, 25°01′06″ N, 113°18′26″ E; 210 m asl, 25°01′04″ N, 113°18′25″ E), on *C. reticulata* and *E. japonica*; 4 ♀♀ and one ♂ collected at **Bibei Village** (222 m asl, 25°0′57″ N, 113°16′53″ E; 239 m asl, 25°0′57″ N, 113°16′51″ E) on *E. thymifolia* and *P. clematidea*.

Scapulaseius anuwati (Ehara & Bhandhufalck)

Amblyseius (*Amblyseius*) *anuwati* Ehara & Bhandhufalck, 1977: 63; Chant & McMurtry, 2007: 67.
Amblyseius (*Amblyseius*) *anuwanti* [sic], Wu, 1981: 205.
Typhlodromips anuwati, Moraes *et al.*, 1986: 136, 2004: 207.
Amblyseius anuwati, Wu, 1980: 49; Chen *et al.*, 1984: 325; Wu *et al.*, 1997a: 76.
Amblyseius (*Neoseiulus*) *anuwati*, Wu *et al.*, 2009: 85; Ehara, 2002a: 30.
Scapulaseius anuwati, Chant & McMurtry, 2007: 67; Wu *et al.*, 2010: 298, 2021: 104.

World Distribution — China (Fujian, Guangdong, Hainan, Hunan, Jiangsu, Jiangxi, Taiwan), Thailand, Malaysia.

Specimens examined — one ♀ collected at **Tianjingshan National Forest Park** (684 m asl, 24°41′23″ N, 113°01′25″ E), on *B. eutuldoides* var. *eutuldoides*; one ♀ collected at **Tongtianluo Virgin Forest** (707 m asl, 24°59′22″ N, 113°06′46′E), on *D. dichotoma*; 2 ♀♀ collected at **Guikeng Village** (200 m asl, 25°01′09″ N, 113°18′30″ E), on *C. lanceolata* and unknown plant.

Scapulaseius asiaticus (Evans)

Typhlodromus asiaticus Evans, 1953: 461.
Typhlodromus (*Amblyseius*) *asiaticus*, Chant, 1959: 80.
Amblyseius (*Typhlodromopsis*) *asiaticus*, Muma, 1961: 287.
Amblyseius (*Amblyseius*) *asiaticus*, Ehara, 1966a: 20; Wu, 1980: 50; Chen *et al.*, 1984: 323; Wu *et al.*, 1997a: 91.
Amblyseius asiaticus, Carmona, 1968: 267; Schicha, 1987: 94; Schicha & Corpuz-Raros, 1992: 60.
Amblyseius (*Amblyseius*) *siaki* (Ehara & Lee, 1971: 64) (synonymy according to Ehara & Bhandhufalck, 1977).
Amblyseius (*Amblyseius*) *baiyunensis* (Wu, 1982: 97) (synonymy according to Wu *et al.*, 2009).
Amblyseius (*Neoseiulus*) *asiaticus*, Ehara, 2002b: 127; Wu *et al.*, 2009: 96.
Typhlodromips asiaticus, Moraes *et al.*, 2004: 207.
Scapulaseius asiaticus, Chant & McMurtry, 2007: 67; Wu *et al.*, 2010: 298, 2021: 104.
Scapulaseius reptans (Blommers) (synonymy according to Kreiter & Ferragut, 2021).

World Distribution — China (Fujian, Guangdong, Guangxi, Hainan, Hunan, Hongkong, Jiangxi, Yunnan), Angola, Cyprus, France (Reunion Island), India, Indonesia, Malaysia, Philippines, Singapore, Mauritius, Sri Lanka, Thailand, Vietnam.

Specimens examined — 2 ♀♀ collected at **Tianjingshan National Forest Park** (467 m asl, 24°41′09″ N, 112°59′32″ E), on *R. rivulare*; 4 ♀♀ collected at **Guikeng Village** (200 m asl, 25°01′09″ N, 113°18′30″ E), on *B. championii*; one ♀ collected at **Banling Villag** (305 m asl, 25°01′01″ N, 113°16′52″ E), on *C. maxima*.

Scapulaseius jianyangensis (Wu)

Amblyseius (*Proprioseiopsis*) *jianyangensis* Wu, 1981: 212.
Amblyseius jianyangensis, Wu *et al.*, 1997a: 78.
Typhlodromips jianyangensis, Moraes *et al.*, 1986: 141, 2004: 215.
Scapulaseius jianyangensis, Chant & McMurtry, 2007: 67; Wu *et al.*, 2010: 298; 2021: 105.
Amblyseius (*Neoseiulus*) *jianyangensis*, Wu *et al.*, 2009: 82.

World Distribution — China (Fujian, Guangdong, Hainan).

Specimens examined — one ♀ collected at **Tianjingshan National Forest Park** (534 m asl, 24°41′26″ N, 112°59′31″ E), on unknown plant.

Tribe Kampimodromini Kolodochka

Sub-tribe Kampimodromina Chant & McMurtry

Genus *Okiseius* Ehara

Okiseius subtropicus Ehara

Okiseius subtropicus Ehara, 1967a: 77; Tseng, 1976: 102; Ehara & Hamaoka, 1980: 6; Wu & Qian, 1983: 75; Chen *et al.*, 1984: 348; Moraes *et al.*, 1986: 102; Wu, 1989: 210; Wu *et al.*, 2009: 251, 2021: 81; Ehara *et al.*, 1994: 136; Wu *et al.*, 1997a: 129, 2009: 251; Walter, 1999: 90.
Okiseius wui (Denmark & Kolodochka, 1996: 235) (synonymy according to Wu *et al.*, 1997b).
Amblyseius (*Kampimodromus*) *subtropicus*, Ueckermann & Loots, 1985: 195.
Okiseius (*Okiseius*) *subtropicus*, Kolodochka & Denmark, 1996: 235.
Amblyseius (*Okiseius*) *subtropicus*, Ehara & Amano, 1998: 45.

World Distribution — China (Fujian, Guangdong, Guangxi, Hainan, Guizhou, Jiangsu, Jiangxi, Yunnan, Zhejiang, Taiwan), Australia, Japan, Malaysia, Philippines.

Specimens examined — one ♀ collected at **Nanshui Reservoir** (223 m asl, 24°44′09″ N, 113°08′59′E), on *F. concinna*.

Sub-tribe Paraphytoseiina Chant & McMurtry

Genus *Paraphytoseius* Swirski & Shechter

Paraphytoseius cracentis (Corpuz & Rimando)

Ptenoseius cracentis Corpuz & Rimando, 1966: 115.
Paraphytoseius cracentis, Swirski & Golan, 1967: 226; Schicha & Corpuz, 1985: 68; Moraes *et al.*, 1986: 104, 2004: 160; Wu *et al.*, 1997a: 133, 2009: 270, 2021: 85; Liao *et al.*, 2020: 117.
Paraphytoseius multidentatus (Swirski & Shechter, 1961: 114) (synonymy according to Matthysse & Denmark, 1981).
Paraphytoseius hyalinus (Tseng, 1973 : 77) (synonymy according to Prasad, 2016).
Paraphytoseius nicobarensis (Gupta, 1977: 631) (synonymy according to Prasad & Karmakar, 2015).

World Distribution — China (Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hongkong, Hunan, Jiangxi, Yunnan, Taiwan), France (New Caledonia), Japan, Papua New Guinea, Philippines, Singapore, Thailand, Vietnam.

Specimens examined — 2 ♀♀ collected at **Guikeng Village** (200 m asl, 25°01′09″ N, 113°18′30″ E), on unknown plant.

Paraphytoseius orientalis (Narayanan, Kaur & Ghai)

Typhlodromus (*Amblyseius*) *orientalis* Narayanan, Kaur & Ghai, 1960: 394.
Paraphytoseius multidentatus (Swirski & Shechter, 1961: 114) (synonymy according to Chant & McMurtry, 2003).
Paraphytoseius subtropicus (Tseng, 1972: 1) (synonymy according to Matthysse & Denmark, 1981).
Paraphytoseius orientalis, Ehara, 1966: 25; Moraes *et al.*, 2004: 162; Wu *et al.*, 2021: 86.

World Distribution — China (Fujian, Guangdong, Guangxi, Guizhou, Hongkong, Hunan, Jiangxi, Yunnan, Taiwan), Argentina, Benin, Brazil, Burundi, Colombia, Costa Rica, Congo, France (Guadeloupe, Mayotte, New Caledonia, Reunion, Martinique), India, Japan, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Nigeria, Pakistan, Philippines, Rwanda, Venezuela, Vietnam.

Specimens examined — one ♀ collected at **Banling Villag** (305 m asl, 25°01′01″ N, 113°16′52″ E), on *C. maxima*; one ♀ collected at **Guikeng Village** (200 m asl, 25°01′09″ N, 113°18′30″ E), on *C. lanceolata*.

Sub-Family Phytoseiinae Berlese

Genus *Phytoseius* Ribaga

Phytoseius crinitus Swirski & Shechter

Phytoseius (*Dubininellus*) *crinitus* Swirski & Shechter, 1961: 102; Denmark, 1966: 66; Wu, 1997: 154; Wu *et al.*, 2009: 296, 2010: 296.
Phytoseius (*Phytoseius*) *crinitus*, Ehara, 1966: 26; Moraes *et al.*, 1986: 220.
Phytoseius crinitus, Wu *et al.*, 1997a: 151, 2021: 192; Chant & McMurtry, 2007: 129.

World Distribution — China (Guangdong, Guangxi, Hainan, Hongkong, Jiangxi, Yunnan, Taiwan), Burundi, France (Reunion Island), India, Indonesia, Japan, Madagascar, Mauritius (Main land, Rodriguez Island), Philippines, Singapore.

Specimens examined — 3 ♀♀ collected at **Ruyuan Grand Canyon** (495 m, 24°31′18″ N, 113°07′29″ E), on *B. eutuldoides* var. *eutuldoides* and unknown plant.

Phytoseius nipponicus Ehara

Phytoseius (*Dubininellus*) *nipponicus* Ehara, 1962: 55; Denmark, 1966: 90; Wu *et al.*, 2009: 298, 2010: 297.
Phytoseius (*Phytoseius*) *nipponicus*, Ehara, 1964: 378; Moraes *et al.*, 1986: 226.
Phytoseius shanghaiensis (Xin, Liang & Ke, 1983: 48) (synonymy according to Wu, 1997).
Phytoseius nipponicus, Chen *et al.*, 1984: 356; Wu *et al.*, 1997a: 150, 2021: 193; Moraes *et al.*, 2004: 249; Chant & McMurtry, 2007: 129.

World Distribution — China (Fujian, Gansu, Guangdong, Guangxi, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shandong, Sichuan, Yunnan, Zhejiang), India, Japan, South Korea.

Specimens examined — one ♀ collected at **Tongtianluo Virgin Forest** (707 m asl, 24°59′22″ N, 113°06′46′E), on *D. dichotoma*.

Phytoseius subcapitatus Fang & Wu, sp. nov.

Zoobank: E7FFD341-B5BE-4077-A12D-D5096209B255

(Fig. 2 a-e)

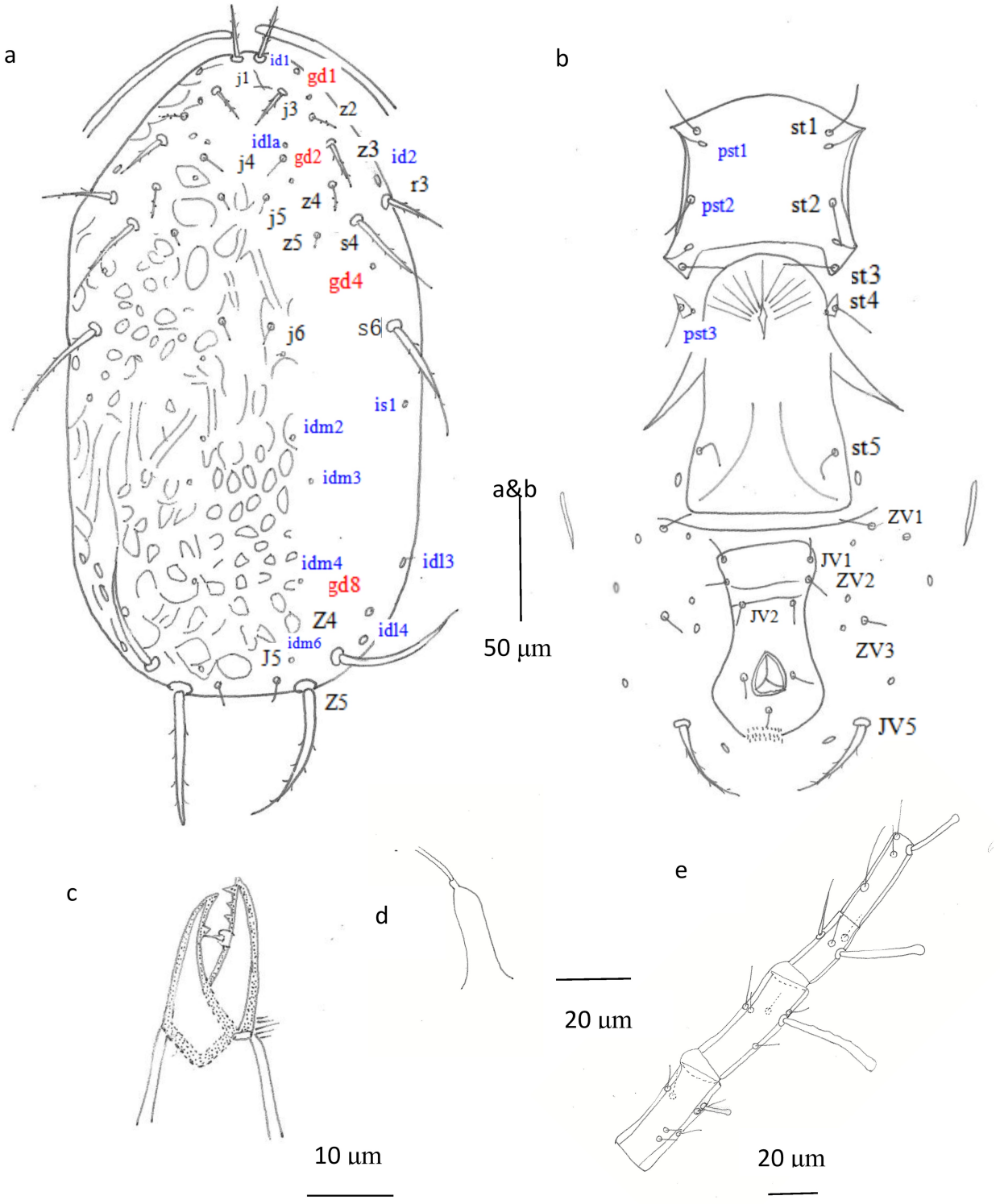


Figure 2 Female of *Phytoseius subcapitatus* **sp. nov.** a – Dorsal shield; b – Ventral idiosoma; c – Chelicera; d – Spermatheca; e – Leg IV, genu – basitarsus.

Description

Female (n = 3)

Dorsum (Fig. 2a). Idiosomal setal pattern 12A: 3A/ JV-3, 4: ZV. Dorsal shield rugose, with granular reticulation throughout. Dorsal shield **265** 267 (265–269) long and **148** 146 (143–148) wide at level of *s4*, **161** 160 (159-161) at level of *s6*, distances between setae *j1–J5* **260** 260 (258–262) and *s4–s4* **91** 89 (87–91), *s6-s6* **120** 118 (115–120), shield long oval, without median constriction; *R1* absent. Dorsal shield with four pairs of solenostomes (*gd1*, *gd2*, *gd4*, *gd8*), and 10 pairs of lyrifissures (*idla*, *id1*, *id2*, *is1*, *idl3*, *idl4*, *idm2*-*idm4*, *idm6*). Length of setae: *j1* **26** 25 (23–26), *j3* **18** 18 (17–18), *j4* **8** 8 (8–9), *j5* **8** 6 (6–9), *j6* **8** 8 (6–9), *J5* **11** 10 (9–11), *z2* **12** 12 (12–13), *z3* **25** 25 (24–26), *z4* **13** 13 (12–14), *z5* **8** 8 (7–8), *Z4* **63** 63 (61–66), *Z5* **58** 60 (55–66), *s4* **44** 44 (41–46), *s6* **56** 56 (53–61), *r3* **30** 30 (29–30). Setae *j1*, *j3*, *z2*, *z3*, *z4*, *s4*, *s6*, *Z5* and *r3* distinctly serrated, moderate to long; remaining setae smooth, short, except *Z4* long. Sublateral seta *r3* inserted on the lateral edge of dorsal shield.

Venter (Fig. 2b). All ventral setae thin, smooth, except *JV5*, thick, serrated. Sternal shield smooth, posterior margin almost flat, **69** 69 (68– 69) long, **65** 65 (65–65) wide, wider than long, with three pairs of setae *st1* **27** 25 (23–27), *st2* **22** 23 (21–25), *st3* **17** 19 (17–21), and two pairs of lyrifissures (*pst1–pst2*), distance between *st1–st3* **55** 56 (55–58) and *st2–st2* **56** 55 (54–56). Metasternal platelets small, subtriangular, each with one metasternal seta *st4* **18** 19 (17–22) and one lyrifissure (*pst3*). Genital shield smooth, with one pair of thin genital setae *st5* **25** 24 (23–25), distance between *st5–st5* **55** 55(55–56); one pair of associated poroids on soft cuticle near posterior corners of shield. Ventrianal shield with several striae anteriorly, vase-shaped, **81** 81 (77–84) long, **37** 37 (36–38) wide at level of *ZV2*, **47** 46 (45–47) wide at level of anus, with three pairs of thin pre-anal setae *JV1* **12** 11 (10–12), *JV2* **10** 10 (9–12), *ZV2* **11** 10 (8–11); *Pa* **11** 11 (10–11), *Pst* **9** 10 (9–11) long. Pre-anal pores absent. Opisthogastric soft cuticle with three pairs of setae, *ZV1* **15** 13 (12–15), *ZV3* **7** 7 (6–8), *JV5* **39** 39 (38–42) long. A pair of thin metapodal platelets present, **25** 25 (21–26) long, **2** 2 (1–2) wide.

Peritreme (Fig. 2a). Peritreme extending nearly to seta *j1*.

Chelicera (Fig. 2c). Fixed digit **21** 21 (20–21) long, with three teeth and *pilus dentilis*; movable digit **21** 20 (19– 21) long, with one tooth.

Spermatheca (Fig. 2d). Calyx broad tubular, flaring slightly near vesicle, **26** 25 (23–27) long, **9** 10 (8–12) wide near atrium; atrium small, knobbed, major duct narrow and minor duct invisible.

Legs (Fig. 2 e). Chaetotactic formulae of genua I 2-2/2, 1/1-2, II 2-2/2, 0/0-1, III 1-2/2, 1/0-0 and IV 1-2/2, 1/0-1. Leg IV with four apically knobbed macrosetae on genu, tibia, basitarsus and telotarsus, *Sge* IV **12** 13 (9–16), *Sti* IV **43** 41 (40–44), *Sbt*a IV **33** 33 (31–34), and *Sdta IV* **24** 24 (23-25).

Male. Unknown.

Specimens examined

Holotype: ♀, (accession no. RYTVF-021), **Tongtianluo Virgin Forest** (678 m asl, 24°59′22″ N, 113°06′51″ E), Ruyuan Yao Autonomous County, Shaoguan City, Guangdong Province, on unknown plant, 14/XI/2021, Fang X.D. coll. Paratype: 2 ♀♀ (accession no. RYTVF-022, RYTVF-023), same locality, host, date and collector as holotype.

Etymology

The name *subcapitatus* is derived from a combination of prefix *sub* and *capitatus*, indicating that this species is similar to *Phytoseius capitatus* Ehara, 1966.

Remarks

By having very similar shape of dorsal shield and vase-shaped ventrianal shield, relative length and thickness of dorsal setae, grandular reticulation on dorsal shield and broad tubular calyx of spermatheca, *Phytoseius subcapitatus* **sp. nov.** is very similar to *P. capitatus*, but the new

species differs by having a macroseta on genu, tibia, basitarsus and telotarsus of leg IV, while *P. capitatus* only has macroseta only on tibia and basitarsus of leg IV. Additionally, the new species has the anterior part of the ventrianal shield striate, while in *P. capitatus* the ventrianal shield is smooth.

Sub-Family Typhlodrominae Wainstein

Tribe Typhlodromini Wainstein

Genus *Typhlodromus* Scheuten

Typhlodromus (*Anthoseius*) *higoensis* Ehara

Typhlodromus (*Anthoseius*) *higoensis* Ehara, 1985: 115; Moraes *et al.*, 2004: 328; Chant & McMurtry, 2007: 155; Wu *et al.*, 2009: 404, 2010: 301, 2021: 224.
Amblydromella higoensis, Moraes *et al.*, 1986: 163.
Typhlodromus higoensis, Wu *et al.*, 1997a: 197.
Amblydromella (*Amblydromella*) *higoensis*, Denmark & Welbourn, 2002: 307.

World Distribution — China (Fujian, Guangdong, Hainan, Hunan), Japan.

Specimens examined — 11 ♀♀ collected at **Ruyuan Grand Canyon** (495 m asl, 24°31′18″ N, 113°07′29″ E), on *B. eutuldoides* var. *eutuldoides*; 2 ♀♀ collected at **Tianjingshan National Forest Park** (565 m asl, 24°41′35″ N, 112°59′39″ E; 684 m asl, 24°41′23″ N, 113°01′25″ E), on *B. eutuldoides* and *E. chinense*.

Typhlodromus (*Anthoseius*) *serrulatus* Ehara

Typhlodromus (*Anthoseius*) *serrulatus* Ehara, 1972: 142; Ryu & Lee, 1992: 31; Moraes *et al.*, 2004: 350; Chant & McMurtry, 2007: 155; Wu *et al.*, 2009: 382, 2010: 302, 2021: 232.
Typhlodromus (*Typhlodromus*) *serrulatus*, Chang & Tseng, 1978: 342.
Amblydromella serrulata, Moraes *et al.*, 1986: 175.
Typhlodromus serrulatus, Wu *et al.*, 1997a: 187.
Amblydromella (*Amblydromella*) *serrulata*, Denmark & Welbourn, 2002: 307.
Typhlodromus fujianensis (Wu & Liu, 1991: 86) (synonymy according to Wu *et al.*, 2009).

World Distribution — China (Anhui, Fujian, Guangdong, Guangxi, Hebei, Hunan, Jiangxi, Liaoning, Shandong, Zhejiang, Taiwan), Japan, South Africa, Thailand.

Specimens examined — 6 ♀♀ collected at **Tongtianluo Virgin Forest** (677 m asl, 24°59′20″ N, 113°06′49″ E; 678 m asl, 24°59′22″ N, 113°06′51″ E), on *C. myrsinifolia*, *P. wallichiana* and unknown plant.

Typhlodromus (*Anthoseius*) *zhaoi* Wu & Li

Typhlodromus (*Anthoseius*) *zhaoi* Wu & Li, 1983: 170; Moraes *et al.*, 2004: 359; Chant & McMurtry, 2007: 157; Wu *et al.*, 2009: 424, 2010: 303, 2021: 238.
Amblydromella zhaoi, Moraes *et al.*, 1986: 179.
Typhlodromus zhaoi, Wu *et al.*, 1997a: 199.
Amblydromella (*Amblydromella*) *zhaoi*, Denmark & Welbourn, 2002: 307.

World Distribution — China (Fujian, Guangdong, Hainan).

Specimens examined — 2 ♀♀ collected at **Ruyuan Grand Canyon** (490 m asl, 24°31′18″ N, 113°07′29″ E; 495 m asl, 24°31′18″ N, 113°07′29″ E), 1 ♀ on *B. eutuldoides* var. *eutuldoides* and *O. compositus*.

Typhlodromus (*Anthoseius*) *yasumatsui* Ehara

Typhlodromus (*Neoseiulus*) *yasumatsui* Ehara, 1966: 11.
Typhlodromus (*Typhlodromus*) *yasumatsui*, Tseng, 1983: 70.
Amblydromella yasumatsui, Moraes *et al.*, 1986: 178.
Typhlodromus yasumatsui, Wu & Liu, 1997: 152.
Amblydromella (*Aphanoseia*) *yasumatsui*, Denmark & Welbourn, 2002: 309.
Typhlodromus (*Anthoseius*) *yasumatsui*, Moraes *et al.*, 2004: 359; Chant & McMurtry, 2007: 157; Wu *et al.*, 2009: 418, 2010: 303, 2021: 237.

World Distribution — China (Fujian, Guangdong, Hainan), Japan, South Korea.
Specimens examined — 8 ♀♀ collected at **Ruyuan Grand Canyon** (414 m asl, 24°31′14″ N, 113°07′28″ E; 495 m asl, 24°31′18″ N, 113°07′29″ E; 524 m asl, 24°31′18″ N, 113°07′29″ E; 547 m asl, 24°31′18″ N, 113°07′29″ E), on *B. eutuldoides* var. *eutuldoides*, *C. concinna*, *M. perlarius* and unknown plant; one ♀ collected at **Tianjingshan National Forest Park** (534 m asl, 24°41′26″ N, 112°59′31″ E), on unknown plant; one ♀ collected at **Tongtianluo Virgin Forest** (701 m asl, 24°59′22″ N, 113°06′46″ E), on *P. wallichiana*.

Typhlodromus xiufui Wu & Liu

Typhlodromus xiufui Wu & Liu, 1997: 148.
Typhlodromus (*Anthoseius*) *xiufui*, Moraes *et al.*, 2004: 358; Chant & McMurtry, 2007: 157; Wu *et al.*, 2009: 405, 2010: 302, 2021: 236.

World Distribution — China (Ningxia).
Specimens examined — 2 ♀♀ collected at **Tongtianluo Virgin Forest** (677 m asl, 24°59′20″ N, 113°06′49″ E), on unknown plant.

Typhlodromus (*Anthoseius*) *agilis* (Chaudhri)

Orientiseius agilis Chaudhri, 1975: 189; Moraes *et al.*, 1986: 202.
Typhlodromus agilis, Wu & Lan, 1994: 430; Wu *et al.*, 1997a: 182.
Typhlodromus (*Anthoseius*) *agilis*, Moraes *et al.*, 2004: 309; Chant & McMurtry, 2007: 152; Wu *et al.*, 2009: 343, 2010: 300, 2021: 218.

World Distribution — China (Fujian, Hunan, Yunnan), Pakistan.
Specimens examined — one ♀ collected at **Yunxi Village** (692 m asl, 25°03′32″ N, 113°08′07″ E), on unknown plant.
Typhlodromus (*Anthoseius*) *insularis* Ehara
Typhlodromus (*Neoseiulus*) *insularis* Ehara, 1966: 10.
Typhlodromus (*Typhlodromus*) *insularis*, Tseng, 1983: 70.
Amblydromella insularis, Moraes *et al.*, 1986: 164.
Amblydromella (*Amblydromella*) *insularis*, Denmark & Welbourn, 2002: 307.
Typhlodromus (*Anthoseius*) *insularis*, Ehara, 1967b: 212; Ehara, 1972: 138; Moraes *et al.*, 2004: 330; Chant & McMurtry, 2007: 155; Wu *et al.*, 2009: 397, 2010: 301, 2021: 226.

World Distribution — China (Guangdong), Japan.
Specimens examined — one ♀ collected at **Ruyuan Grand Canyon** (495 m asl, 24°31′18″ N, 113°07′29″ E), on *F. hispida*.

Typhlodromus (*Anthoseius*) *ruyuanensis* Fang & Wu sp. nov.

Zoobank: E69810E8-162A-434D-8469-46FAF40EC8E7
(Fig. 3a-e)

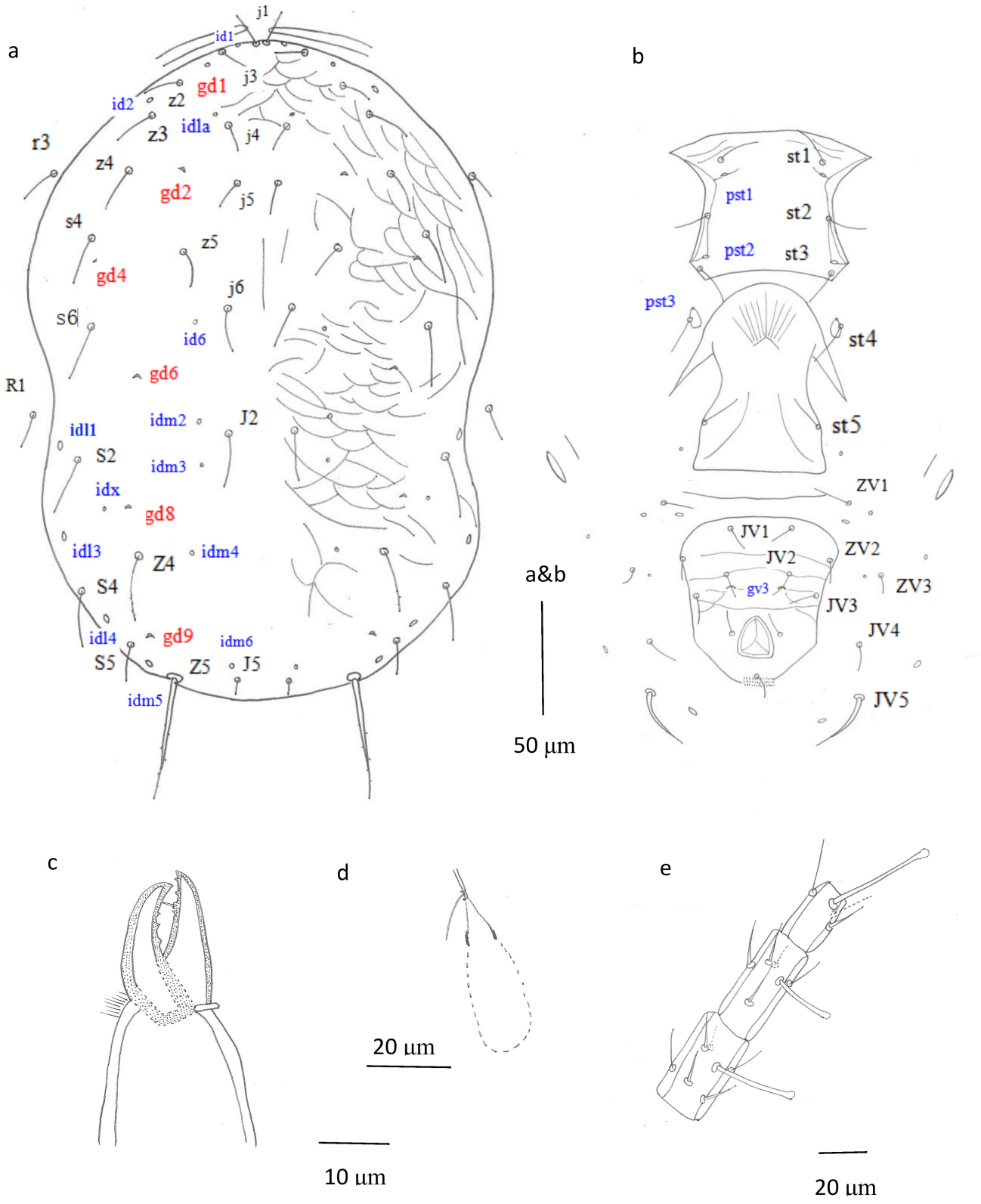


Figure 3 Female of *Typhlodromus ruyuanensis* **sp. nov.** a – Dorsal shield; b – Ventral idiosoma; c – Chelicera; d – Spermatheca; e – Leg IV, genu – basitarsus.

Description

Female (n = 5)

Dorsum (Fig. 3a). Idiosomal setal pattern 12A: 8A/ JV: ZV. Dorsal shield **302** 304 (299–312) long and **203** 202 (192–214) wide at level of *s4*, **217** 216 (199-232) wide at level of *s6*, distances between setae *j1–J5* **295** 296 (287–308), *s4–s4* **151** 151 (148–155) and *s6–s6* **154** 156 (154–160), slightly constricted at level of *R1*; shield reticulate to colliculate throughout, *r3* and *R1* on soft membranous cuticle laterad dorsal shield. Dorsal setae smooth except *Z4* and *Z5*, serrated. All dorsal shield setae setiform. Dorsal shield with six pairs of solenostomes (*gd1*, *gd2*, *gd4*, *gd6*, *gd8*, *gd9*) and 13 pairs of lyrifissures (*id1a*, *id1*, *idl1*, *id6*, *idx*, *idl2–4, idm2–6*). Length of setae: *j1* **13** 16 (13–23), *j3* **20** 22 (20–24), *j4* **16** 15 (15–16), *j5* **17** 17 (16–19), *j6* **21** 20 (18–22), *J2* **24** 23 (22–24), *J5* **8** 8 (6–8), *z2* **14** 15 (13–17), *z3* **20** 21 (20–23), *z4* **22** 22 (20–24), *z5* **16** 17 (16–18), *Z4* **34** 34 (31–36), *Z5* **61** 59 (56–61), *s4* **24** 24 (22–26), *s6* **27** 27 (25–29), *S2* **29** 28 (26–31), *S4* **26** 26 (23–28), *S5* **18** 19 (17–22), *r3* **19** 19 (17–22), *R1* **16** 16 (15–17).

Venter (Fig. 3b). All ventral setae thin and smooth, except *JV5*, thick, serrated. Sternal shield smooth, anterior margin convex, posterior margin of shield nearly straight, **75** 78 (75–84) long, **70** 70 (68–72) wide, length slightly longer than wide, with three pairs of setae *st1* **24** 24 (23–25), *st2* **21** 20 (19–23), *st3* **21** 21 (19–23), and two pairs of lyrifissures (*pst1*, *pst2*). Metasternal platelets ellipsoidal, with one pair of setae *st4* **20** 21 (19–24) and one pair of lyrifissures (*pst3*). Genital shield smooth, with one pair of thin genital setae *st5* **23** 21(18–26), **63** 62 (60–66) wide, posterior edge flat; one pair of associated poroids on soft cuticle near posterior corners of shield. Ventrianal shield smooth, pentagonal, **96** 97 (96–99) long, **76** 75 (69–81) wide at level of *ZV2*, **67** 69 (67–72) wide at level of anus, with four pairs of thin pre-anal setae *JV1* **11** 14 (11–16), *JV2* **13** 11 (6–13), *JV3* **10** 12 (9–17), *ZV2* **11** 11(8–12); *Pa* **12** 12 (11–14), *Pst* **15** 14 (9–15) long. Pre-anal pores *gv3* crescent-shaped, posteromesad *JV2*, distance between pores **25** 25 (23–27). On soft cuticle laterad of dorsal shield: four pairs of setae, *ZV1* **17** 16 (14–17), *ZV3* **10** 11 (7–15), *JV4* **13** 13 (10–15), *JV5* **39** 40 (38–42) long. Two pairs of metapodal plates, primary plate **15** 17 (14–19) long, **3** 3 (3–5) wide, secondary plate **8** 8 (7–8) long, **2** 1 (1–2) wide.

Peritreme (Fig. 3a). Peritreme extending to *j1* level.

Chelicera (Fig. 3c). Fixed digit **27** 26 (25–27) long, with three teeth and *pilus dentilis*; movable digit **25** 25 (23–27) long, with three teeth.

Spermatheca (Fig. 3d). Calyx funnel-shaped, **15** 16 (13–23) long, **7** 8 (7–9) wide at opening; distinctly more sclerotized near vesicle, elsewhere weakly sclerotized, nearly membranous; atrium **2** 2 (2–2) wide, small, C-shaped; major duct narrow; minor duct visible.

Legs (Fig. 3e). Chaetotactic formulae of genua I 2–2/2, 1/1–2, II 1–2/2, 1/0–1, III 1–2/2, 0/1–1 and IV 1–2/2, 0/1–1. Leg III with one macroseta on genu and on tibia, *Seg* III **20** 23 (19-26), *Sti* III **18** 19 (17-20). Leg IV with three apically knobbed macrosetae on genu, tibia and basitarsus, *Sge* IV **34** 35 (34–37), *Sti* IV **25** 24 (19–26) and *St* IV **45** 43 (35–45).

Male. Unknown.

Specimens examined

Holotype: ♀ (accession no. RYNL-011), **Nanling National Nature Reserve** (827 m asl, 24°35′00″ N, 113°02′03″ E), Ruyuan Yao Autonomous County, Shaoguan City, Guangdong Province, on *Thyrostachys siamensis* (Kurz ex Munro) Gamble (Poaceae), 15/XI/2021, Fang X.D. coll. Paratype: 2 ♀♀ (accession no. RYTJS-011, RYTJS-012), **Tianjingshan National Forest Park** (467 m asl, 24°41′09″ N, 112°59′32″ E), on *Rhododendron rivulare* Hand.-Mazz. (Ericaceae), 12/XI/2021, Fang X.D. coll.; Paratype: 1 ♀ (accession no. RYGC-261), **Ruyuan Grand Canyon** (493 m asl, 24°31′19″ N, 113°07′50″ E), on *Desmos chinensis Lour.* (Annonaceae), 11/XI/2021, Fang X.D. coll; Paratype: 1 ♀ (accession no. RYBB-091), **Bibei Village** (239 m asl, 25°0′57″ N, 113°16′51″ E), on unknown plant, 13/XI/2021, Fang X.D. coll.

Etymology

The name *ruyuanensis* refers to Ruyuan Yao Autonomous County, the type locality.

Remarks

By having similar shape of dorsal shield, pentagonal and striated ventrianal shield, stronger sclerotization of the calyx near the vesicle, a knobbed macrosetae on genu, tibia and basitarsus of leg IV, *Typhlodromus ruyuanensis* **sp. nov.** is most similar to *T. orientalis* Wu, 1981, *T. armiger* Ehara & Amano, 1998 and *T. chinensis* Ehara & Lee, 1971. By having similar shape of dorsal shield, ventrianal shield, calyx of spermatheca and knobbed macrosetae on leg IV, this new species is also similar to *T. lobatus* Zannou, Moraes & Oliveira, 2008 and *T. microbullatus* van der Merwe, 1968. Differences between *Typhlodromus ruyuanensis* **sp. nov.** and the related species are given in Table 3.

Conclusion

Wu *et al.* (2009) reported seven species from Ruyuan Yao Autonomous County. In a subsequent study, Fang *et al.*(2020a) reported other 17 species from the same area. Thus, until now, 24 phytoseiid species had been reported from this county, mainly from Nanling National Nature Reserve. As a result of the present work, 20 other species were added to the known phytoseiid fauna in Ruyuan Yao county, namely *N. womersleyi*, *A. longisaccatus*, *A. obtuserellus*, *E. australis*, *T. ochii*, *T. syzygii*, *P. orientalis*, *P. salebrosus*, *O. subtropicus*, *S. jianyangensis*, *P. crinitus*, *P. nipponicus*, *T. agilis*, *T. insularis*, *T. serrulatus*, *T. zhaoi*, *T. xiufui* as well as the three newly described species, *Euseius hamiltonii* **sp. nov.**, *Phytoseius subcapitatus* **sp. nov.** and *Typhlodromus ruyuanensis* **sp. nov.** Thus, 44 species are now known from Ruyuan Yao County, belonging to nine genera in the three phytoseiid subfamilies.

Nanling Mountain is one of the richest biodiversity hotspots in China (Pang, 2003), additional surveys are still required to adequately characterize its biodiversity. *Amblyseius herbicolus* (with 74 specimens collected) and *S. okinawanus* (with 49 specimens collected) accounted for respectively about 31 and 20% of all specimens collected in this study. These were the dominant species in this survey. But their ecological role is still unknown, which also needs to be revealed in the future.

Table 3 Differences in diagnostic characters and measurements between *Typhlodromus ruyuanensis* Fang & Wu **sp. nov.** and similar species.

Species	*ruyuanensis* [d]	*orientalis* [e]	*chinensis* [f]	*armiger* [g]	*lobatus* [h]	*microbullatus* [i]
Dorsal shield length	304 (299 – 312)	302	323–326	356	264 (256 – 283)	292 (276 – 306)
Dorsal shield width	202 (199 – 232)	200	206	221	142 (134 – 158)	158 (147 – 172)
Dorsal shield ornament	strongly reticulate	anterolateral striated only	strongly reticulated	strongly reticulated	strongly reticulated	strongly reticulated
Serrate dorsal setae	*Z4*, *Z5*	Z5	*Z4*, *Z5*	all	*Z4*, *Z5*	*Z4*, *Z5*
Calyx of spermatheca	funnel	trumpet	triangular	sack-like	triangular	bell-shaped
Atrium	C-shape, connected directly to calyx	C-shape, connected directly to calyx	knobbed, connected directly to calyx	unclear	knobbed, connected directly to calyx	knobbed, incorporated within calyx
j1	16 (13 – 23)	20	19 – 21	28	14 (13 – 16)	19 (16 – 21)
j3	22 (20 –24)	45	17 – 24	39	18 (16 – 22)	25 (20 – 26)
s4	24 (22 – 26)	44	18 – 21	44	24 (19 – 27)	26 (23 – 28)
S4	26 (23 – 28)	35	22	54	26 (24 – 34)	29 (26 – 33)
S5	19 (17 – 22)	30	17 – 19	–	19 (16 – 21)	28 (25 – 33)
Z4	34 (31 – 36)	53	30	53	30 (27 – 34)	31 (28 – 34)
Z5	59 (56 – 61)	65	48 – 52	63	40 (34 – 48)	45 (40 – 55)
Sge IV	35 (34 – 37)	35	33	24	–	–
Sti IV	24 (19 – 26)	23	25	28	2 knobbed setae	–
St IV	43 (35 – 40)	43	44	45	23 (21 – 27)	21 (17 – 24)

[d] from five specimens, [e, f] from Wu *et al.* (2009), [g] from Ehara & Amano (1998), [h, i] from Ueckermann *et al.* (2008)

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