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Phytoseiid mites of the subgenus *Typhlodromus* (*Anthoseius*) De Leon (Acari: Mesostigmata: Phytoseiidae) in Taiwan

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Abstract

Predatory mites belonging to family Phytoseiidae (Acari: Mesostigmata) have received great attention. The subgenus *Typhlodromus* (*Anthoseius*) De Leon is one of the largest and complicated group in the family Phytoseiidae. There are 11 species of *Typhlodromus* (*Anthoseius*) reported in Taiwan so far and eight of them described by Y.H. Tseng. In addition, all specimens including types are lost after his retirement. The undetailed descriptions and the simple illustrations caused some difficulties in proper identifications of Taiwanese species. In this study, six species previously described from Taiwan that follows *T. (A.) changi*, *T. (A.) gracilentus*, *T. (A.) lanyuensis*, and *T. (A.) neocrassus*, *T. (A.) obesus*, *T. (A.) tridentiger*, are re-discovered. In addition, three species, *T. (A.) bambusae*, *T. (A.) chinensis*, and *T. (A.) serrulatus* are reported for the first time for Taiwanese fauna. We also provided the first description of male *T. (A.) bambusae*. Detailed descriptions of all species and a revised key to the Taiwanese species of the subgenus *Typhlodromus* (*Anthoseius*) are also included.

Key words: predatory mites, Typhlodrominae, redescription, new records, Taiwan

Introduction

Predatory mites of the family Phytoseiidae (Acari: Mesostigmata) have received considerable attention due to their potential as biological control agents of phytophagous mites and other small arthropods (McMurtry *et al.* 2013, 2015). Thus far, more than 2,700 species included in three subfamilies and 91 genera have been recorded worldwide (Chant & McMurtry 2007; Demite *et al.* 2019). Yi-Hsiung Tseng provided the most complete survey of phytoseiid mites from Taiwan in the past, and described 20 species for science (Tseng 1972, 1973, 1975, 1976; Chang & Tseng 1978; Tseng 1983). However, after his retirement, all specimens including the type specimens were lost. In addition, Tseng provided undetailed descriptions and simple illustrations which may cause difficulties for proper identification. Therefore, redescrptions of these species are necessary to avoid further confusions (BAPHIQ 2009; Liao *et al.* 2017a).

The subgenus *Typhlodromus* (*Anthoseius*) De Leon is characterized by having dorsal setae S5 (Chant & McMurtry 1994, 2007). This subgenus is one of the most largest and complicated groups in the family Phytoseiidae. Totally 363 valid species of *Typhlodromus* (*Anthoseius*) are known worldwide (Demitte *et al.* 2019). However, only 10 species were recorded from Taiwan, and nine of them described by Tseng (Tseng 1972, 1973, 1975, 1976; Chang & Tseng 1978; Tseng 1983).

During the nationwide surveys to determine native populations of phytoseiid mites, six *Typhlodromus* (*Anthoseius*) species described by Tseng were found. In addition, three species are found for the first time in Taiwan. A revised key to Taiwanese species of subgenus *Typhlodromus* (*Anthoseius*) were also provided.

Materials and Methods

Mite specimens examined in this study were collected from various plants from the main island and surrounding islands of Taiwan during the years 1985–2018. Specimens were mounted in Hoyer's medium. Also, poor condition specimens were soaked with water, clean by lactic acid, bleached by high concentration (50%) H_2O_2 in the blacken specimen, rinsed in ethanol (75%), and remounted in Hoyer's medium (Yeh *et al.* 2008). Specimens were examined under Olympus BX51 microscope, and measurements taken using a stage-calibrated ocular micrometers as well as ImageJ 1.47 (Schneider *et al.* 2012). Photos were taken by using Motic® Moticam 5+ camera attached to the microscope. All measurements were provided in micrometers (μm) following by their mean and range (in parenthesis). The dorsal shield lengths were measured from anterior to posterior margins along the midline and the widths measured at *j6* and *S4* levels. The sternal shield lengths and widths were taken from anterior to posterior margins along the midline and at broadest level, respectively. The genital shield widths were taken from broadest level. The ventrianal shield lengths were taken from anterior to posterior margins along the midline including cribrum and the shield widths measured at *ZV2* and anus levels. The general terminology used for morphological descriptions in this study follows that of Chant & McMurtry (2007). The notation for idiosomal setae follows that of Lindquist & Evans (1965) and Lindquist (1994), as adapted by Rowell *et al.* (1978) and Chant & Yoshida-Shaul (1992). The notation for solenostomes and lyrifissures is based on Athias-Henriot (1975).

Specimens were deposited in the following institutions: NCHU (Department of Entomology, National Chung Hsing University, Taichung, Taiwan); NMNS (National Museum of Natural Science, Taichung, Taiwan), NTU (Department of Entomology, National Taiwan University, Taipei, Taiwan), TARL (Taiwan Acari Research Laboratory, Taichung City, Taiwan). Other specimens were received on loan from acarological collections of HUM (Hokkaido University Museum, Sapporo, Japan), NSMT (National Museum of Nature and Science, Tsukuba, Japan). If necessary, the locality names were translated using the Geographic Name Information System, Department of Land Administration, Ministry of the Interior (Taiwan) (<http://gn.moi.gov.tw/geonames/Translation/Translation.aspx>).

Result

Family Phytoseiidae Berlese

Subfamily Typhlodrominae Wainstein

Genus *Typhlodromus* Scheuten

Subgenus *Anthoseius* De Leon

Key to *Typhlodromus* (*Anthoseius*) species known from Taiwan based on adult females¹

1. Ventrianal shield with three pairs of preanal setae 2
— Ventrianal shield with four pairs of preanal setae 3
2. Dorsal setae serrated *transvaalensis* (Nesbitt, 1951)
— Dorsal setae smooth *bambusae* Ehara, 1964
3. Preanal pores absent 4
— Preanal pores present 5

1. *Typhlodromus* (*Anthoseius*) *eleglidus* Tseng was not treated in the key due to simple original description. Besides, *Typhlodromus* (*Anthoseius*) *pseudoserrulatus* was also excluded in the key because of uncertain species status.

4. Sternal shield with two pairs of setae *neocrassus* Tseng, 1983
- Sternal shield with three pairs of setae *changi* Tseng, 1975
5. Ventrianal shield with small rounded preanal pores *ryukyuensis* Ehara, 1967
- Ventrianal shield with crescentic preanal pores 6
6. Sternal shield with two pairs of setae *obesus* Tseng, 1983
- Sternal shield with three pairs of setae 7
7. Movable digit of chelicera with one tooth 8
- Movable digit of chelicera with more than one tooth 9
8. Fixed digit of chelicera with one tooth *lanyuensis* Tseng, 1975
- Fixed digit of chelicera with four teeth *gracilentus* Tseng, 1975
9. All setae setiform *chinensis* Ehara & Lee, 1971
- At least seta Z5 shovel-shaped with expanded blade 10
10. Fixed digit of chelicera with seven teeth *serrulatus* Ehara, 1972
- Fixed digit of chelicera with about 3–4 teeth 11
11. Both dorsal setae Z4 and Z5 shovel-shaped end with expanded blade
- Only dorsal setae Z4 shovel-shaped end *crossostephium* Liao & Ho, 2017b
- Only dorsal setae Z4 shovel-shaped end *tridentiger* Tseng, 1975

***Typhlodromus (Anthoseius) bambusae* Ehara, 1964**

(Figures 1–15)

Typhlodromus (Neoseiulus) bambusae Ehara, 1964: 379.

Amblydromella bambusae.—Moraes *et al.*, 1986: 156.

Typhlodromus bambusae.—Yin *et al.* 1996: 59.

Amblydromella (Lindquistoseia) bambusae.—Denmark & Welbourn, 2002: 301.

Typhlodromus (Anthoseius) takahashii Ehara, 1978.—(synonymy according to Ehara, 1981)

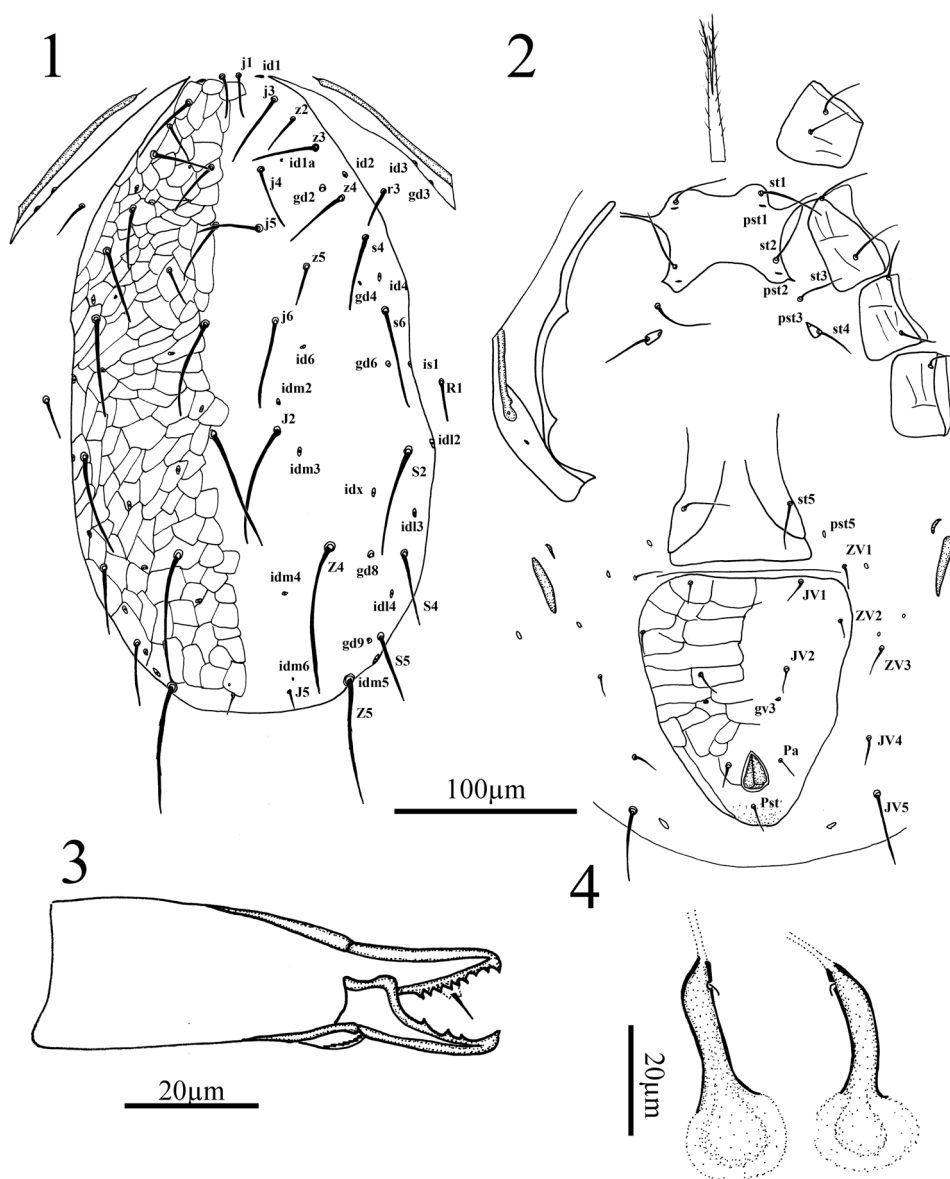
Female (n=7)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV-3:ZV.

Dorsal idiosoma (Figure 1). Dorsal shield nearly oval, constricted at level of R1, strongly reticulated; 348 (313–377) long and 183 (159–200) wide at level of j6, 184 (162–192) wide at level of S4; five pairs of solenostomes on dorsal shield (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 15 pairs of lyrifissures (*idl1*, *idl1a*, *id2*, *id4*, *id6*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *isl1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 22 (19–24), *j3* 42 (39–47), *j4* 30 (27–32), *j5* 35 (31–39), *j6* 48 (39–56), *J2* 59 (53–65), *J5* 10 (5–14), *z2* 22 (17–34), *z3* 30 (27–34), *z4* 32 (28–36), *z5* 20 (16–24), *Z4* 70 (61–78), *Z5* 65 (60–68), *s4* 42 (37–47), *s6* 49 (40–54), *S2* 49 (44–53), *S4* 35 (32–39), *S5* 31 (22–37), *r3* 20 (17–22), *R1* 22 (19–25). All setae smooth, except seta Z5 serrated.

Peritreme (Figures 1, 2). Peritreme extending to level of z2; peritremal shield lightly sclerotized, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*id3*).

Ventral idiosoma (Figure 2). Sternal shield smooth, posterior margin concave, much wider than long, 46 (41–58) long, 76 (65–94) wide, with two pairs of setae *st1* 27 (22–33), *st2* 24 (19–30), and two pairs of lyrifissures (*pst1*, *pst2*); setae *st3* 19 (16–23) on soft cuticle. Exopodal shield at coxae II–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 17 (15–19), and one pair of lyrifissures (*pst3*). Genital shield smooth, with one pair of genital setae *st5* 22 (17–26), 72 (67–77) wide at level of genital setae. Distances between *st1*–*st1* 48 (41–52), *st2*–*st2* 58 (49–62), *st3*–*st3* 77 (57–84), *st1*–*st3* 61 (50–69), *st5*–*st5* 62 (58–66). Ventrianal shield pentagonal, smooth, 132 (116–142) long, 115 (107–125) wide at level of ZV2, 65 (59–73) wide at level of anus; with three pairs of preanal setae, *JV1* 18 (14–23), *JV2* 19 (17–23), *ZV2* 16 (13–21), solenostomes *gv3* small, rounded; *Pa* 16 (13–21), *Pst* 13 (12–14) on shield. Setae *JV4* 12 (8–16), *JV5* 36 (33–39), *ZV1* 16 (12–21), *ZV3* 13 (12–14) on interscutal membrane. All setae smooth. Two pairs of metapodal plates: 31 (24–36) long, 6 (4–7) wide; 9 (7–11) long, 3 (2–4) wide.

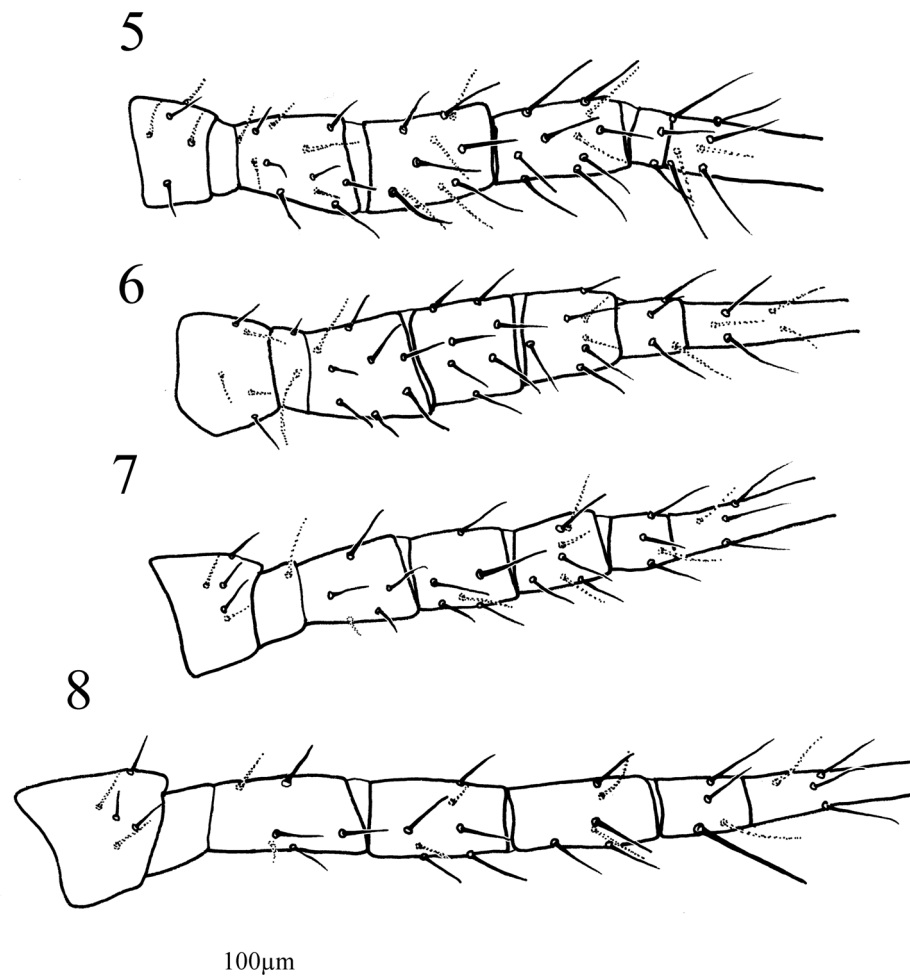


FIGURES 1–4. *Typhlodromus (Anthoseius) bambusae* Ehara, 1964, female. 1. Dorsal shield; 2. Ventral idiosoma; 3. Chelicera; 4. Spermatheca.

Spermatheca (Figure 4). Calyx elongated saccular, flaring distally, 33 (29–39) long, 11 (7–14) wide; atrium incorporate with calyx, minor and major ducts visible.

Chelicera (Figure 3). Movable digit 30 (29–32) long, with three teeth; fixed digit 27 (24–31) long, with eight teeth, with *pilus dentilis*.

Legs (Figures 5–8). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I 2-3/1-2/2-2, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III 1-2/1-1/0-1, 1-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV 1-2/1-1/0-1, 1-2/0-2/1-1, 1-1/0-2/1-1, 1-1/1-1. Macrosetae: *Sti* IV (*ad*) 24 (22–26), *St* IV (*d*) 31 (28–33). Macrosetae setiform.



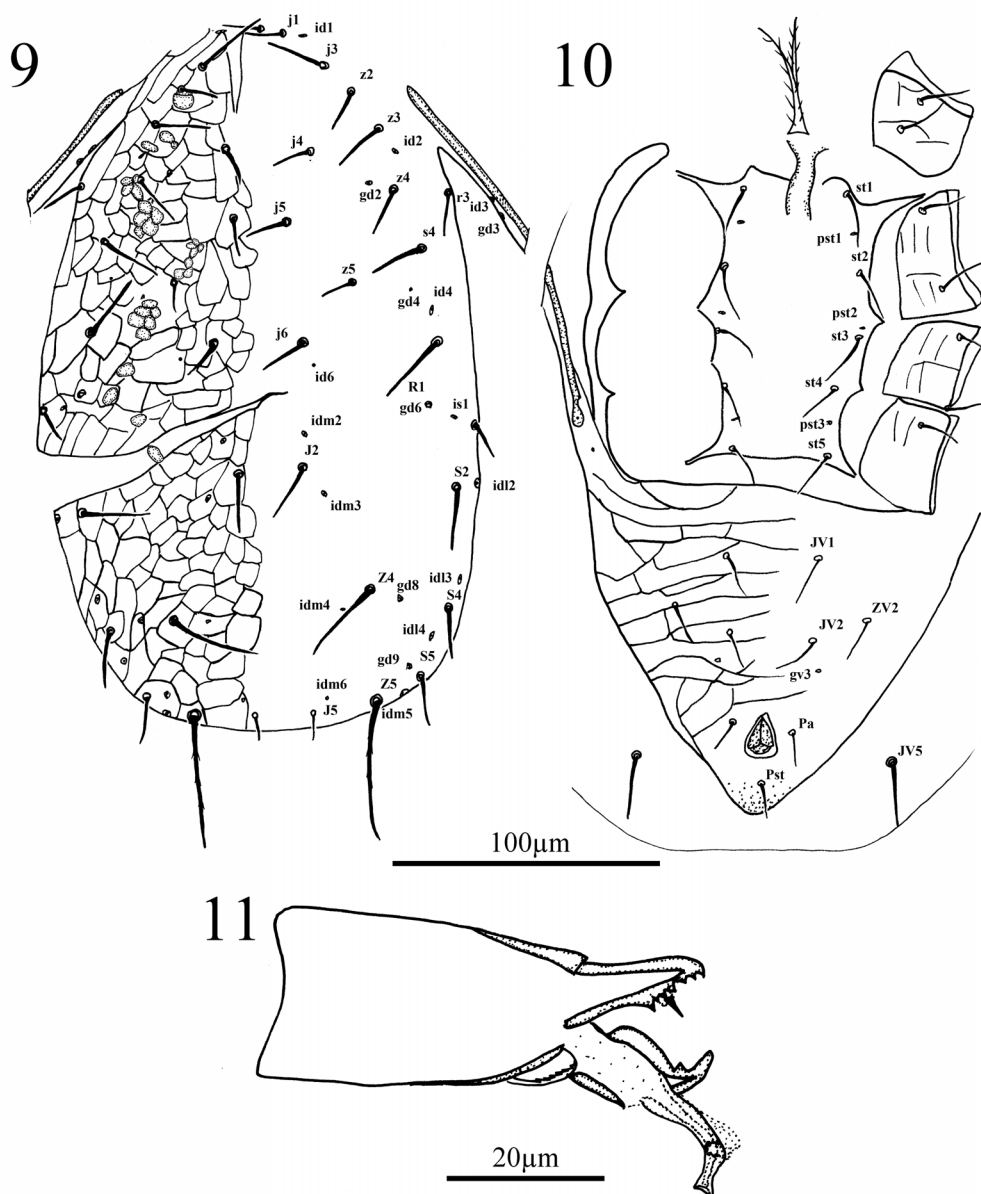
FIGURES 5–8. *Typhlodromus (Anthoseius) bambusae* Ehara, 1964, female, legs. 5. Leg I anterodorsal view; 6. Leg II dorsal view; 7. Leg III anterodorsal view; 8. Leg IV anterodorsal view.

Male (n=1)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV-3,4:ZV-1,3.

Dorsal idiosoma (Figure 9). Dorsal shield nearly oval, constricted at level of *R1*, strongly reticulated; 255 long and 157 wide at level of *j6*, 132 wide at level of *S4*, five pairs of solenostomes on dorsal shield (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 15 pairs of lyrifissures (*id1*, *id1a*, *id2*, *id4*, *id6*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *is1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 15, *j3* 23, *j4* 18, *j5* 17, *j6* 19, *J2* 19, *J5* 7, *z2* 15, *z3* 16, *z4* 17, *z5* 14, *Z4* 28, *Z5* 42, *s4* 23, *s6* 30, *S2* 22, *S4* 17, *S5* 18, *r3* 14, *R1* 12. All setae smooth, except seta *Z5* serrated.

Peritreme (Figures 9, 10). Peritreme extending to level of *z2–z3*; peritremal shield lightly sclerotized, with one pair of solenostomes (*gd3*) and one pair of lyrifissures (*id3*).

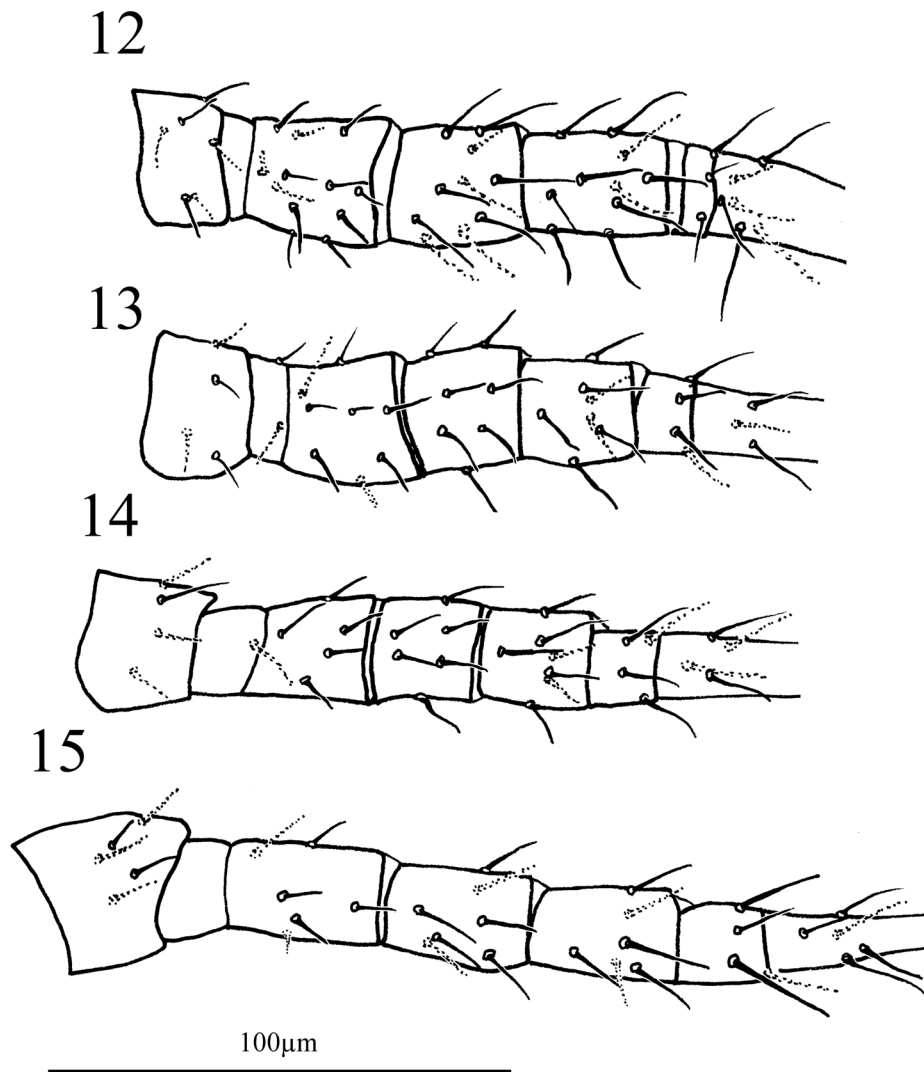


FIGURES 9–11. *Typhlodromus (Anthoseius) bambusae* Ehara, 1964, male. 9. Dorsal shield; 10. Ventral idiosoma; 11. Chelicera and spermatodactyl.

Ventral idiosoma (Figure 10). Sternogenital shield smooth, posterior margin almost straight, longer than wide, 108 long, 61 wide at level of *st5*, with five pairs of setae, *st1* 19, *st2* 18, *st3* 15, *st4* 16, *st5* 19, three pairs of lyrifissures (*pst1*, *pst2*, *pst3*). Distances between *st1-st1* 46, *st2-st2* 50, *st3-st3* 52, *st4-st4* 42, *st5-st5* 34, *st1-st5* 99. Exopodal shield at coxae II–IV. Ventrianal shield subtriangular, reticulated, 108 long, 133 wide at anterior corner, 51 at level of anus, fused with peritremal shield cingulum; with three pairs of preanal setae, *JV1* 17, *JV2* 15, *ZV2* 14, solenostomes *gv3* small, rounded; *Pa* 9, *Pst* 11 on shield. Seta *JV5* 19 on interscutal membrane. All setae smooth.

Chelicera (Figure 11). Movable digit 18 long, with one tooth; fixed digit 16 long, with six teeth, with *pilus dentilis*. Spermatodactyl L-shaped, shaft 11 long, heel reduced, foot 5 long.

Legs (Figures 12–15). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/1-2/2-2, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/0-2/1-1, 1-1/0-2/1-1, 1-1/1-1. Macrosetae: *Sti* IV (*ad*) 19, *St* IV (*d*) 21. Macrosetae setiform.



FIGURES 12–15. *Typhlodromus (Anthoseius) bambusae* Ehara, 1964, male, legs. 12. Leg I anterodorsal view; 13. Leg II dorsal view; 14. Leg III dorsal view; 15. Leg IV dorsal view.

Specimens examined

JAPAN: Tottori, Tottori Pref., holotype female (ZIHU-3410) from *Chimonobambusa marmorea* (Poaceae), 4 July 1964, T. Godo (HUM); near Sugadaira, Nagano Pref., two paratype females (ZIHU3410–1, 2) from *Sasa* sp. (Poaceae), 3 Aug 1964, S. Ehara (HUM); Tokyo Metropolitan University, Hachioji City, Tokyo, three females from *Sasa* sp. (Poaceae), 2 Dec 2018, J. R. Liao & H. C. Liao (NTU).

TAIWAN: Chung Cheng Camp Zone, Dakeng, Beitun District, Taichung City, one female (TAL092G118) from *Bambusa stenostachya* (Poaceae), 23 Feb 2003, C. C. Ho (TARL); Zhutian Township, Pingtung County, one female (TAL092D0078) from soil of *Zea mays* (Poaceae), 21 Apr 2003, C. C. Ho (TARL); Lidong Rd., Neipu Township, Pingtung County, one female (TAL092D1007) from soil of *Areca cathecha* (Palmse), 23 Apr 2003, C. C. Ho (TARL); Daguan, Heping Dist., Taichung City, one female (TAL093B748) from soil, 23 Mar 2004, C. C. Ho (TARL); Qingshan, Dongshan Dist., Tainan City, two females (HAL096C024) from *Miscanthus floridulus* (Poaceae), 30 Jan 2007, C. C. Ho (TARL); Aonao, Tai'an Township, Taichung City (24° 23' 25.5" N, 121° 57' 31.4" E, 887m), three females (HAL101B133, 34, 35) from bamboo (Poaceae), 23 Mar 2012, C. C. Ho (TARL); Datunshan, Beitou Dist., Taipei City (25° 09' 40.1" N, 121° 29' 36" E, 470m), six females and one male (HAL101B299, 300, 301, 307, 308, 309, 310, 311) from bamboo (Poaceae), 9 Nov 2012, C. C. Ho (TARL); Zhanghu Mountain, Gukeng Township, Yunlin County (23° 36' 58.9" N, 120° 37' 54.3" E, 739m), eight females and one male (HAL102B08–14) from *Phyllostachys makinoi* (Poaceae), 23 Jan 2013, C. C. Ho (TARL); Guanziling, Baihe Dist., Tainan County (23° 20' 0.8" N, 120° 29' 45.3" E, 382m), one female (HAL102B10160) from *Phyllostachys makinoi* (Poaceae), 6 Nov 2013, C. C. Ho (TARL).

Distribution

Asia: China [Fujian (Lin *et al.* 2000), Zhejiang (Yin *et al.* 1996)], Japan (Ehara 1964), Taiwan (present study).

Remarks

Typhlodromus (*Anthoseius*) *bambusae* Ehara is reported for the first time for Taiwanese fauna. Also, this is the first description of the male of the species. Ehara (1964) described this species from *Chimonobambusa marmorea* and sasa bamboo in Japan. Zhang *et al.* (1999) reported this species as an effective biological control agent of spider mites belonging to the genus *Schizotetranychus* in China. According to McMurtry *et al.* (2013) this species has subtype I-b lifestyle and specialized predators of web-nest producing mites. We also observed the species when its feeding on the similar circumstance.

According to the original description of the species, “macrosetae of leg IV: tibia 49, basitarsus 54; largest seta on tibia IV 33”. Ehara (1981) mentioned that the original description was erroneously recorded. He then corrected macrosetae as follows, “macroseta on tibia 26, that on basitarsus 28, that on distitarsus 23, the largest seta on genu 17”. Our measurements taken from the holotype are agree with Ehara (1981).

Typhlodromus (*Anthoseius*) *neocrassus* Tseng, 1983

(Figures 16–23)

Typhlodromus (*Typhlodromus*) *neocrassus* Tseng, 1983: 67

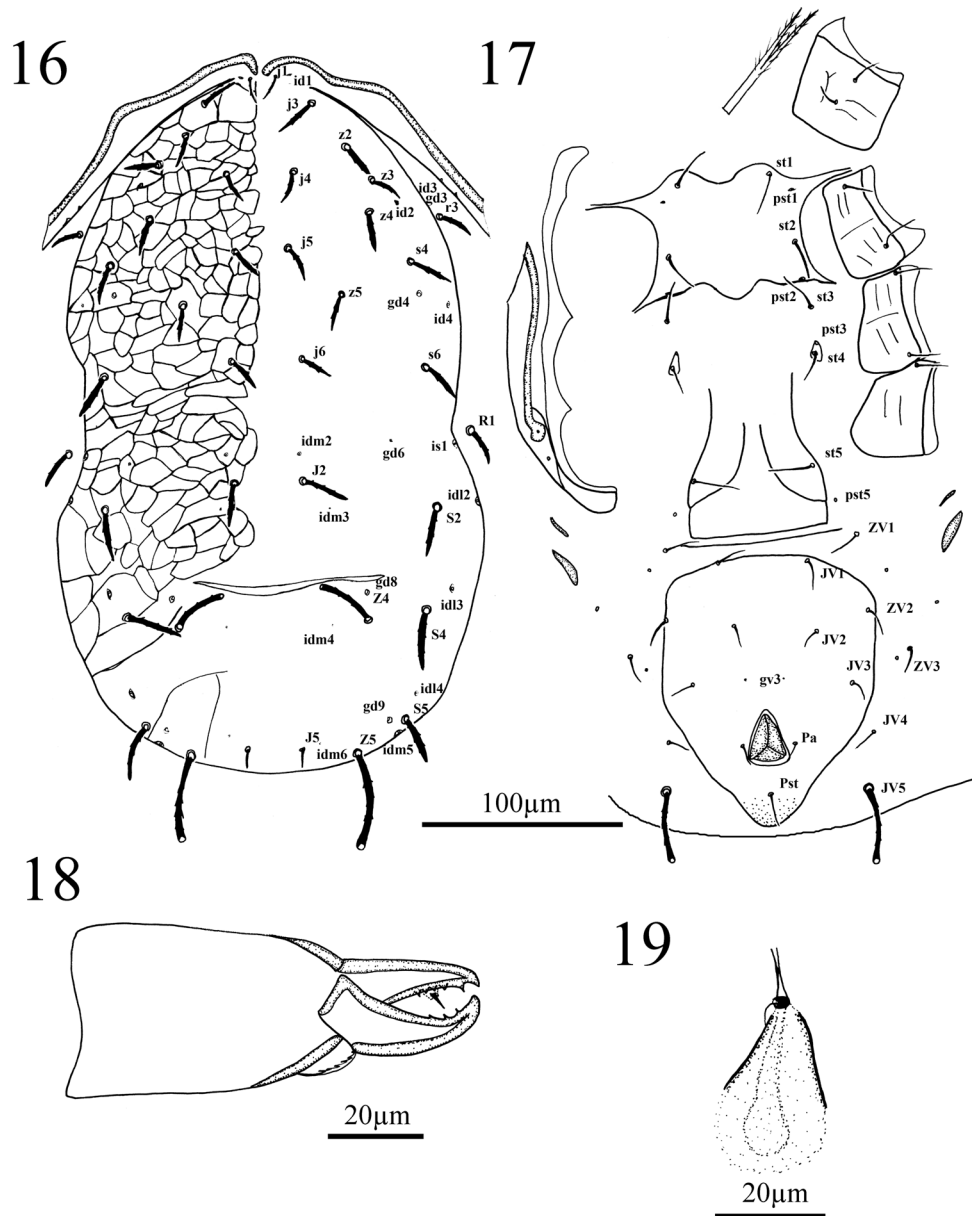
Typhlodromus (*Anthoseius*) *neocrassus*.—Moraes *et al.*, 2004: 339.

Female (n=1)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 16). Dorsal shield nearly oval, constricted at level of *R1*, well sclerotized, strongly reticulated, 356 long and 208 wide at level of *j6*, 221 wide at level of *S4*; four pairs of solenostomes on dorsal shield (*gd4*, *gd6*, *gd8*, *gd9*), 12 pairs of lyrifissures (*id1*, *id2*, *id4*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *is1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 19, *j3* 20, *j4* 14, *j5* 16, *j6* 16,

J2 21, *J5* 7, *z2* 15, *z3* 16, *z4* 17, *z5* 17, *Z4* 30, *Z5* 41, *s4* 19, *s6* 23, *S2* 23, *S4* 27, *S5* 26, *r3* 18, *R1* 19.
All setae short, thick and serrated, sharp end, except setae *Z4*, *Z5* shovel end.

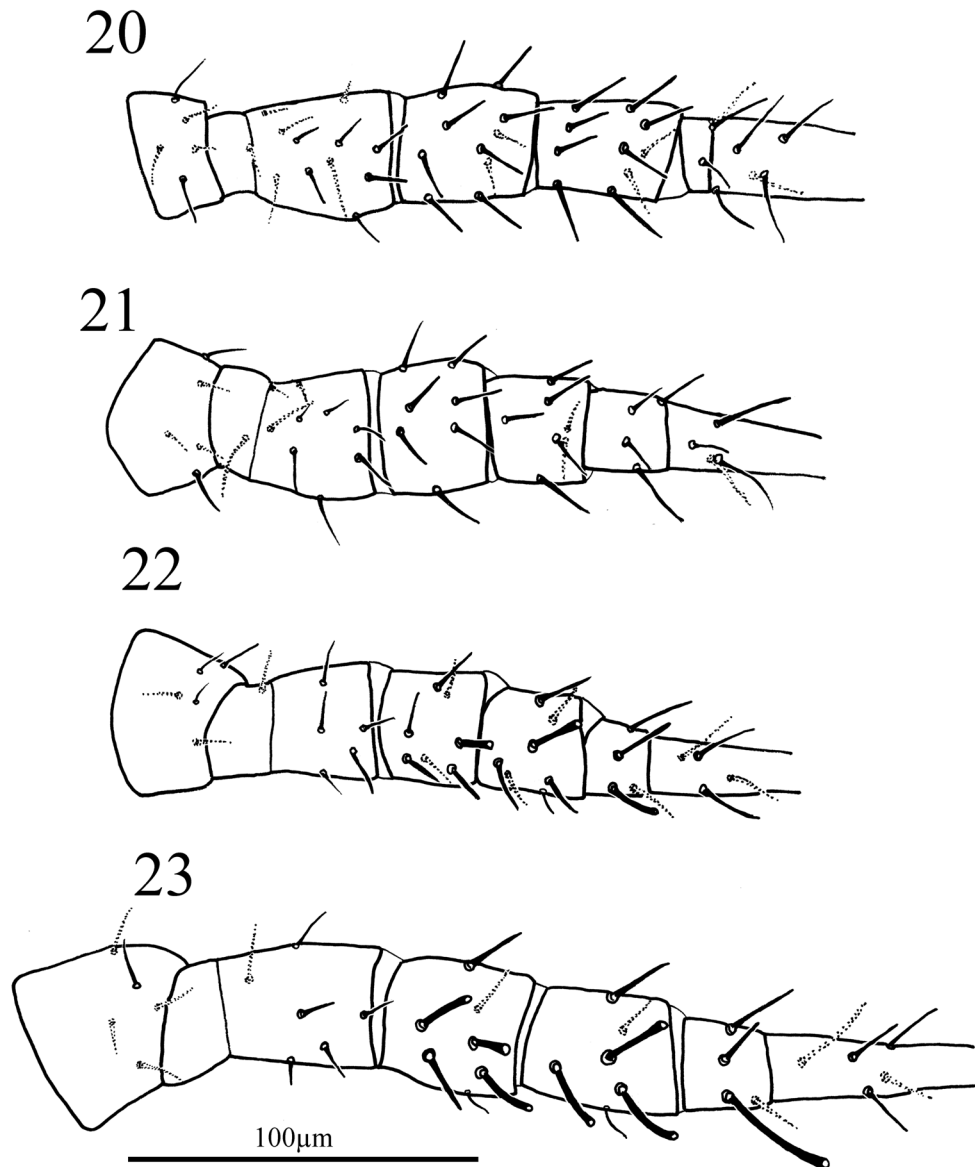


FIGURES 16–19. *Typhlodromus (Anthoseius) neocrassus* Tseng, 1983, female. 16. Dorsal shield; 17. Ventral idiosoma; 18. Chelicera; 19. Spermatheca.

Peritreme (Figures 16, 17). Peritreme extending beyond *j1* and curved downward, with one pair of solenostome (*gd3*), and one pair of lyrifissures (*id3*).

Ventral idiosoma (Figure 17). Sternal shield smooth, posterior margin with median projection, much wider than long, 51 long, 88 wide, with two pairs of setae *st1* 18, *st2* 15, and two pairs of lyrifissures (*pst1*, *pst2*), *st3* 12 on soft cuticle. Exopodal shield at coxae I–IV. Metasternal platelets

tear-shaped, with one pair of metasternal setae, *st4* 12. Genital shield smooth, posteriorly truncate, with one pair of genital setae *st5* 15, 72 wide at level of genital setae. Distances between *st1–st1* 49, *st2–st2* 66, *st3–st3* 75, *st1–st3* 72, *st5–st5* 62. Ventrianal shield pentagonal, longer than wide, 128 long, 115 wide at level of *ZV2*, 85 wide at level of anus; with four pairs of preanal setae, *JV1* 15, *JV2* 11, *JV3* 11, *ZV2* 11, solenostomes *gv3* small, rounded; *Pa* 8, *Pst* 12 on shield. Setae *JV4* 11, *JV5* 34, *ZV1* 12, *ZV3* 8 on interscutal membrane. All setae smooth, *JV5* thick, serrated, shovel end. Two pairs of metapodal plates: 22 long, 6 wide; 8 long, 2 wide.



FIGURES 20–23. *Typhlodromus (Anthoseius) neocrassus* Tseng, 1983, female, legs. 20. Leg I dorsal view, 21. Leg II dorsal view, 22. Leg III anterodorsal view, 23. Leg IV anterodorsal view.

Spermatheca (Figure 19). Calyx cup-shaped, 20 long, 20 wide; atrium nodular and attached to the calyx without neck, minor and major ducts visible.

Chelicera (Figure 18). Movable digit 32 long, with three teeth; fixed digit 28 long, with five teeth, and *pilus dentilis*.

Legs (Figures 20–23). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* III (*ad2*) 12, *Sti* III (*ad*) 15, *St* III (*d*) 14, *Sge* IV (*ad2*) 12, *Sti* IV (*ad*) 14, *St* IV (*d*) 28. Macrosetae apically shovel-shaped with expanded blade.

Specimens examined

Jiaoxi Township, Yilan County, one female (no. 1107–2) from *Gardenia jasminoides* (Rubiaceae), 27 Jan 2011, Y. T. Shih (NTU).

Distribution

Asia: Taiwan (Tseng 1983).

Remarks

Tseng (1983) reported this species from guajava (guava, *Psidium guajava*) in Taichung City. This species is characterized by having two pairs of setae on the sternal shield, all of the dorsal setae short, thick and serrated, and seta *Z5* with a shovel end. Besides, Tseng (1983) provided the illustration of spermatheca as a concentric circle which does not show the real structure of spermatheca. We assumed that the concentric circle is probably an artefact caused by the slide-making technique.

***Typhlodromus (Anthoseius) changi* Tseng, 1975**

(Figures 24–31)

Typhlodromus (Typhlodromus) changi Tseng, 1975: 57.

Amblydromella changi.—Moraes *et al.*, 1986: 159.

Amblydromella (Amblydromella) changi.—Denmark & Welbourn, 2002: 307.

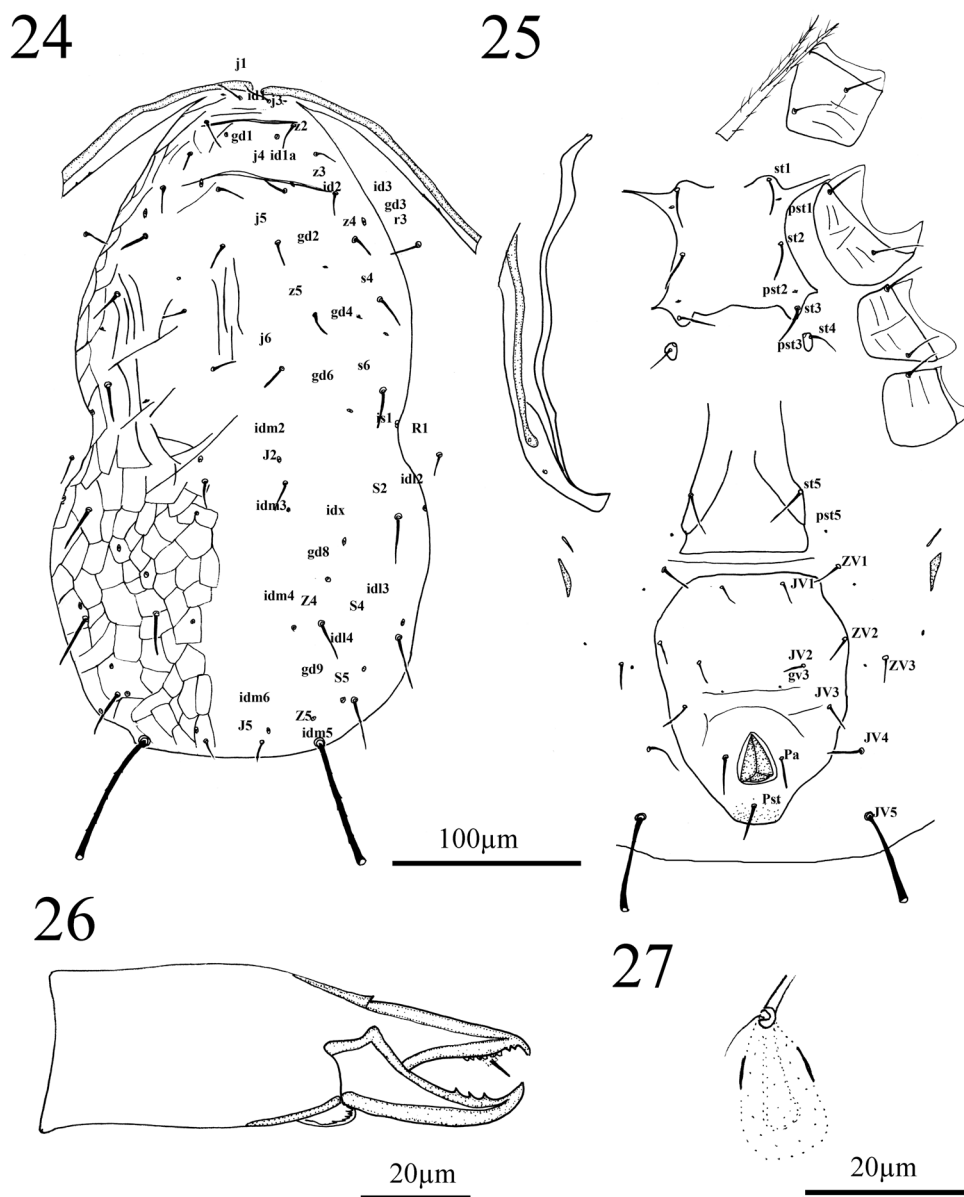
Typhlodromus (Anthoseius) changi.—Chant & McMurtry, 2007: 152.

Female (n=6)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 24). Dorsal shield nearly oval, constricted at level of *R1*, well sclerotized, strongly reticulated, 357 (344–366) long and 179 (171–230) wide at level of *j6*, 187 (183–193) wide at level of *S4*; six pairs of solenostomes on dorsal shield (*gd1*, *gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 14 pairs of lyrifissures (*idl1*, *idl1a*, *id2*, *id4*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *isl*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 15 (11–20), *j3* 13 (12–15), *j4* 9 (6–12), *j5* 10 (9–12), *j6* 12 (11–14), *J2* 14 (12–17), *J5* 8 (7–10), *z2* 13 (11–15), *z3* 11 (9–14), *z4* 13 (12–14), *z5* 10 (9–12), *Z4* 17 (10–21), *Z5* 57 (53–61), *s4* 15 (14–16), *s6* 17 (15–20), *S2* 20 (16–22), *S4* 25 (21–30), *S5* 21 (18–29), *r3* 13 (10–15), *R1* 14 (12–15). All setae smooth, except seta *Z5* serrated, shovel-shaped with expanded blade.

Peritreme (Figures 24, 25). Peritreme extending to level of *j1*, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*id3*).



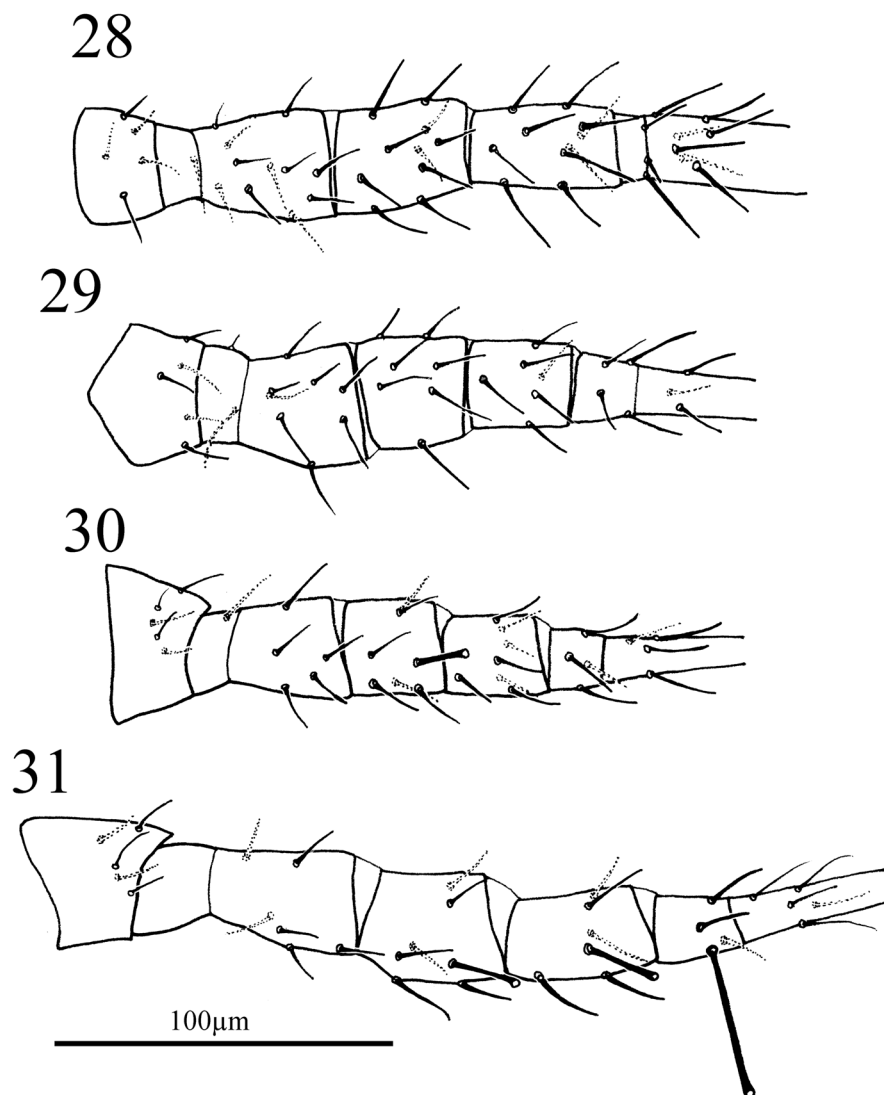
FIGURES 24–27. *Typhlodromus (Anthoseius) changi* Tseng, 1975, female, 24. Dorsal shield; 25. Ventral idiosoma; 26. Chelicera; 27. Spermatheca.

Ventral idiosoma (Figure 25). Sternal shield smooth, posterior margin irregular, wider than long, 77 (71–84) long, 81 (73–87) wide, with three pairs of setae *st1* 20 (15–24), *st2* 20 (15–24), *st3* 16 (14–19), and two pairs of lyrifissures (*pst1*, *pst2*). Exopodal shield at coxae I–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 14 (10–19), with one pair of lyrifissures (*pst3*). Genital shield smooth, posteriorly truncate, with one pair of genital setae *st5* 15 (12–21), 67 (60–75) wide at level of genital setae. Distances between *st1*–*st1* 52 (42–65), *st2*–*st2* 57 (50–68), *st3*–*st3* 65 (62–71), *st1*–*st3* 70 (67–74), *st5*–*st5* 57 (54–62). Ventrianal shield pentagonal, lateral margins

slightly concave, 127 (122–134) long, 99 (88–95) wide at level of *ZV2*, 79 (74–87) wide at level of anus; with four pairs of preanal setae, *JV1* 10 (7–11), *JV2* 8 (6–11), *JV3* 11 (9–15), *ZV2* 12 (8–14), solenostomes *gv3* small, rounded; *Pa* 12 (8–16), *Pst* 12 (9–16) on shield. Setae *JV4* 14 (12–17), *JV5* 47 (41–51), *ZV1* 11 (10–12), *ZV3* 11 (8–12) on interscutal membrane. All setae smooth, sharp pointed, except seta *JV5* shovel end. Two pairs of metapodal plates: 20 (19–23) long, 7 (6–9) wide; 9 (7–11) long, 3 (2–4) wide.

Spermatheca (Figure 27). Calyx cup-shaped, 12 (8–14) long, 7 (6–8) wide; with distal half thick, other membrane, atrium nodular, connected to the calyx without neck, minor and major ducts visible.

Chelicera (Figure 26). Movable digit 31 (27–38) long, with three teeth; fixed digit 28 (26–32) long, with eight teeth and *pilus dentilis*.



FIGURES 28–31. *Typhlodromus (Anthoseius) changi* Tseng, 1975, legs. 28. Leg I anterior view; 29. Leg II anterior view; 30. Leg III posterior view; 31. Leg IV posterodorsal view.

Legs (Figures 28–31). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-1/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* III (*ad2*) 14 (12–16), *Sge* IV (*ad2*) 21 (18–23), *Sti* IV (*ad*) 18 (15–21), *St* IV (*d*) 45 (42–49). Macrosetae shovel-shaped with expanded blade.

Specimens examined

Shouka, Mudan Township, Pingtung County (22° 14.577' N, 120° 50.650' E, 555m), one female (no. 617–1) from *Bambusa olhamii* (Poaceae), 14 June 2010, J. R. Liao, Y. H. Chiang & A. K. Dubey (NTU); Simaxian, Tai'an Township, Miaoli County (24° 23.753' N, 120° 55.520' E, 513m), one female (no. 1660–3) from *Arundo formosana* (Poaceae), 2 May 2016, J. R. Liao (NTU); Guanziling, Baihe Dist., Tainan County (23° 20.035' N, 120° 28.930' E, 320m), one female (no. 1823–2–1) from *Bambusa olhamii* (Poaceae), 10 Aug 2016, J. R. Liao (NTU); Guanziling, Baihe Dist., Tainan County (23° 20.035' N, 120° 28.930' E, 320m), one female (no. 1832–1) from *Phyllostachys makinoi* (Poaceae), 10 Aug 2016, J. R. Liao (NTU); Guanziling, Baihe Dist., Tainan County (23° 19.330' N, 120° 28.993' E, 456m), one female (no. 1840–1) from *Phyllostachys makinoi* (Poaceae), 10 Aug 2016, J. R. Liao (NTU).

Distribution

Asia: Taiwan (Tseng 1975).

Remarks

Tseng (1975) described this species based on a single female specimen collected from *Areca catechu* (Arecaceae) in Neipu, Chiayi (now Neipu, Zhuqi Township, Chiayi County). Dorsal reticulation did not mentioned in the original description of the species. The reticulation on dorsal shield is a common character among *Typhlodromus* (*Anthoseius*) species (Papadoulis *et al.* 2009; Döker *et al.* 2017). In addition, according to the original description, there are five teeth on the fixed digit of the chelicera as oppose to eight teeth on the fixed digit of the specimens examined in this study.

***Typhlodromus* (*Anthoseius*) *obesus* Tseng, 1983**

(Figures 32–40)

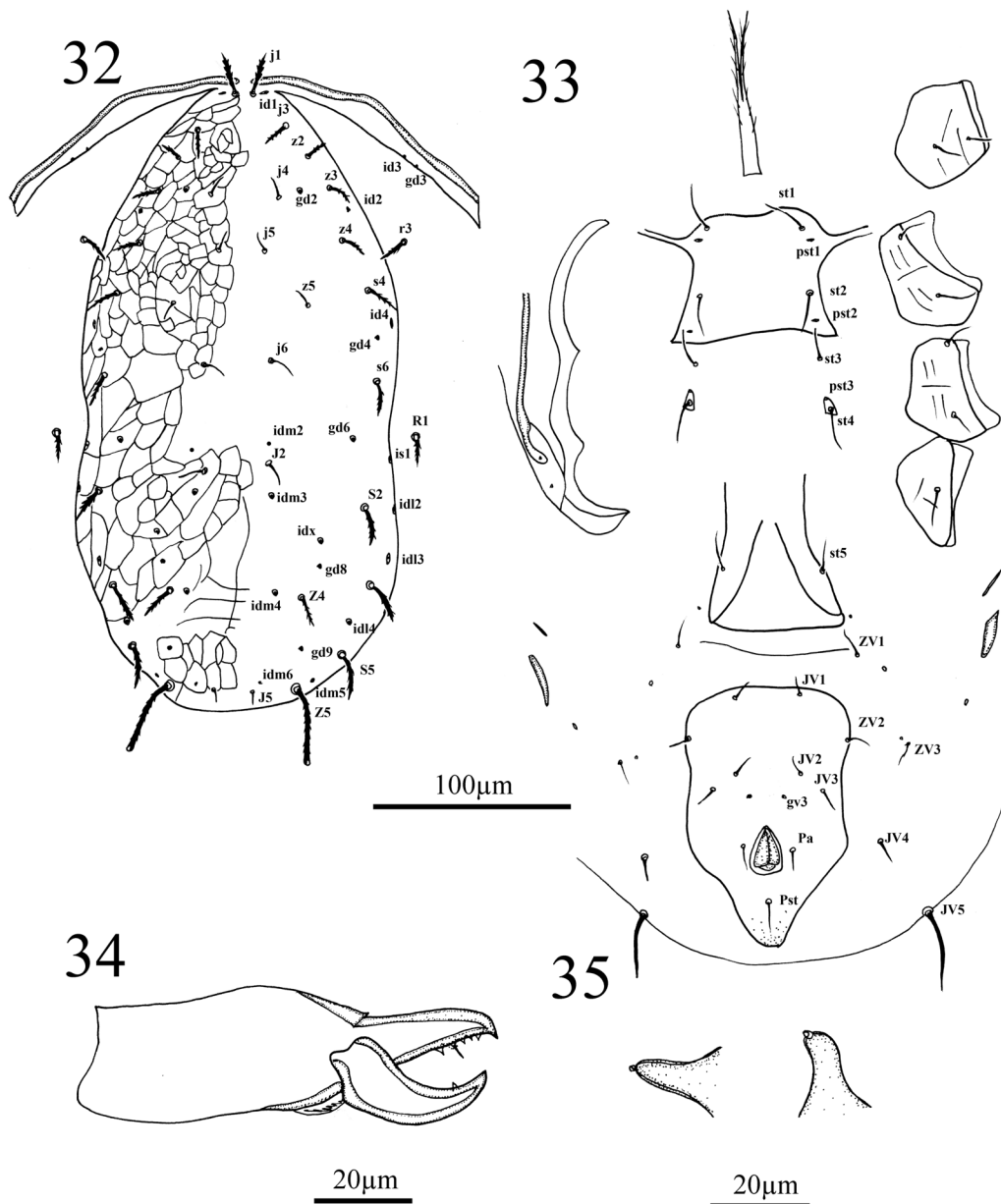
Typhlodromus (*Typhlodromus*) *obesus* Tseng, 1983: 64

Female (n=8)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 32). Dorsal shield nearly oval, slightly constricted at level of *R1*, strongly reticulated; 348 (328–364) long and 181 (171–197) wide at level of *j6*, 181 (162–198) wide at level of *S4*; five pairs of solenostomes on dorsal shield (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 11 pairs of lyrifissures (*id1*, *id2*, *id4*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *is1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 19 (15–22), *j3* 15 (14–18), *j4* 11 (9–14), *j5* 11 (9–13), *j6* 13 (9–16), *J2* 13 (11–16), *J5* 9 (7–12), *z2* 14 (12–18), *z3* 14 (12–16), *z4* 15 (13–18), *z5* 11 (8–13), *Z4* 20 (16–23), *Z5* 37 (34–40), *s4* 17 (15–19), *s6* 19 (14–23), *S2* 23 (21–25), *S4* 24 (23–28), *S5* 16 (14–19), *r3* 17 (13–18), *R1* 13 (11–15). Setae *j3*, *j4*, *j5*, *j6*, *J2*, *J5*, *z5* short, smooth, remaining setae thick and serrated, *Z5* shovel-shaped apically with expanded blade.

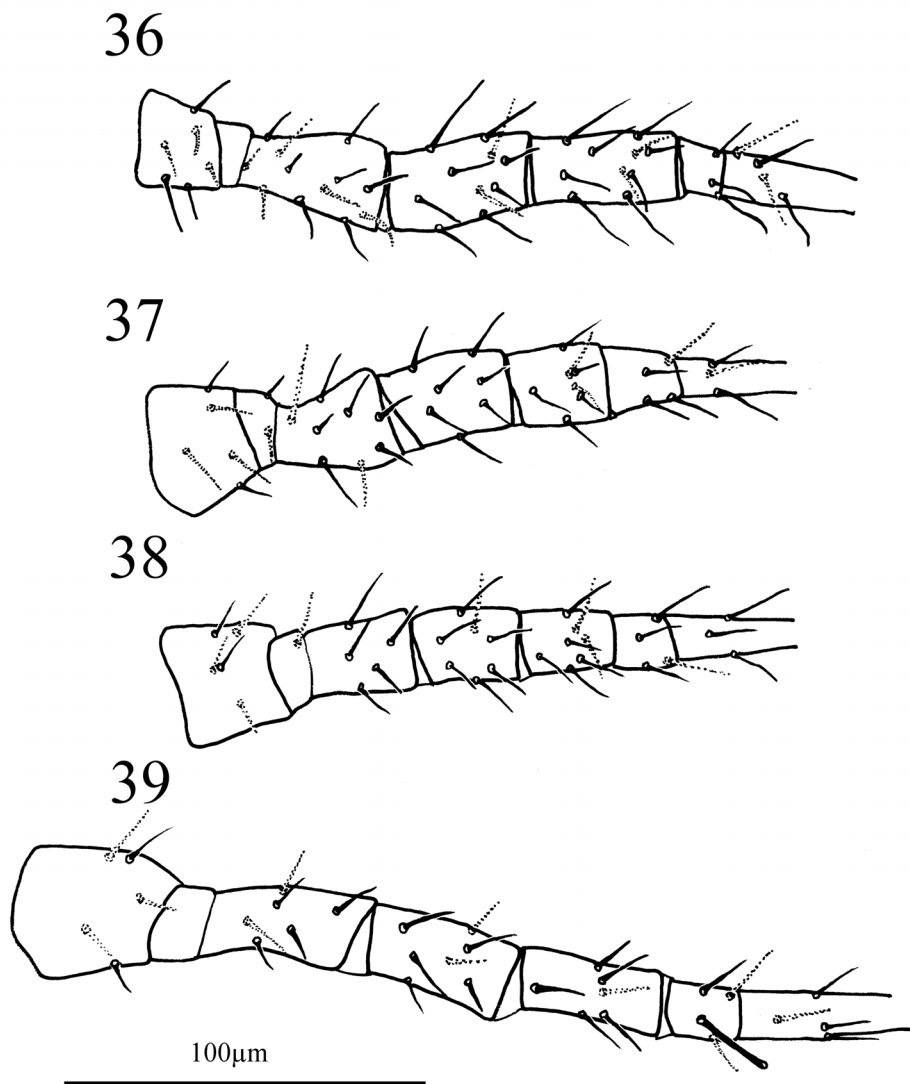
Peritreme (Figures 32, 33). Peritreme extending to level of *j1*; peritremal shield lightly sclerotized, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*id3*).



FIGURES 32–35. *Typhlodromus (Anthoseius) obesus* Tseng, 1983, female. 32. Dorsal shield; 33. Ventral idiosoma; 34. Chelicera; 35. Spermatheca.

Ventral idiosoma (Figure 33). Sternal shield smooth, posterior margin irregular, much wider than long, 54 (50–62) long, 78 (70–86) wide, with two pairs of setae *st1* 21 (18–25), *st2* 19 (17–20), and two pairs of lyrifissures (*pst1*, *pst2*), *st3* 17 (14–18) on soft cuticle. Exopodal shield at coxae II–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 16 (12–21), with one pair of lyrifissures (*pst3*). Genital shield smooth, truncate posteriorly, with one pair of genital setae *st5* 17 (10–21), 64 (58–69) wide at level of genital setae. Distances between *st1*–*st1* 47 (45–50), *st2*–*st2* 56 (53–58), *st3*–*st3* 67 (63–73), *st1*–*st3* 69 (66–76), *st5*–*st5* 54 (46–60). Ventrianal shield

pentagonal, smooth, much longer than wide, with slightly waist at *JV2* level, 125 (115–131) long, 92 (79–96) wide at level of *ZV2*, 82 (79–87) wide at level of anus; with four pairs of pre-anal setae, *JV1* 10 (9–11), *JV2* 8 (7–10), *JV3* 8 (7–9), *ZV2* 9 (6–11), solenostomes *gv3* rounded; *Pa* 11 (8–15), *Pst* 13 (9–16) on shield. Setae *JV4* 11 (9–13), *JV5* 35 (31–39), *ZV1* 12 (8–15), *ZV3* 8 (7–10) on interscutal membrane. All setae smooth, sharp pointed. Two pairs of metapodal plates: 27 (24–29) long, 6 (5–8) wide; 13 (12–14) long, 3 (2–3) wide.

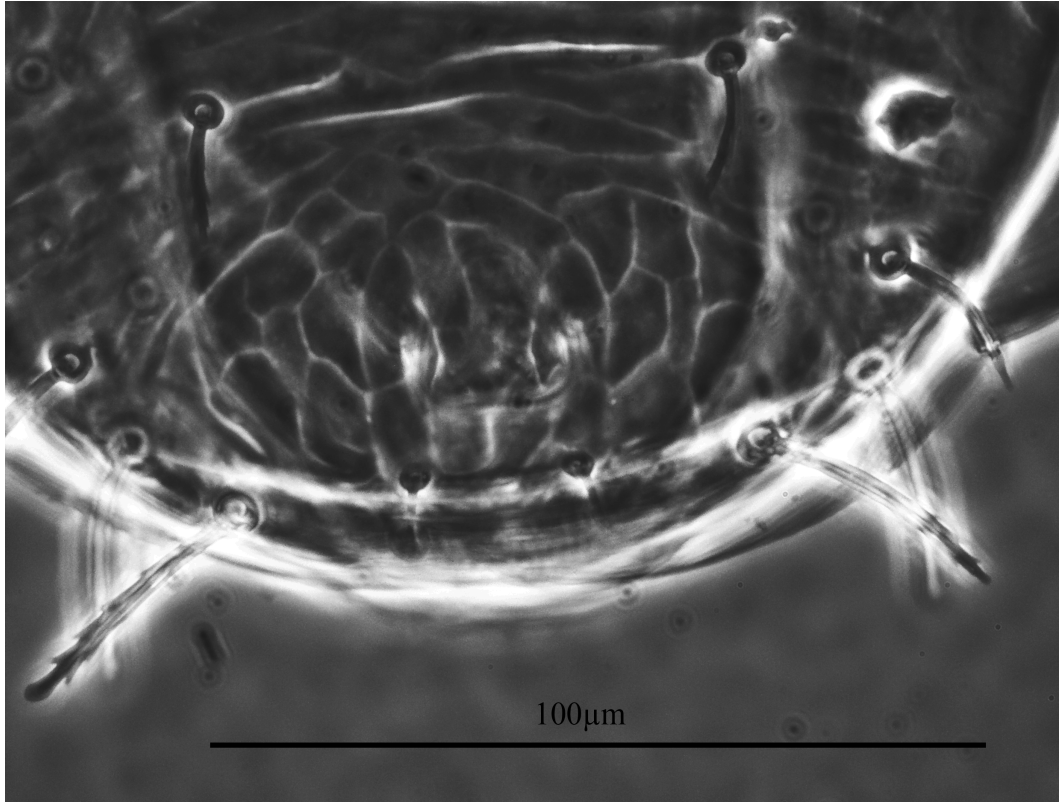


FIGURES 36–39. *Typhlodromus (Anthoseius) obesus* Tseng, 1983, female, legs. 36. Leg I dorsal view; 37. Leg II dorsal view; 38. Leg III dorsal view; 39. Leg IV dorsal view.

Spermatheca (Figure 35). Calyx bell-shaped, flaring distally, 19 (16–26) long, 14 (12–17) wide; small nodular atrium attached to the calyx without neck, minor and major ducts invisible.

Chelicera (Figure 34). Movable digit 29 (24–32) long, with one tooth; fixed digit 27 (24–28) long, with four teeth, with *pilus dentilis*.

Legs (Figures 36–39). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/1-2/2-2, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1/1-1. Macrosetae: *St* IV (*d*) 24 (22–26). Macrosetae apically shovel-shaped with expanded blade.



FIGURES 40. *Typhlodromus (Anthoseius) obesus* Tseng, 1983, seta Z5.

Specimens examined

Qiaotou Sugar Factory, Qiaotou Dist., Kaohsiung City (22°45'27.68"N, 120°18'50.8"E, 14m), one female (no. 9–13) from leaves on *Tabebuia chrysantha* (Bignoniaceae), 7 Aug 2009, H. T. Fang & Y. H. Chiang (NTU). Lintao Park, Penghu County, five females from *Chloris barbata* (Gramineae), 22 Apr 1989, C. C. Ho (NMNS); Liuqiu Isle, Liuqiu Township, Pingtung County, two females from unknown plant, 25 July 1989, C. C. Ho (TARL); Hsiao Liouciou Island, Liuqiu Township, Pingtung County, one females from *Premna serratifolia* (Verbenaceae), 25 July 1989, C. C. Ho (NMNS); Hsiao Liouciou Island, Liuqiu Township, Pingtung County, two females from unknown plant, 25 July 1989, C. C. Ho (TARL); Guan'ao, Jinsha Township, Kinmen County, one female (TAL091C280) from *Sida rhombifolia* (Malvaceae), 26 Oct 2002, C. C. Ho (TARL); Guan'ao, Jinsha Township, Kinmen County, one female (TAL091C283) from soil of *Sida rhombifolia* (Malvaceae), 26 Oct 2002, C. C. Ho (TARL); Sec. 2, Tianxiang St., Zhunan Township, Miaoli County (24° 42' 418' N, 120° 52.218' E, 16m), two females (no. 901–1, 2) from *Bidens pilosa* (Asteraceae), 13 Oct 2010, J. R. Liao (NMNS, NCHU).

Distribution

Asia: Taiwan (Tseng 1983).

Remarks

Tseng (1983) reported that this species has one tooth on movable digit and two teeth on fixed digit of the chelicera, and the present study indicated to presence of one tooth on movable digit but four teeth on fixed digit of the chelicera. Also, the original description of the species reported on the chaetotaxy of genu I-IV as 1-2/1-2/2-2, 2-2/0-2/0-1, 1-2/0-2/1-2, 1-2/1-2/1-1 but we found one less seta on each of the genua III (1-2/1-2/0-1) and IV (1-2/1-2/0-1). In addition, Tseng (1983) described the seta Z5 thick and serrated with sharp end, but we found the end of Z5 is shovel-shape with expanded blade. The circumstance is probably causing by different views of the setae (Figure 40).

Typhlodromus (Anthoseius) lanyuensis Tseng, 1975

(Figures 41–48)

Typhlodromus (Typhlodromus) lanyuensis Tseng, 1975: 54.

Amblydromella lanyuensis.—Moraes *et al.*, 1986: 166.

Amblydromella (Amblydromella) lanyuensis.—Denmark & Welbourn, 2002: 307.

Female (n=4)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 41). Dorsal shield nearly oval, constricted at level of *R1*, laterally reticulated; 326 (313–345) long and 213 (202–230) wide at level of *j6*, 211 (200–218) wide at level of *S4*; five pairs of solenostomes on dorsal shield (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 13 pairs of lyrifissures (*idl1*, *idl2*, *idl4*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *isl1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 21 (19–23), *j3* 29 (27–32), *j4* 9 (8–9), *j5* 8 (7–10), *j6* 11 (10–12), *J2* 12 (11–13), *J5* 5 (5–6), *z2* 6 (6–8), *z3* 22 (20–24), *z4* 11 (9–14), *z5* 8 (7–10), *Z4* 36 (31–41), *Z5* 64 (62–67), *s4* 27 (26–29), *s6* 33 (31–36), *S2* 31 (28–34), *S4* 21 (19–24), *S5* 8 (6–11), *r3* 13 (10–15), *R1* 9 (7–11). All setae smooth, sharp end, except for *Z5* slightly serrated.

Peritreme (Figures 41, 42). Peritreme extending to level of *j1*; peritremal shield lightly sclerotized, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*idl3*).

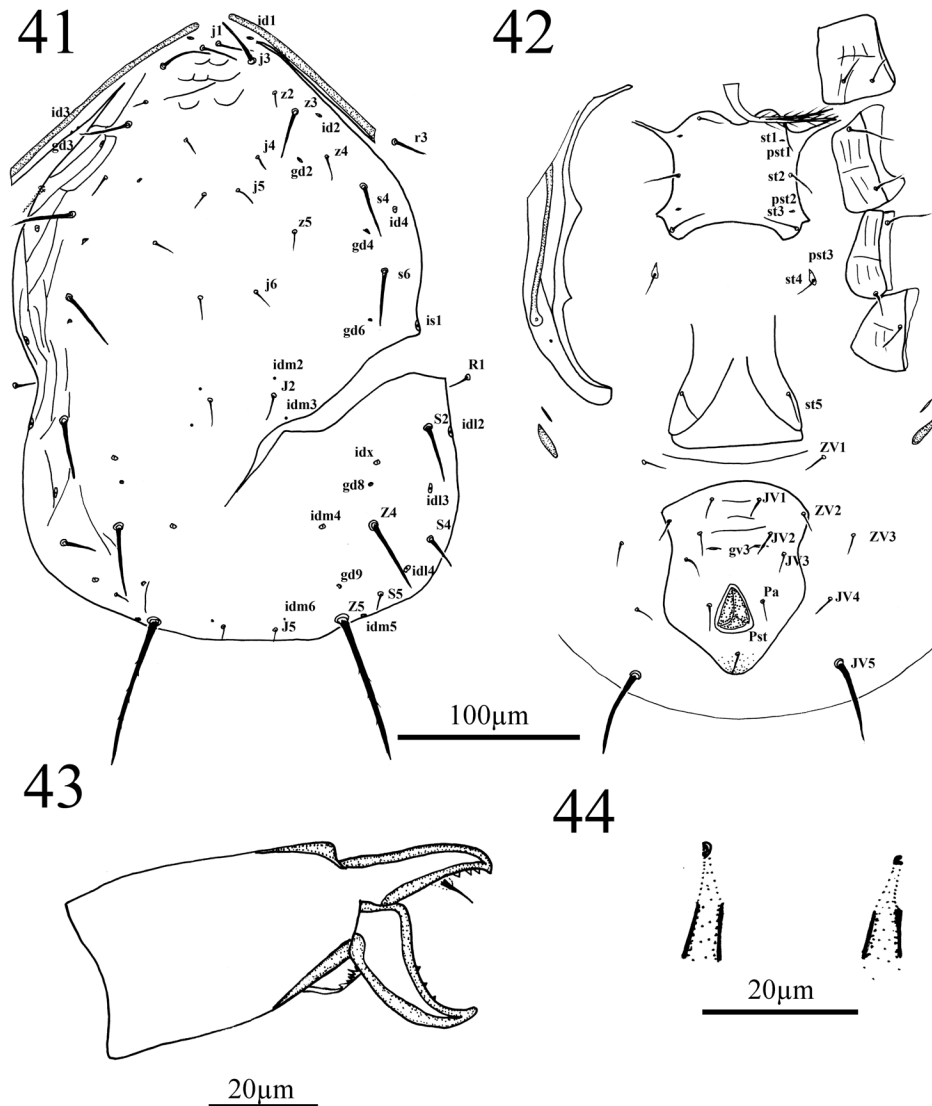
Ventral idiosoma (Figure 42). Sternal shield smooth, posterior margin concave, much wider than long, 64 (61–65) long, 79 (78–81) wide, with three pairs of setae *st1* 15 (12–19), *st2* 14 (13–15), *st3* 15 (14–15), and two pairs of lyrifissures (*pst1*, *pst2*). Exopodal shield at coxae I–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 11 (9–13), with one pair of lyrifissures (*pst3*). Genital shield smooth, truncate posteriorly, with one pair of genital setae *st5* 14 (13–16), 67 (64–69) wide at level of genital setae. Distances between *st1*–*st1* 50 (47–52), *st2*–*st2* 62 (61–64), *st3*–*st3* 65 (63–67), *st1*–*st3* 61 (58–64), *st5*–*st5* 59 (58–61). Ventrianal shield pentagonal with waist at *JV2* level, smooth, 94 (89–97) long, 76 (73–78) wide at level of *ZV2*, 73 (71–74) wide at level of anus; with four pairs of pre-anal setae, *JV1* 9 (6–10), *JV2* 8 (8–10), *JV3* 8 (7–9), *ZV2* 8 (7–10), solenostomes *gv3* crescentic; *Pa* 10 (8–11), *Pst* 11 (9–13) on shield. Setae *JV4* 7 (7–8), *JV5* 39 (38–41), *ZV1* 8 (7–9), *ZV3* 8 (7–10) on interscutal membrane. All setae smooth, sharp pointed. Two pairs of metapodal plates: 18 (17–22) long, 5 (5–5) wide; 10 (8–12) long, 2 (1–2) wide.

Spermatheca (Figure 44). Calyx tubular, flaring distally, with apical half thick, 14 (12–16) long, 5 (4–7) wide; atrium connected to the calyx, minor and major ducts invisible.

Chelicera (Figure 43). Movable digit 26 (25–28) long, with three teeth; fixed digit 25 (23–26) long, anterior half with three teeth, with *pilus dentilis*.

Legs (Figures 45–48). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/1-2, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* III (*ad2*) 24 (21–28), *Sti* III (*ad*) 18 (17–21), *St* III (*d*) 14

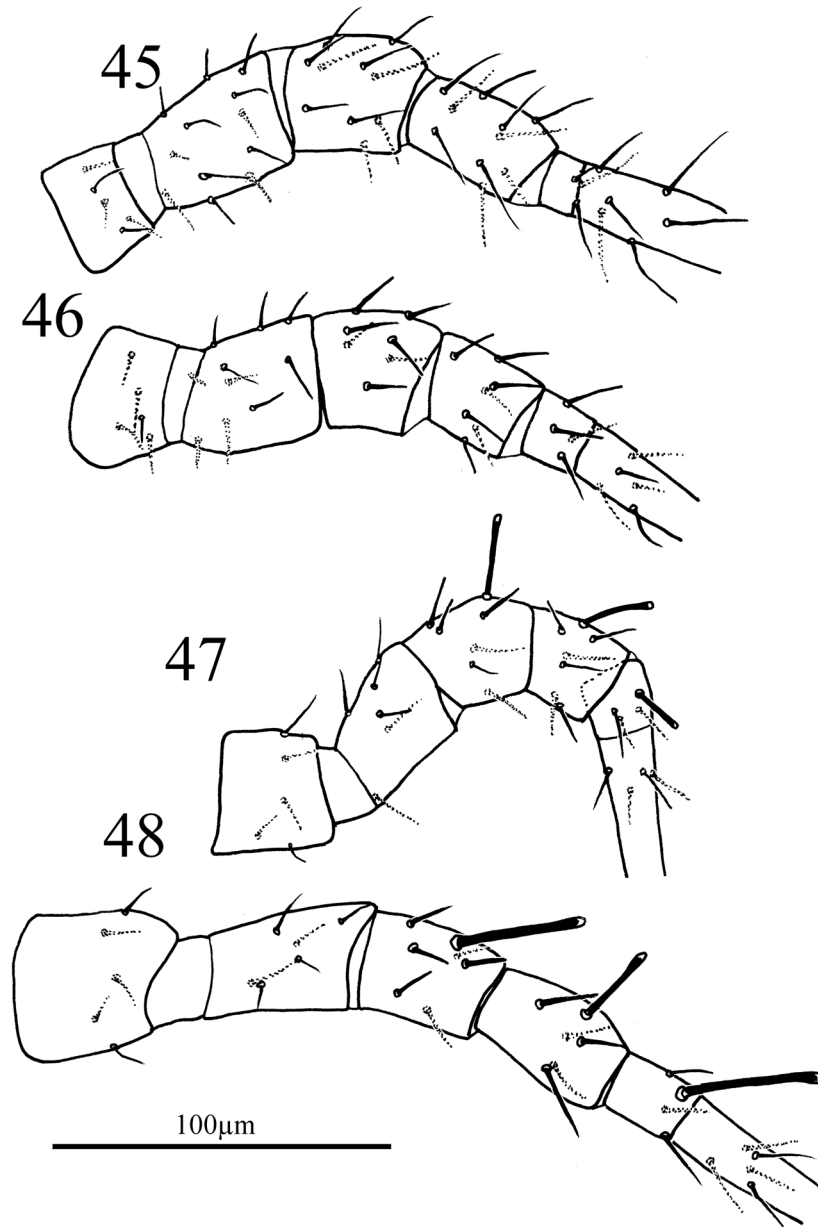
(12–15), *Sge* IV (*ad2*) 40 (37–43), *Sti* IV (*ad*) 24 (21–27), *St* IV (*d*) 41 (40–41). Macrosetae shovel-shaped with expanded blade.



146 m), one female (no. 453–11) from *Leucosyke quadrinervia* (Urticaceae), 4 Apr 2010, J. R. Liao & C. C. Ho (NMNS).

Distribution

Asia: Taiwan [(Lanyu Island (Tseng 1975)).



FIGURES 45–48. *Typhlodromus (Anthoseius) lanyuensis* Tseng, 1975, female, legs. 45. Leg I posterior view; 46. Leg II posterior view; 47. Leg III posterior view; 48. Leg IV posterior view.

Remarks

This species was also described by Tseng (1975) from Lanyu Island based on the material collected from weeds. We also collected current material from the type locality. These specimens are morphologically similar to the original description of the species, except for a few differences. According to the original description of the species there is only one tooth on each cheliceral digits, but we found three teeth on each cheliceral digits. Additionally, macrosetae on leg IV are slightly longer than those of the original description (*Sge* IV 30 vs. 39, *Sti* IV 10 vs. 25, and *St* IV 32.5 vs. 41).

Typhlodromus (Anthoseius) gracilentus Tseng, 1975

(Figures 49–56)

Typhlodromus (Typhlodromus) gracilentus Tseng, 1975: 61.

Amblydromella gracilentus.—Moraes *et al.*, 1986: 162.

Amblydromella (Amblydromella) gracilentus.—Denmark & Welbourn, 2002: 307.

Typhlodromus (Anthoseius) gracilentus.—Chant & McMurtry, 2007: 152.

Female (n=2)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 49). Dorsal shield nearly oval, constricted at level of *R1*, well sclerotized, strongly reticulated, 314 (309–318) long and 188 (180–195) wide at level of *j6*, 180 (167–194) wide at level of *S4*; five pairs of solenostomes on dorsal shield (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 12 pairs of lyrifissures (*idl1*, *idl2*, *idl4*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *isl1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 12 (11–13), *j3* 16 (15–17), *j4* 11 (10–12), *j5* 12 (11–14), *j6* 13 (11–14), *J2* 17 (14–20), *J5* 5 (5–6), *z2* 14 (12–17), *z3* 14 (10–17), *z4* 13 (12–14), *z5* 12 (11–13), *Z4* 23 (22–24), *Z5* 46 (43–50), *s4* 13 (11–15), *s6* 18 (15–22), *S2* 18 (14–22), *S4* 20 (18–23), *S5* 17 (17–17), *r3* 14 (14–15), *R1* 14 (12–15). All setae smooth, except seta *Z5* serrated, shovel-shaped with expanded blade.

Peritreme (Figures 49, 50). Peritreme extending beyond *j1* and curved downward, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*idl3*)

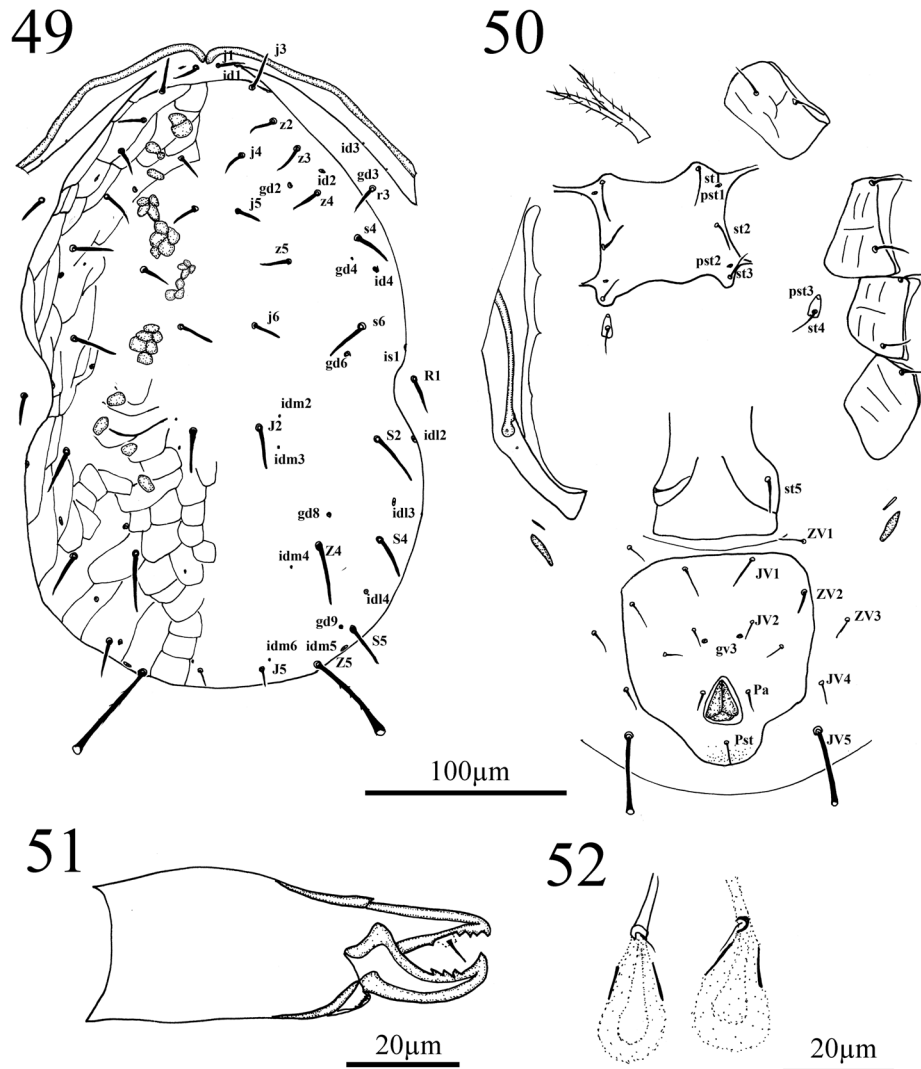
Ventral idiosoma (Figure 50). Sternal shield smooth, posterior margin irregular, much wider than long, 59 (55–62) long, 78 (77–80) wide, with three pairs of setae *st1* 17 (15–18), *st2* 13 (13–13), *st3* 15 (12–18), and two pairs of lyrifissures (*pst1*, *pst2*). Exopodal shield at coxae II–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 13 (10–15). Genital shield smooth, much narrower than ventrianal shield, with one pair of genital setae *st5* 11 (10–13), 61 (59–63) wide at level of genital setae. Distances between *st1*–*st1* 49 (48–50), *st2*–*st2* 57 (55–58), *st3*–*st3* 64 (61–68), *st1*–*st3* 56 (54–58), *st5*–*st5* 60 (60–60). Ventrianal shield pentagonal, 97 (94–99) long, 93 (91–96) wide at level of *ZV2*, 79 wide at level of anus; with four pairs of pre-anal setae, *JV1* 12 (11–13), *JV2* 8, *JV3* 8 (7–8), *ZV2* 8 (6–10), solenostomes *gv3* rounded; *Pa* 8, *Pst* 9 (8–10) on shield. Setae *JV4* 12 (9–15), *JV5* 32 (29–35), *ZV1* 8 (8–9), *ZV3* 7 on interscutal membrane. All setae smooth, sharp pointed, *JV5* thick, shovel-shaped with expanded blade. Two pairs of metapodal plates: 15 (12–17) long, 5 (4–6) wide; 8 (6–9) long, 2 (2–3) wide.

Spermatheca (Figure 52). Calyx cup-shaped, 10 long, 9 (8–10) wide; with apical half thick, other membrane, atrium nodular, connected to the calyx without neck, minor and major ducts visible.

Chelicera (Figure 51). Movable digit 23 (22–25) long, with three teeth; fixed digit 22 (21–23) long, with four teeth, and *pilus dentilis*.

Legs (Figures 53–56). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-1/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/

0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae, *Sge* IV (*ad2*) 10, *Sti* IV (*ad*) 11, *St* IV (*d*) 23 (22–24). Macrosetae shovel-shaped with expanded blade.



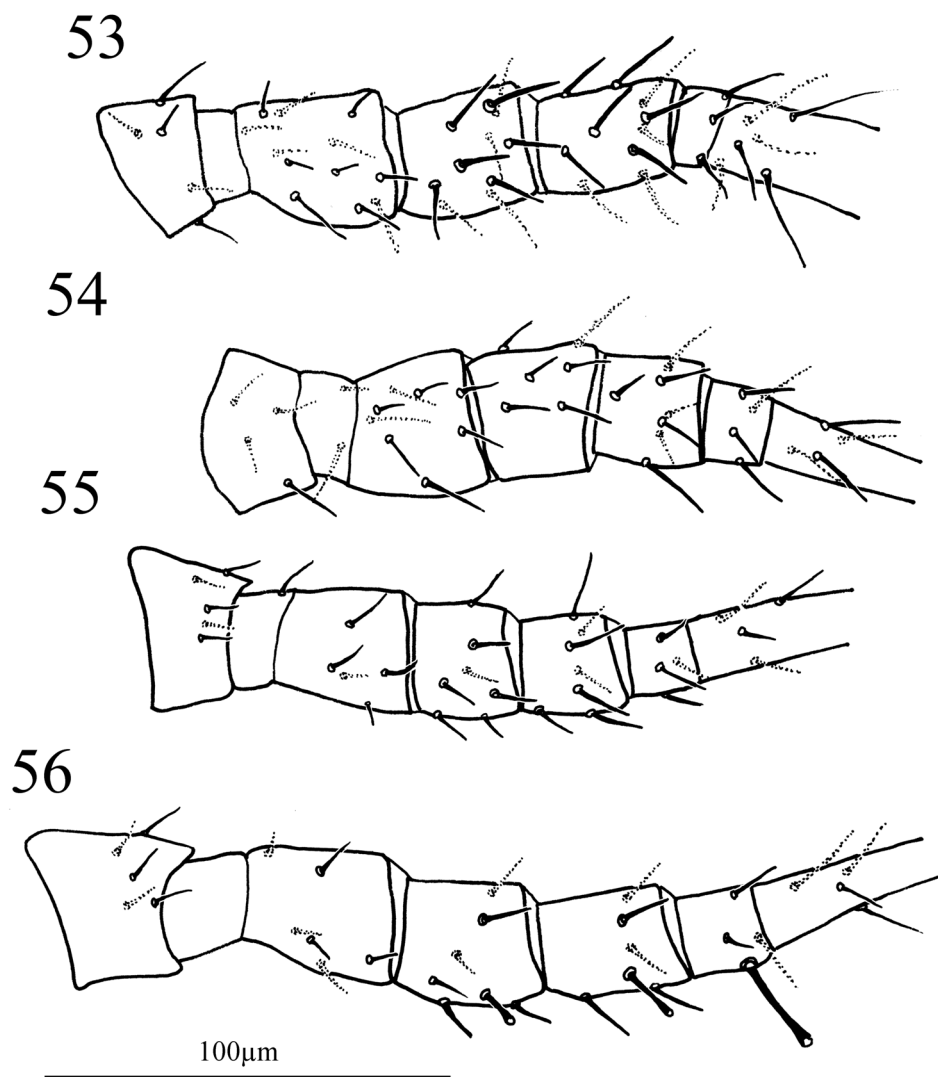
FIGURES 49–52. *Typhlodromus (Anthoseius) gracilentus* Tseng, 1975, female. 49. Dorsal shield; 50. Ventral idiosoma; 51. Chelicera; 52. Spermatheca.

Specimens examined

Mt. Nanren, Manzhou Township, Pingtung County, one female (88-Ty-0007) from *Lasianthus wallichii* (Rubiaceae), 26 Nov 1988, C. C. Ho (TARL); Huisun Timberland, Ren'ai Township, Nantou County, one female (HAL102B140) from bamboo (Poaceae), 26 Oct 2013, C. C. Ho (TARL).

Distribution

Asia: Taiwan (Tseng 1983).



FIGURES 53–56. *Typhlodromus (Anthoseius) gracilentus* Tseng, 1975, female, legs. 53. Leg I anterior view; 54. Leg II dorsal view; 55. Leg III anterior view; 56. Leg IV anterior view.

Remarks

Tseng (1975) described this species from *Grevillea robusta* (Proteaceae) in Yuch Shih Chieh, Kaohsiung (now Yueshijie, Tianliao Dist., Kaohsiung City). The type locality is a unique geographic area called “badlands”, which is filled with a desolate, barren beauty. The species is characterized by the wider and pentagonal ventrianal shield as well as relative length of leg IV macrosetae: $St\ IV > Sti\ IV > Sge\ IV$. Tseng (1975) described this species dorsal shield rugose, but did not draw it in the illustration. The present study found this species is strongly reticulated, but not rugose on dorsal shield. In addition, according to the original description of this species, there are one tooth on the movable digit and four teeth on the fixed digit of the chelicera, but our examination revealed that there are three teeth on the movable digit and four teeth on the fixed digit.

***Typhlodromus (Anthoseius) chinensis* Ehara & Lee, 1971**

(Figures 57–64)

Typhlodromus (Anthoseius) chinensis Ehara & Lee, 1971: 62

Amblydromella chinensis.—Moraes *et al.*, 1986: 159.

Typhlodromus chinensis.—Wu *et al.*, 1997c: 198.

Amblydromella (Amblydromella) chinensis.—Denmark & Welbourn, 2002: 307.

Female (n=6)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 57). Dorsal shield nearly oval, constricted at level of *R1*, strongly reticulated; 305 (292–319) long and 189 (179–207) wide at level of *j6*, 188 (179–197) wide at level of *S4*; six pairs of solenostomes on dorsal shield (*gd1*, *gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 13 pairs of lyrifissures (*id1*, *id2*, *id4*, *id6*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *is1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 17 (14–21), *j3* 19 (17–23), *j4* 12 (9–15), *j5* 12 (6–14), *j6* 57 (12–18), *J2* 18 (14–20), *J5* 6 (3–7), *z2* 11 (9–15), *z3* 14 (11–18), *z4* 15 (12–19), *z5* 12 (10–16), *Z4* 28 (22–32), *Z5* 50 (43–55), *s4* 18 (15–22), *s6* 19 (17–21), *S2* 21 (18–25) [20], *S4* 18 (15–21), *S5* 16 (12–19), *r3* 15 (14–17), *R1* 15 (11–19). All setae smooth, sharp end, except seta *Z5* serrated.

Peritreme (Figures 57–58). Peritreme extending to level of *j1*; peritremal shield lightly sclerotized, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*id3*).

Ventral idiosoma (Figure 58). Sternal shield smooth, posterior margin concave, wider than long, 56 (41–63) long, 76 (59–85) wide, with three pairs of setae *st1* 17 (15–24), *st2* 17 (12–21), *st3* 13 (12–14), and two pairs of lyrifissures (*pst1*, *pst2*). Exopodal shield at coxae II–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 13 (10–17), with one pair of lyrifissures (*pst3*). Genital shield smooth, with one pair of genital setae *st5* 14 (11–18), 62 (45–69) wide at level of genital setae. Distances between *st1*–*st1* 49 (41–54), *st2*–*st2* 59 (44–67), *st3*–*st3* 64 (52–70), *st1*–*st3* 56 (47–62), *st5*–*st5* 59 (56–65). Ventrianal shield pentagonal, with waist at seta *JV3* level, reticulated, 91 (70–101) long, 73 (65–76) wide at level of *ZV2*, 65 (61–71) [61] wide at level of anus; with four pairs of pre-anal setae, *JV1* 9 (7–11), *JV2* 9 (7–12), *JV3* 8 (5–9), *ZV2* 10 (9–14), solenostomes *gv3* crescentic; *Pa* 9 (8–11), *Pst* 9 (7–14) [8] on shield. Setae *JV4* 9 (4–14), *JV5* 32 (28–38) [28], *ZV1* 9 (7–13) [12], *ZV3* 8 (6–9) [6] on interscutal membrane. All setae smooth. Two pairs of metapodal plates: 18 (15–21) long, 4 (3–5) wide; 7 (5–9) long, 2 (2–3) wide.

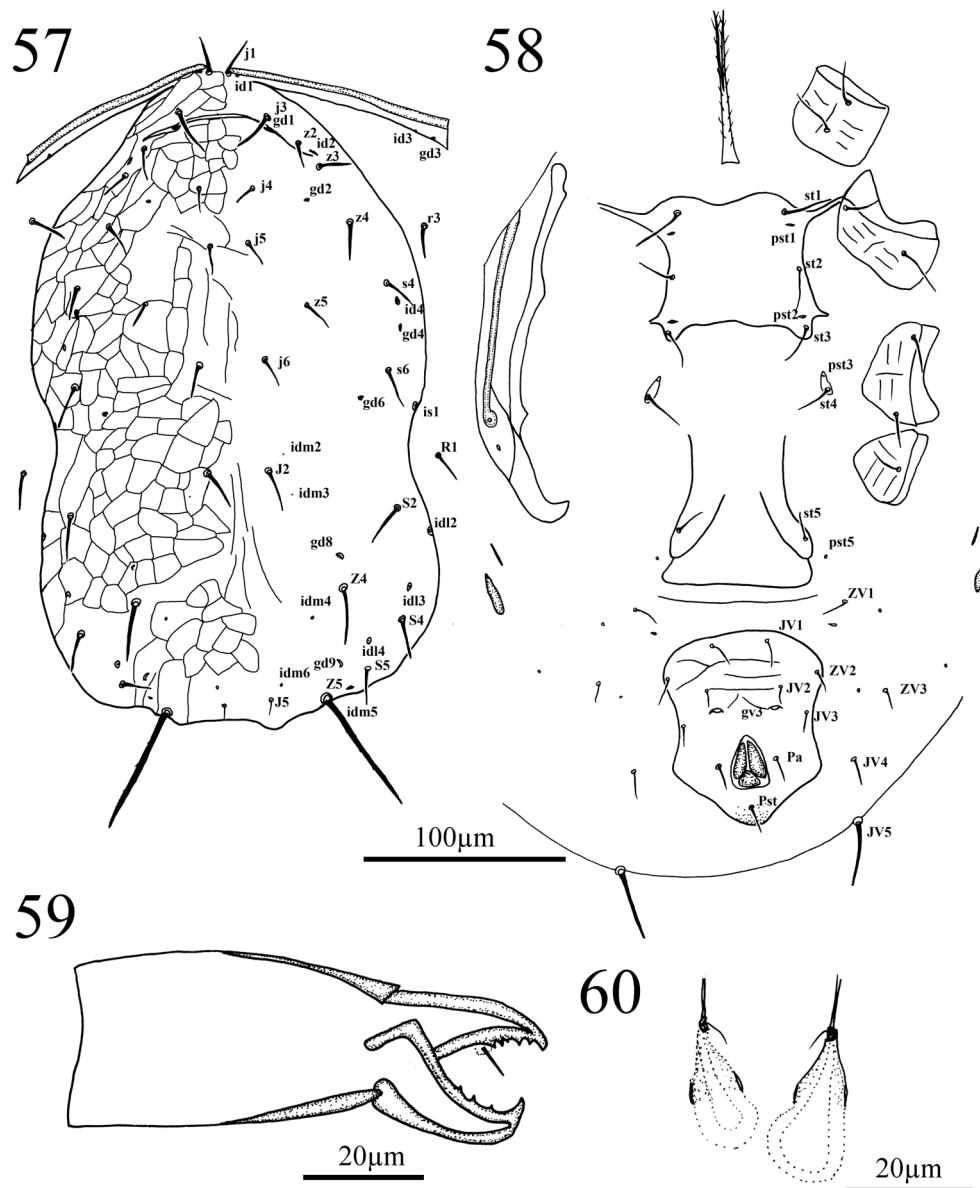
Spermatheca (Figure 60). Calyx cup-shaped, 9 (8–10) long, 6 (4–8) wide; with apical half thick, other membrane, atrium nodular, minor and major ducts visible.

Chelicera (Figure 59). Movable digit 22 (17–25) long, with three teeth; fixed digit 22 (17–24) long, with five teeth, with *pilus dentilis*.

Legs (Figures 61–64). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* III (*ad2*) 21 (14–25), *Sti* III (*ad*) 18 (16–19), *Sge* IV (*ad2*) 32 (25–36), *Sti* IV (*ad*) 19 (14–22), *St* IV (*d*) 43 (39–49). Macrosetae shovel-shaped with expanded blade.

Specimens examined

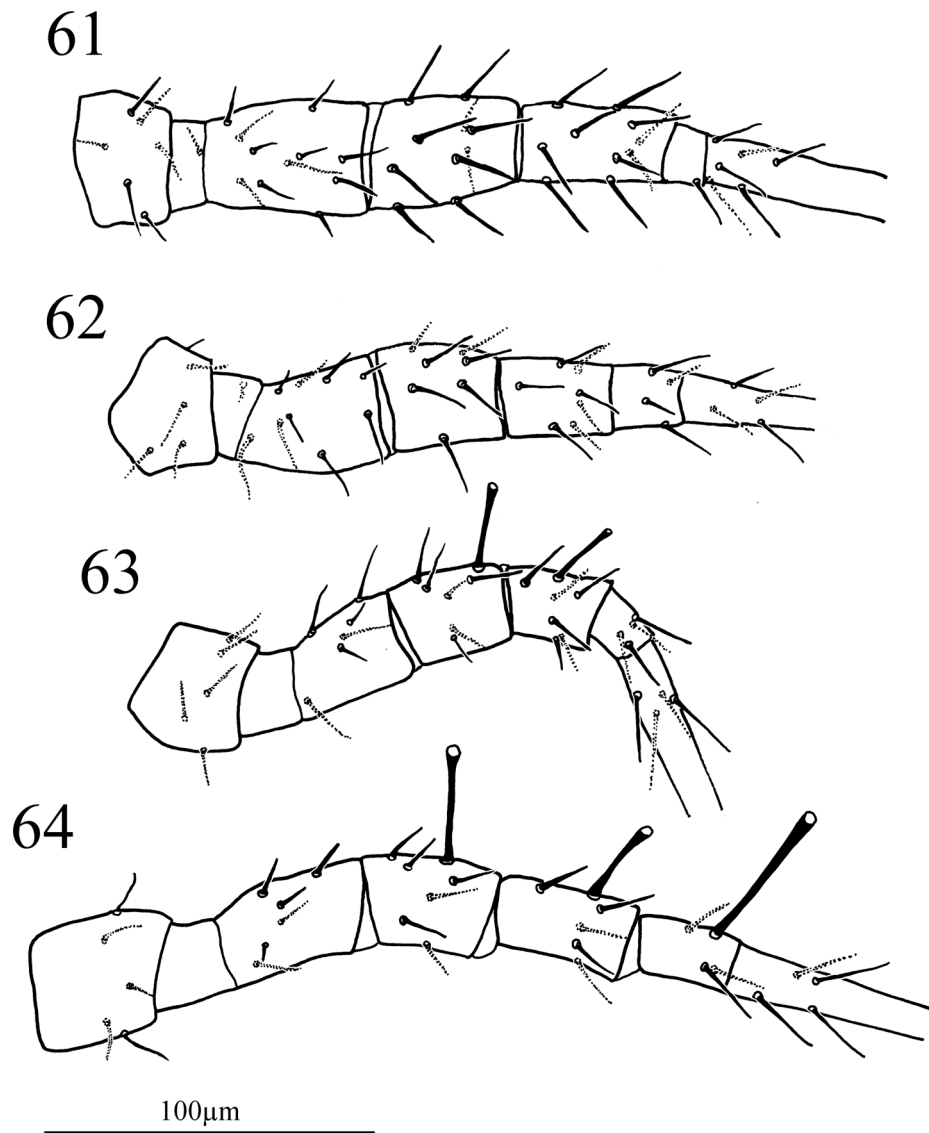
CHINA. Shek O, Hong Kong, holotype female (Ac-13075) from *Bauhinia* sp. (Fabaceae), 18 Oct 1970, S. Ehara (NSMT); Shek O, Hong Kong, two paratype females (ZIHU3554) from *Bauhinia* sp. (Fabaceae), 18 Oct 1970, S. Ehara (HUM).



FIGURES 57–60. *Typhlodromus (Anthoseius) chinensis* Ehara & Lee, 1971, female. 57. Dorsal shield, 58. Ventral idiosoma, 59. Chelicera, 60. Spermatheca.

TAIWAN. Dalu forest road, Wufeng Township, Hsinchu County (24° 32.460' N, 121° 06.410' E, 1228m), one female (no. 775–3, 4) from *Callicarpa formosana* (Lamiaceae), 13 Aug 2010, C. T. Chen & J. R. Liao (NTU); Dalu forest road, Wufeng Township, Hsinchu County (24° 32.460' N, 121° 06.410' E, 1228m), one female (no. 777–3, 4) from *Morus* sp. (Moraceae), 13 Aug 2010, C. T. Chen & J. R. Liao (NTU); Lijia forest road, Beinan Township, Taitung County (22° 48.306' N, 121° 01.906' E, 989m), one female (no. 1073–4) from *Callicarpa formosana* (Lamiaceae), 23 Jan 2011, J. R. Liao & J. F. Hsieh (NTU); Yulao, Jianshi Township, Hsinchu County (24° 39.920' N, 121° 16.105' E, 1199m), four females (no. 1263–2, 8, 10, 11) from *Rubus* sp. (Rosaceae), 17 Apr 2014, J. R. Liao (NTU); Yulao, Jianshi Township, Hsinchu County (24° 40.122' N, 121° 16.512' E, 1185m),

one female (no. 1591–6) from *Debregeasia orientalis* (Urticaceae), 31 Dec 2015, J. R. Liao (NTU); Yulao, Jianshi Township, Hsinchu County (24° 39.932' N, 121° 16.112' E, 1216m), three females (no. 1621–4, 10, 12) from *Debregeasia orientalis* (Urticaceae), 4 Mar 2016, S. P. Kao (NTU); Longtan Dist., Taoyuan City (24° 52.113' N, 121° 09.692' E, 292m), one female (no. 1694–3) from *Morus alba* (Moraceae), 11 May 2016, J. R. Liao (NTU).



FIGURES 61–64. *Typhlodromus (Anthoseius) chinensis* Ehara & Lee, 1971, female, legs. 61. Leg I dorsal view, 62. Leg II posterodorsal view, 63. Leg III posterior view, 64. Leg IV posterior view.

Distribution

Asia: China [Hong Kong (Ehara & Lee 1971)], South Korea (Ryu 1993), Taiwan (present study).

Remarks

Typhlodromus (Anthoseius) chinensis Ehara & Lee is reported for the first time for Taiwanese fauna. Ehara & Lee (1971) described this species from *Bauhinia* sp. and grass in Hong Kong. The present specimens mostly collected in mountainous area (altitude about 1000m). All morphological characters and measurements are similar to those of the original description of the species.

Typhlodromus (Anthoseius) serrulatus Ehara, 1972

(Figures 65–79)

Typhlodromus (Anthoseius) serrulatus Ehara, 1972: 142.

Typhlodromus (Typhlodromus) serrulatus.—Chang & Tseng, 1978: 342.

Amblydromella serrulata.—Moraes *et al.*, 1986: 175.

Amblydromella (Amblydromella) serrulata.—Dennmark & Welbourn, 2002: 307.

Female (n=9)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 65). Dorsal shield nearly oval, constricted at level of *R1*, strongly reticulated; 301 (287–311) long and 173 (163–196) wide at level of *j6*, 175 (169–185) wide at level of *S4*; four pairs of solenostomes on dorsal shield (*gd4*, *gd6*, *gd8*, *gd9*), 14 pairs of lyrifissures (*idl1*, *idl2*, *idl4*, *id6*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *is1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 13 (10–16), *j3* 16 (14–18), *j4* 12 (9–15), *j5* 12 (9–14), *j6* 14 (11–17), *J2* 16 (13–18), *J5* 8 (4–9), *z2* 12 (10–14), *z3* 14 (12–18), *z4* 15 (10–17), *z5* 13 (11–15), *Z4* 23 (20–26), *Z5* 43 (40–45), *s4* 16 (15–19), *s6* 18 (14–23), *S2* 19 (16–25), *S4* 20 (17–24), *S5* 12 (9–13), *r3* 15 (11–17), *R1* 14 (12–15). All setae smooth, sharp end, except *Z4* serrated, sharp end and *Z5* serrated, shovel-shaped with expanded blade.

Peritreme (Figures 65, 66). Peritreme extending beyond level of *j1* and curved downward; peritremal shield lightly sclerotized, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*id3*).

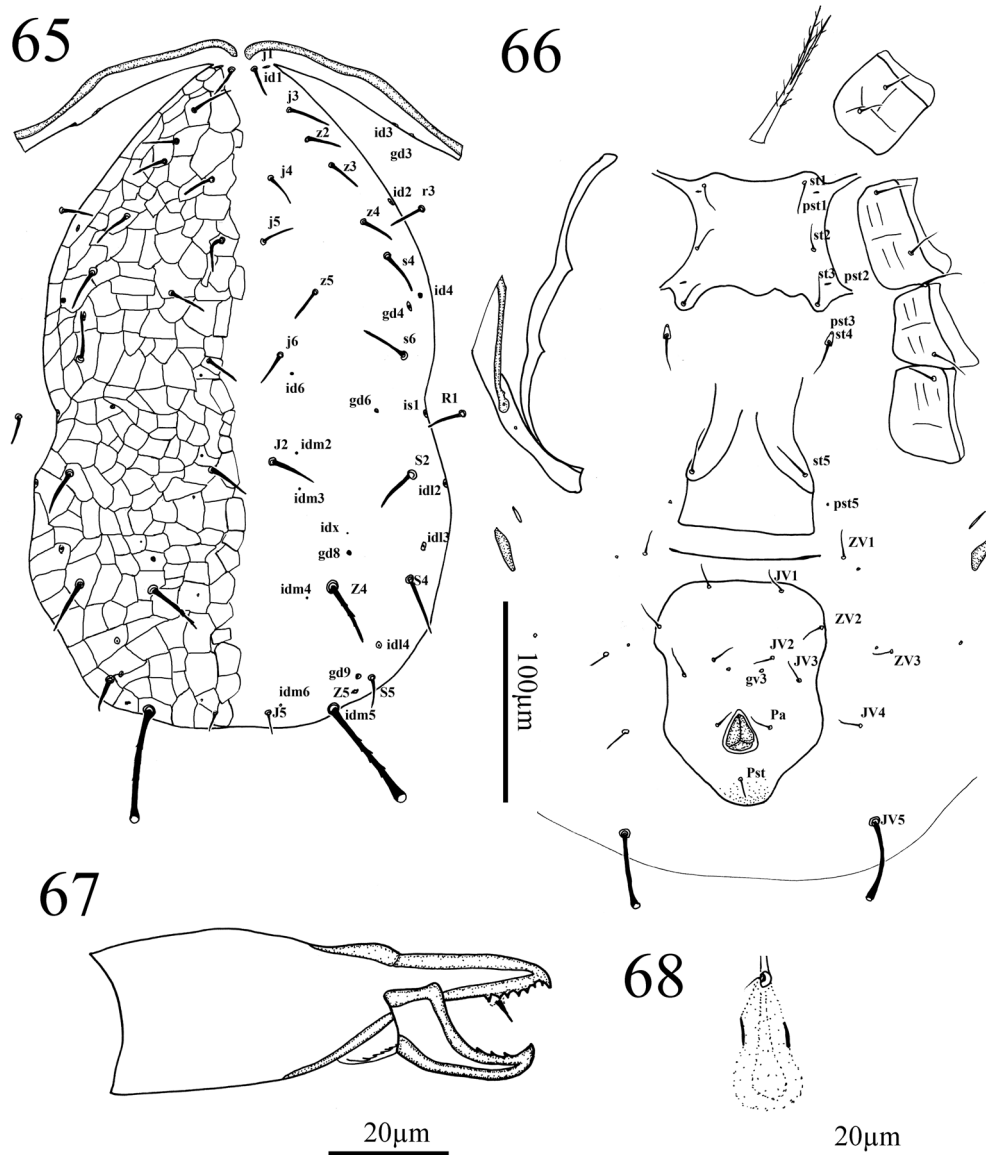
Ventral idiosoma (Figure 66). Sternal shield smooth, posterior margin irregular, wider than long, 60 (52–66) long, 74 (67–77) wide, with three pairs of setae *st1* 15 (12–19), *st2* 13 (10–17), *st3* 14 (10–19), and two pairs of lyrifissures (*pst1*, *pst2*). Exopodal shield at coxae II–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 13 (10–17), with one pair of lyrifissures (*pst3*). Genital shield smooth, with one pair of genital setae *st5* 17 (12–23), 60 (54–63) wide at level of genital setae. Distances between *st1*–*st1* 45 (41–55), *st2*–*st2* 55 (50–66), *st3*–*st3* 62 (55–67), *st1*–*st3* 55 (45–60), *st5*–*st5* 52 (49–56). Ventrianal shield pentagonal, with waist at seta *JV3* level, smooth, 97 (92–108) long, 76 (74–80) wide at level of *ZV2*, 70 (66–71) wide at level of anus; with four pairs of pre-anal setae, *JV1* 9 (6–13), *JV2* 9 (7–11), *JV3* 8 (6–9), *ZV2* 8 (5–10), solenostomes *gv3* small, rounded; *Pa* 9 (7–11), *Pst* 9 (8–10) on shield. Setae *JV4* 9 (7–12), *JV5* 26 (22–30), *ZV1* 9 (7–11), *ZV3* 6 8 (6–9) on interscutal membrane. All setae smooth, sharp pointed, *JV5* shovel-shaped with expanded blade. Two pairs of metapodal plates: 20 (17–22) long, 5 (4–6) wide; 8 (6–11) long, 2 (2–3) wide.

Spermatheca (Figure 68). Calyx bell-shaped, 16 (14–18) long, 8 (6–10) wide; with distal half thicker, other membranous, atrium connected to the calyx, minor and major ducts visible.

Chelicera (Figure 67). Movable digit 24 (21–30) long, with three teeth; fixed digit 24 (21–30) long, anterior half with two teeth, posterior half with five teeth, and *pilus dentilis*.

Legs (Figures 69–72). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/

0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* IV (*ad2*) 11 (9–13), *Sti* IV (*ad*) 13 (11–15), *St* IV (*d*) 26 (22–30). Macrosetae shovel-shaped with expanded blade.



FIGURES 65–68. *Typhlodromus (Anthoseius) serrulatus* Ehara, 1972, female. 65. Dorsal shield; 66. Ventral idiosoma; 67. Chelicera; 68. Spermatheca.

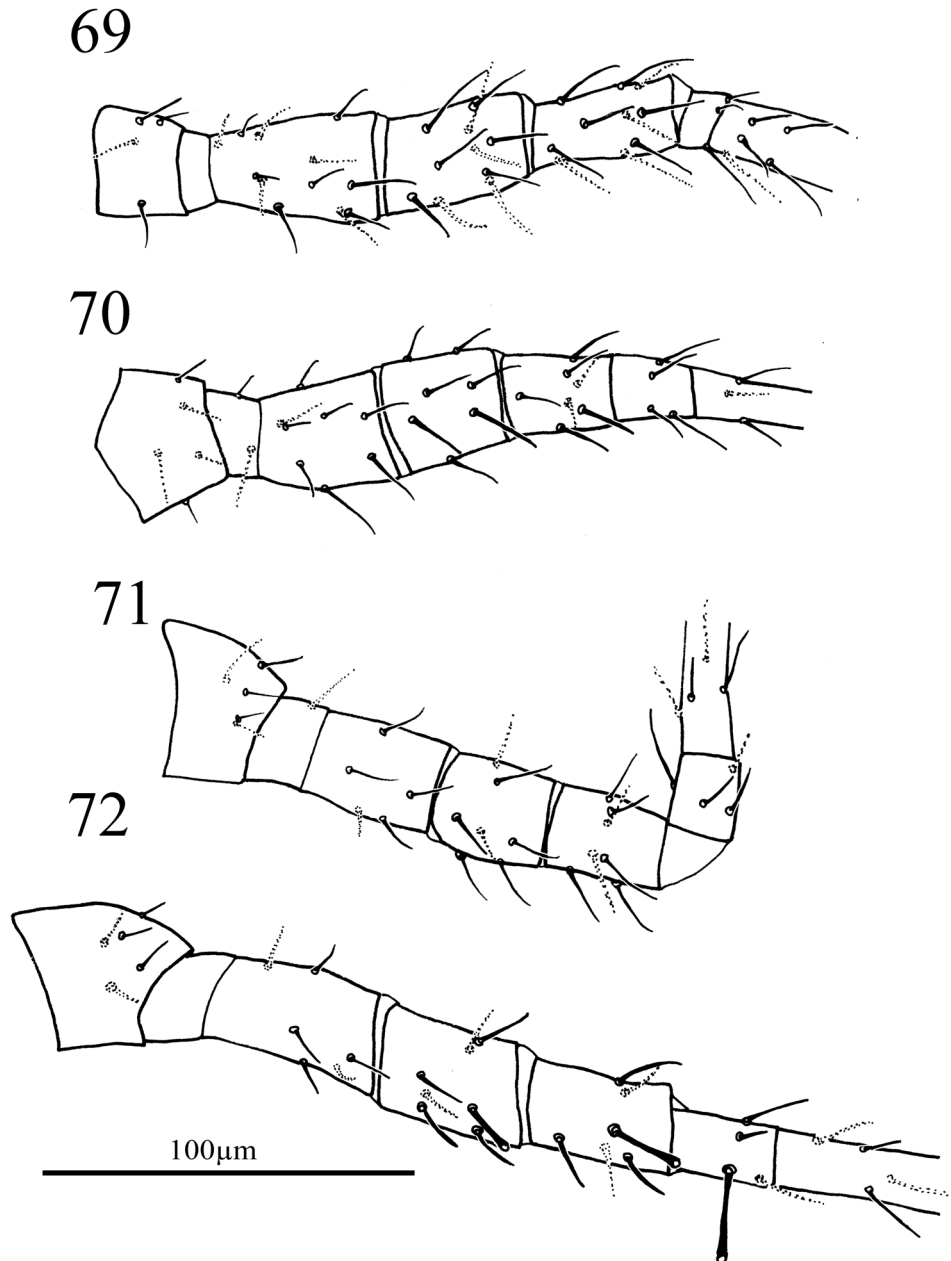
Male (n=2)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV-4:ZV-1,3.

Dorsal idiosoma (Figure 73). Dorsal shield nearly oval, constricted at level of *R1*, strongly reticulated, 237 (233–242) long and 151 (143–159) wide at level of *j6*, 126 (125–128) wide at level of *S4*, four pairs of solenostomes on dorsal shield (*gd4*, *gd6*, *gd8*, *gd9*), 14 pairs of lyrifissures (*idl1*, *id2*, *id4*, *id6*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *idx*, *is1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 12 (11–13), *j3* 14 (14–14), *j4* 11 (10–13), *j5* 10 (8–11), *j6* 11 (9–12), *J2* 13 (12–13), *J5* 6 (5–7), *z2* 11, *z3* 12 (11–12), *z4* 11 (10–13), *z5* 10 (9–10), *Z4* 19 (18–19), *Z5* 31 (31–32), *s4* 16 (15–16), *s6* 16 (14–17), *S2* 15

(15–16), *S4* 14 (12–19), *S5* 10 (9–11), *r3* 13 (12–13), *R1* 11. All setae smooth, sharp end, except seta *Z4* serrated, sharp end, seta *Z5* serrated, shovel-shaped with expanded blade.

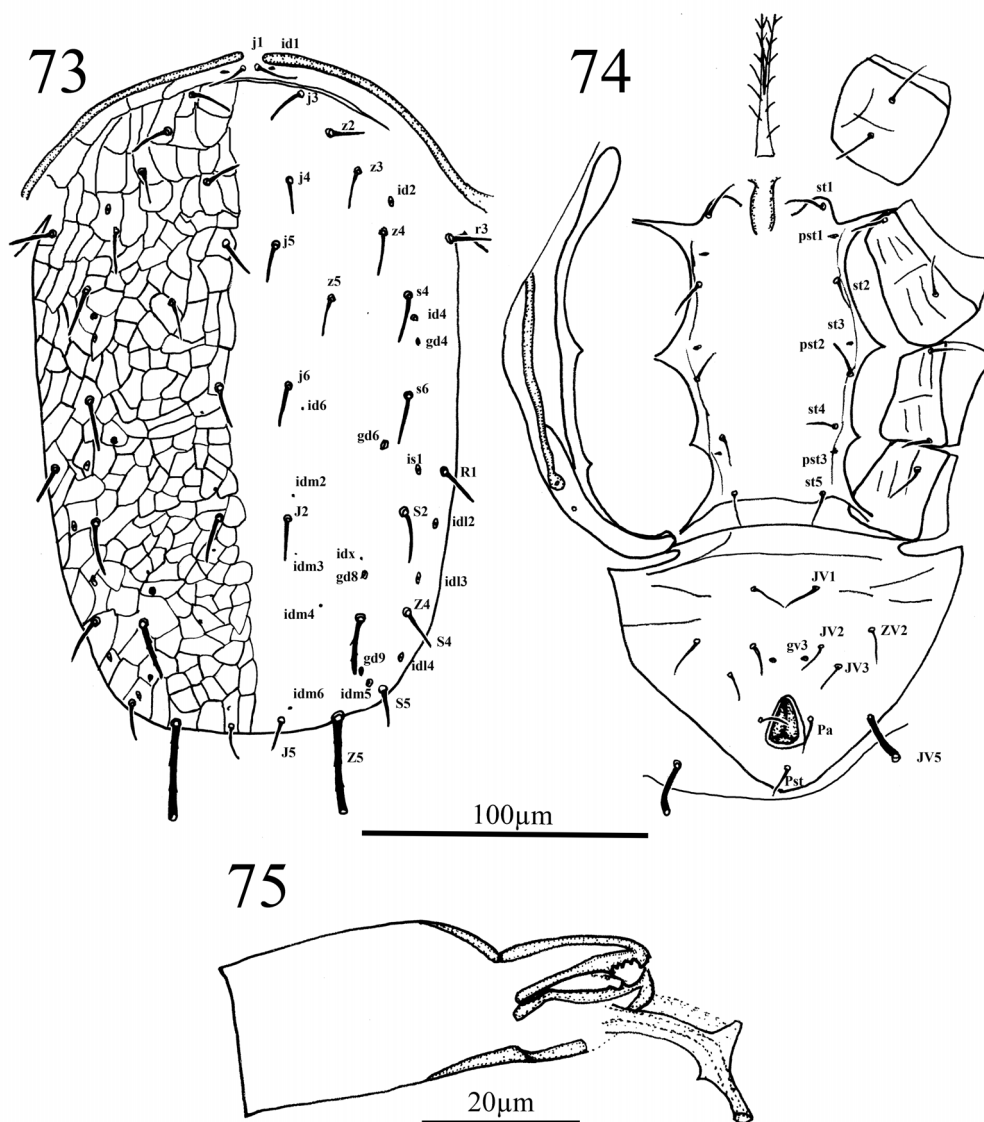
Peritreme (Figures 73, 74). *Peritreme* extending to level of *jl*; peritremal shield lightly sclerotized.



FIGURES 69–72. *Typhlodromus (Anthoseius) serrulatus* Ehara, 1972, female, legs. 69. Leg I anteriodorsal view; 70. Leg II dorsal view; 71. Leg III anterior view; 72. Leg IV anterior view.

Ventral idiosoma (Figure 74). Sternogenital shield smooth, lateral slightly reticulated, posterior margin concave, longer than wide, 107 (105–109) long, 62 (56–67) wide at level of *st5*, with five

pairs of setae, *st1* 11 (9–13), *st2* 11 (10–13), *st3* 11, *st4* 12, *st5* 11 (10–11), three pairs of lyrifissures (*pst1*, *pst2*, *pst3*). Distances between *st1*–*st1* 41 (39–43), *st2*–*st2* 49 (48–51), *st3*–*st3* 52 (49–55), *st4*–*st4* 41 (38–44), *st5*–*st5* 32 (32–32), *st1*–*st5* 98 (97–99). Exopodal shield at coxae II–IV. Ventrianal shield subtriangular, slightly reticulated, 94 (93–96) long, 121 (120–122) wide at anterior corner, 58 (57–60) at level of anus, fused with peritremal shield cingulum; with four pairs of pre-anal setae, *JV1* 8 (7–8), *JV2* 7 (7–7), *JV3* 7 (6–9), *ZV2* 11 (9–13), solenostomes *gv3* small, rounded; *Pa* 9 (8–9), *Pst* 9 (8–9) on shield. Seta *JV5* 14 (13–15) on interscutal membrane. All setae smooth, sharp pointed, except *JV5* shovel-shaped with expanded blade.

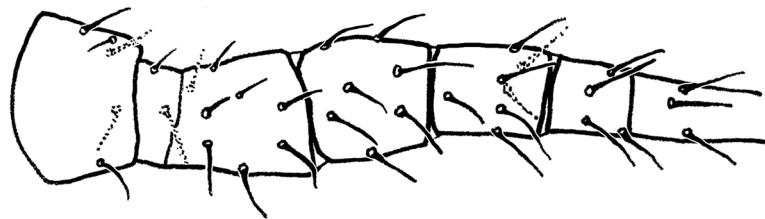


FIGURES 73–75. *Typhlodromus (Anthoseius) serrulatus* Ehara, 1972, male. 73. Dorsal shield; 74. Ventral idiosoma; 75. Chelicera and spermatodactyl.

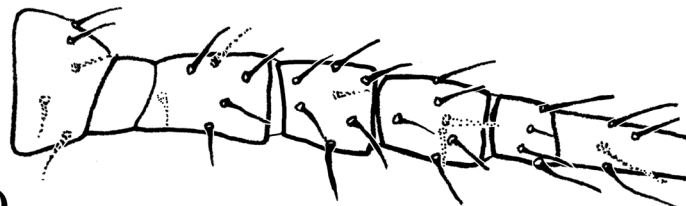
76



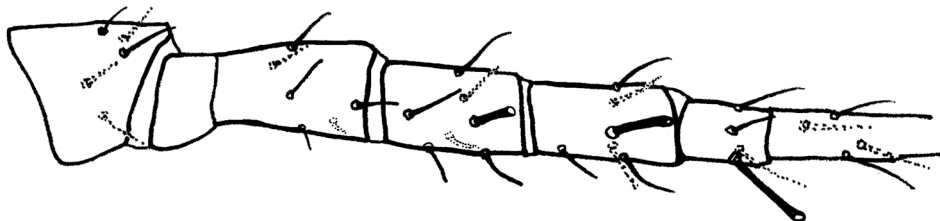
77



78



79



100μm

FIGURES 76–79. *Typhlodromus (Anthoseius) serrulatus* Ehara, 1972, male, legs. 76. Leg I dorsal view, 77. Leg II dorsal view, 78. Leg III dorsal view, 79. Leg IV anterior view.

Chelicera (Figure 75). Movable digit 17 (15–18) long, with two teeth; fixed digit 18 (17–18) long, with four teeth, with *pilus dentilis*. Spermatodactyl L-shaped, shaft 16 (14–18) long, heel rounded, foot 11 (10–12) long, with expanded toe and lateral thorn-like projection.

Legs (Figures 76–79). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* IV (*ad*2) 10 (8–12), *Sti* IV (*ad*) 11, *St* IV (*d*) 21 (20–22). Macrosetae shovel-shaped apically with expanded blade.

Specimens examined

JAPAN. Shiroyama, Tokushima City, Shikoku, holotype female (AC-13091) from *Zelkova serrata* (Ulmaceae), 26 Aug 1971, S. Ehara (NSMT); Shiroyama, Tokushima City, Shikoku, two paratype females (ZIHU3559, 3560) from *Zelkova serrata* (Ulmaceae), 26 Aug 1971, S. Ehara (HUM); Botanical Garden, Hokkaido University, Sapporo, Hokkaido, one paratype female (ZIHU3561) from *Juglans mandshurica* (Juglandaceae), 7 Sept 1967, S. Ehara (HUM).

TAIWAN. Luye Township, Taitung County, four females (89-Ty-0012, 13, 14, 16) from *Hibiscus* sp. (Malvaceae), 20 Feb 1989, Y. J. Wang (TARL); National Chung Hsing University, South Dist., Taichung City, one female from *Gardenia jasminoides* (Rubiaceae), 29 May 1997, C. C. Ho (TARL); National Chung Hsing University, South Dist., Taichung City, two females from *Gardenia jasminoides* (Rubiaceae) associated with *Chrysomphalus aonidum*, 22 Aug 1997, C. C. Ho (TARL); Wanfeng Village, Wufeng Dist., Taichung City, one female and two males (HAL099B696, 706, 712) from *Acacia confusa* (Fabaceae), 8 Aug 2010, C. C. Ho (TARL); Zhanggong N. Lane, Wufeng Dist., Taichung City, nine females and one male from *Acacia confusa* (Fabaceae), 14 May 2012, C. C. Ho (TARL); Zhanggong N. Lane, Wufeng Dist., Taichung City, two females and two males from leaf of *Acacia confusa* (Fabaceae), 30 May 2012, C. C. Ho (TARL); Nanhua Dist., Tainan City (23° 01' 27.8" N, 120° 27' 54" E, 123m), one female and one male (HAL101B212) from *Cinnamomum camphora* (Lauraceae), 24 July 2012 (TARL); Guanziling, Baihe Dist., Tainan County (23° 19.330' N, 120° 28.993' E, 451m), one female (no. 1841–1) from unknown plant, 10 Aug 2016, J. R. Liao (NTU); Guanziling, Baihe Dist., Tainan County (23° 20.336' N, 120° 30.443' E, 358m), three females and one male (no. 1843–1, 6, 8, 9) from *Mangifera indica* (Anacardiaceae), 10 Aug 2016, J. R. Liao (NTU).

Distribution

Asia: China [Fujian (Wu 1981), Wuling Mountain Region (Wu & Lan 1992a)], Japan (Ehara 1972), South Korea (Ryu & Lee 1992), Taiwan (present study), Thailand (Ehara & Bhandhufalck 1977).

Remarks

Ehara (1972) described this species from *Zelkova serrata* (Ulmaceae) in Japan. Chang & Tseng (1978) reported this species in Taiwan, but they provided some differences (e.g. dorsal shield slightly reticulated, seta *S5* shorter). Tseng (1983) considered these specimens belonging to a different species and described them as *T. (A.) pseudoserrulatus*. However, these two characters are probably misidentified, because of the slide-making technique or other reasons. Besides, earlier specimens were lost after Tseng retirement (Liao *et al.* 2017a). There is no differences between our specimens and the holotype specimen. Therefore, this study proposed the existence of this species in Taiwan, and also considered that *T. (A.) pseudoserrulatus* is probably junior synonym of *T. (A.) serrulatus*.

Typhlodromus (Anthoseius) tridentiger Tseng, 1975

(Figures 80–94)

Typhlodromus (Typhlodromus) tridentiger Tseng, 1975: 64.

Amblydromella tridentiger.—Moraes *et al.*, 1986: 177.

Amblydromella (Amblydromella) tridentiger.—Denmark & Welbourn, 2002: 307.

Female (n=10)

A lightly sclerotized mite. Idiosomal setal pattern: 12A:8A/JV:ZV.

Dorsal idiosoma (Figure 80). Dorsal shield nearly oval, constricted at level of *R1*, laterally reticulated; 324 (304–340) long and 202 (190–212) wide at level of *j6*, 195 (178–210) wide at level of *S4*; six pairs of solenostomes on dorsal shield (*gd1*, *gd2*, *gd4*, *gd6*, *gd8*, *gd9*), 12 pairs of lyrifissures (*idl1*, *idl2*, *idl4*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *isl1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 20 (13–23), *j3* 20 (18–23), *j4* 11 (9–14), *j5* 11 (9–13), *j6* 17 (15–20), *J2* 22 (17–24), *J5* 7 (5–9), *z2* 11 (9–14), *z3* 15 (11–18), *z4* 18 (16–19), *z5* 11 13 (10–16), *Z4* 30 (27–32), *Z5* 42 (39–49), *s4* 20 (15–23), *s6* 22 (21–25), *S2* 23 (22–25), *S4* 19 (17–23), *S5* 9 (7–10), *r3* 12 (9–15), *R1* 11 (8–16). All setae smooth, shovel-shaped apically except for *S5*, *J5* short and normal, *Z5* which are distinct shovel-shaped apically with expanded blade.

Peritreme (Figures 80, 81). Peritreme extending to level of *j1*; peritremal shield lightly sclerotized, with one pair of solenostomes (*gd3*), and one pair of lyrifissures (*idl3*).

Ventral idiosoma (Figure 81). Sternal shield smooth, posterior margin concave, wider than long, 60 (52–65) long, 85 (82–89) wide, with three pairs of setae *st1* 19 (17–21), *st2* 15 (13–19), *st3* 16 (12–19), and two pairs of lyrifissures (*pst1*, *pst2*). Exopodal shield at coxae II–IV. Metasternal platelets tear-shaped, with one pair of metasternal setae, *st4* 16 (12–19), with one pair of lyrifissures (*pst3*). Genital shield smooth, truncate posteriorly, with one pair of genital setae *st5* 17 (13–20), 77 73 (65–79) wide at level of genital setae. Distances between *st1*–*st1* 48 (44–52), *st2*–*st2* 63 (60–66), *st3*–*st3* 72 (66–75), *st1*–*st3* 61 (58–64), *st5*–*st5* 60 (55–67). Ventrianal shield pentagonal, smooth, with slightly waist at *JV2* level, 101 (93–112) long, 87 (76–94) wide at level of *ZV2*, 67 (64–72) wide at level of anus; with four pairs of pre-anal setae, *JV1* 12 (9–15), *JV2* 11 (9–15), *JV3* 10 (8–14), *ZV2* 11 (7–15), solenostomes *gv3* crescentic; *Pa* 7 9 (7–11), *Pst* 9 (8–11) on shield. Setae *JV4* 8 (7–10), *JV5* 29 (27–32), *ZV1* 13 (9–18), *ZV3* 9 (7–12) on interscutal membrane. All setae smooth, sharp pointed, *JV5* shovel-shaped. Two pairs of metapodal plates: 19 (17–21) long, 4 (3–6) wide; 8 (5–10) long, 2 (1–3) wide.

Spermatheca (Figure 83). Calyx bell-shaped, with apical half straight and thick, 17 (14–22) long, 8 (6–10) wide; atrium nodular and connected to the calyx without neck, minor and major ducts invisible.

Chelicera (Figure 82). Movable digit 26 (24–27) long, with three teeth; fixed digit 25 (23–29) long, with five teeth, with *pilus dentilis*.

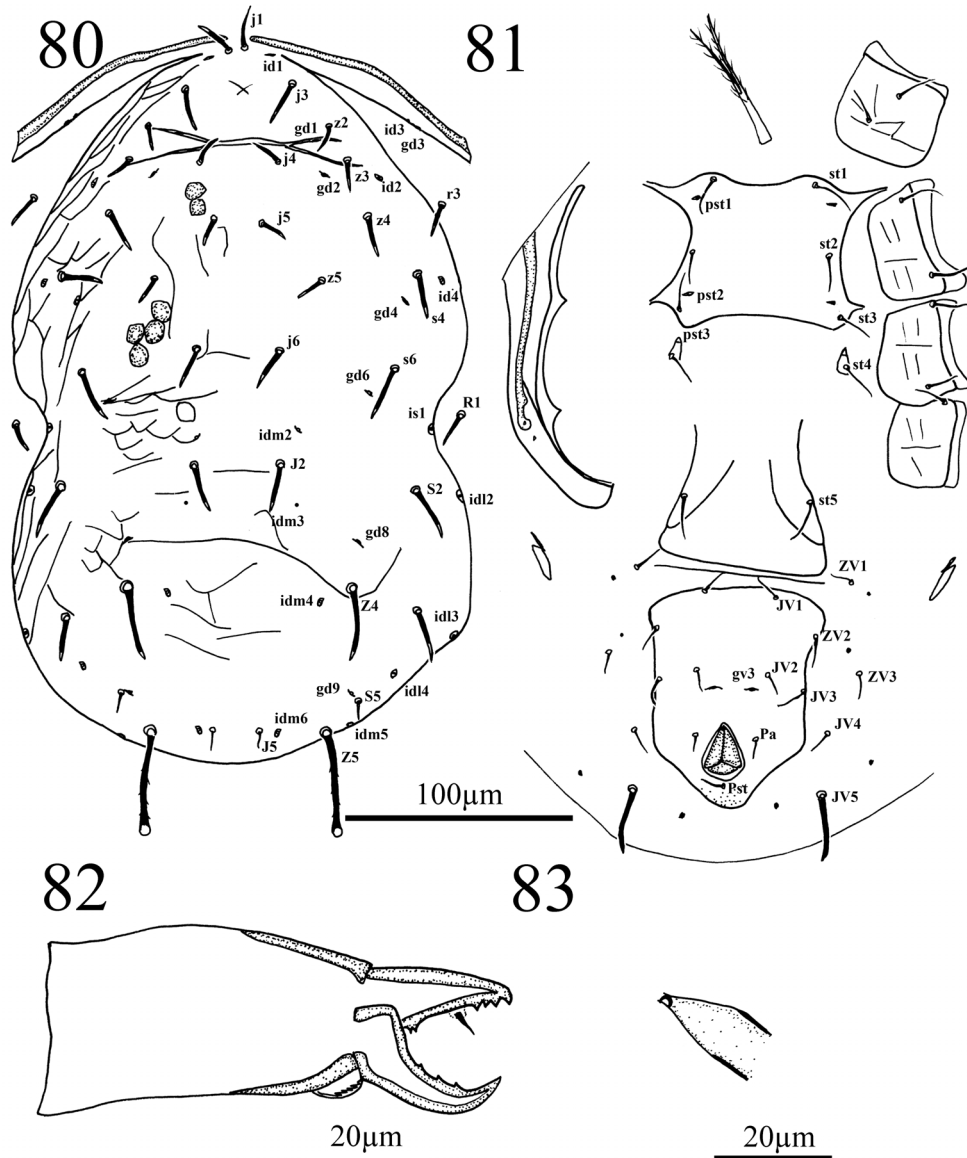
Legs (Figures 84–87). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* III (*ad2*) 14 (14–16), *Sti* III (*ad*) 11 (10–13), *St* III (*d*) 9 (7–10), *Sge* IV (*ad2*) 24 (22–26), *Sti* IV (*ad*) 13 (11–17), *St* IV (*d*) 23 (22–24). Macrosetae apically shovel-shaped with expanded blade.

Male (n=2)

A lightly sclerotized mite. Idiosomal setal pattern: 13A:8B/JV-4: ZV-1, 3.

Dorsal idiosoma (Figure 88). Dorsal shield nearly oval, constricted at level of *R1*, with lateral reticulation; 228 (224–233) long and 156 (152–160) wide at level of *j6*, 131 (126–135) wide at level of *S4*, six pairs of solenostomes on dorsal shield (*gd1*, *gd2*, *gd4*, *gd6*, *gd8*, *gd9*), twelve pairs of lyrifissures (*idl1*, *idl2*, *idl4*, *idm2*, *idm3*, *idm4*, *idm5*, *idm6*, *isl1*, *idl2*, *idl3*, *idl4*); length of setae: *j1* 14 (13–15), *j3* 14 (13–14), *j4* 9 (8–9), *j5* 8 (8–9), *j6* 11 (8–14), *J2* 16 (14–17), *J5* 5 (4–5), *z2* 9 (8–10), *z3* 10 (9–10), *z4* 12 (11–12), *z5* 9 (9–9), *Z4* 20 (18–21), *Z5* 28 (28–28), *s4* 16 (15–16), *s6* 16 (14–18), *S2* 17 (17–17), *S4* 17 (16–18), *S5* 13 (13–13), *r3* 8 (8–9), *R1* 9 (8–10). All setae smooth, shovel-shaped apically except for *S5*, *J5* short and normal, *Z5* distinct shovel-shaped apically with expanded blade.

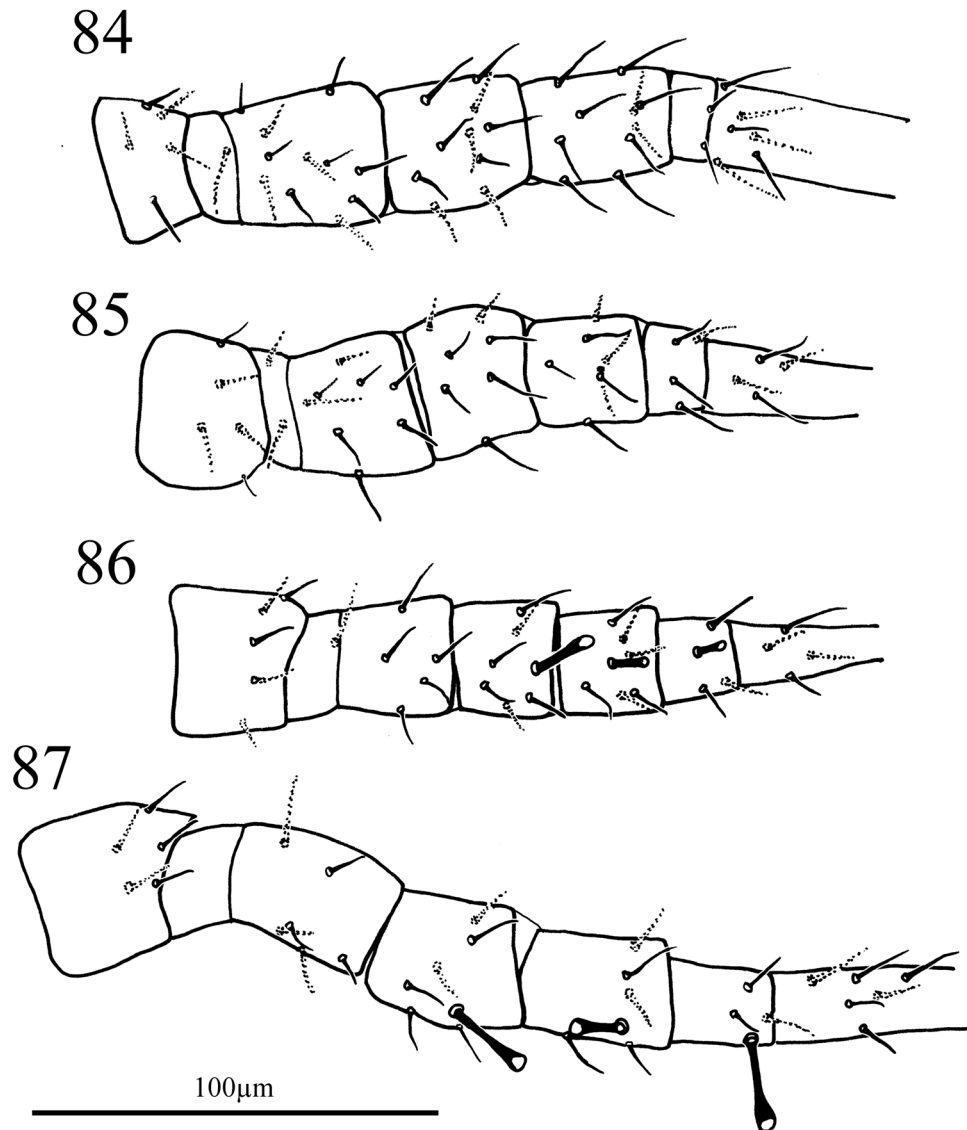
Peritreme (Figures 88–89). Peritreme extending to level of *j1*; peritremal shield lightly sclerotized.



FIGURES 80–83. *Typhlodromus (Anthoseius) tridentiger* Tseng, 1975, female. 80. Dorsal shield; 81. Ventral idiosoma; 82. Chelicera; 83. Spermatheca.

Ventral idiosoma (Figure 89). Sternogenital shield smooth, lateral slightly reticulated, posterior margin straight, longer than wide, 107 (107–108) long, 61 (59–64) wide at level of *st5*, with five pairs of setae, *st1* 11 (10–13), *st2* 11, *st3* 11 (10–11), *st4* 13 (13–14), *st5* 13, three pairs of lyrifissures (*pst1*, *pst2*, *pst3*). Distances between *st1*–*st1* 38 (36–40), *st2*–*st2* 54 (53–56), *st3*–*st3* 56 (56–56), *st4*–*st4* 39 (39–40), *st5*–*st5* 35 (34–35), *st1*–*st5* 98 (95–101). Exopodal shield at coxae II–IV. Ventrianal shield subtriangular, with striation, 96 (95–96) long, 129 (126–132) wide at anterior corner, 50 (48–53) at level of anus, fused with peritremal shield cingulum; with four pairs of pre-anal setae, *JV1* 9

(8–9), *JV2* 8 (7–9), *JV3* 10 (8–11), *ZV2* 8, solenostomes *gv3* crescentic; *Pa* 7 (6–9), *Pst* 7 (5–9) on shield. Seta *JV5* 15 (14–16) on interscutal membrane. All setae smooth, sharp pointed, *JV5* shovel-shaped.

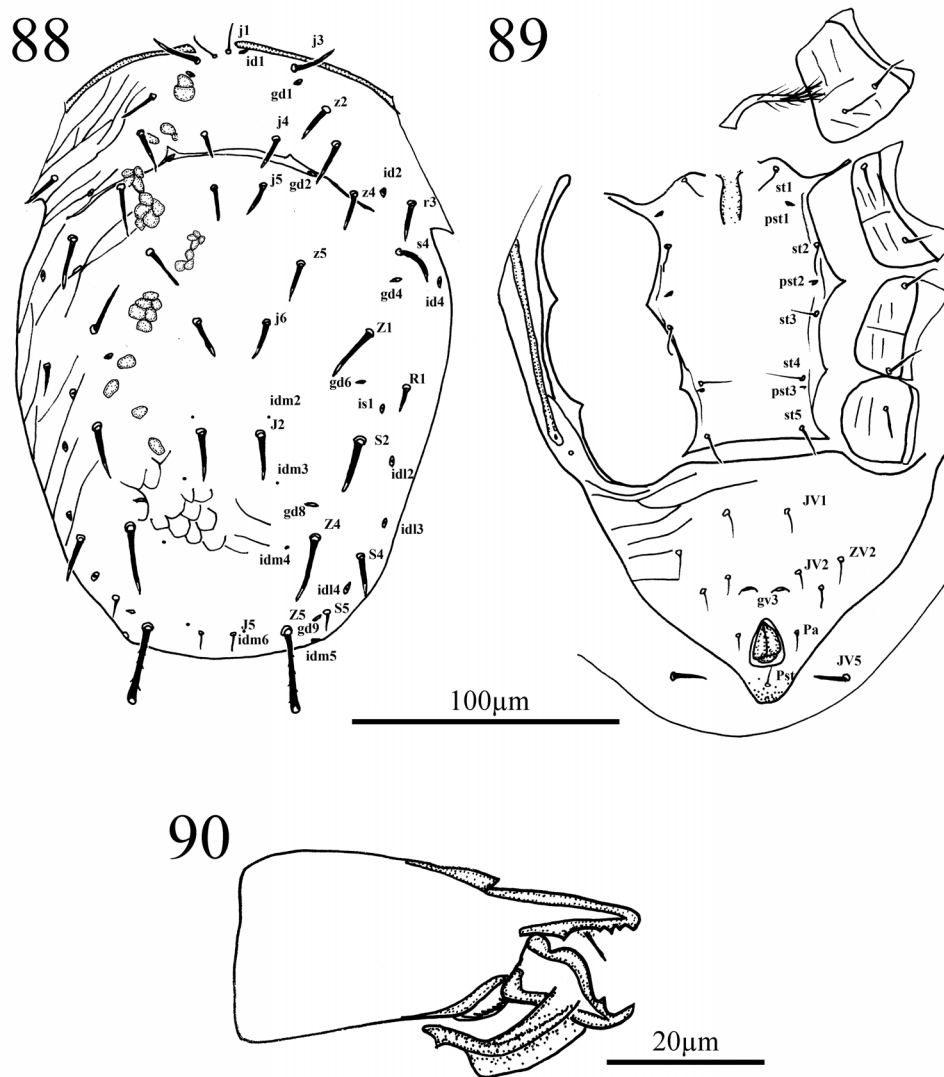


FIGURES 84–87. *Typhlodromus (Anthoseius) tridentiger* Tseng, 1975, female, legs. 84. Leg I dorsal view; 85. Leg II dorsal view; 86. Leg III dorsal view; 87. Leg IV anterior view.

Chelicera (Figure 90). Movable digit 16 (15–18) long, with one tooth; fixed digit 16 (15–17) long, with three teeth, with *pilus dentilis*. Spermatodactyl L-shaped, shaft 16 (15–18) long, heel rounded, foot 8 (6–9) long, with expanded toe and lateral thorn-like projection.

Legs (Figures 91–94). Complement of setae on coxae I–IV: 2-2-2-1. Chaetotaxy (femur to basitarsus): leg I, 2-3/2-2/2-1, 2-2/1-2/1-2, 2-2/1-2/1-2, 1-1/1-1; leg II, 2-3/1-2/1-1, 2-2/0-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg III, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/1-1, 1-1/1-1; leg IV, 1-2/1-1/0-1, 1-2/1-2/0-1, 1-1/1-2/0-1, 1-1/1-1. Macrosetae: *Sge* III (*ad2*) 12 (10–13), *Sti* III (*ad*) 7 (7–8), *St* III (*d*) 6 (5–

6), *Sge* IV (*ad*2) 16 (15–17), *Sti* IV (*ad*) 9 (8–10), *St* IV (*d*) 17 (16–18). Macrosetae apically shovel-shaped with expanded blade.

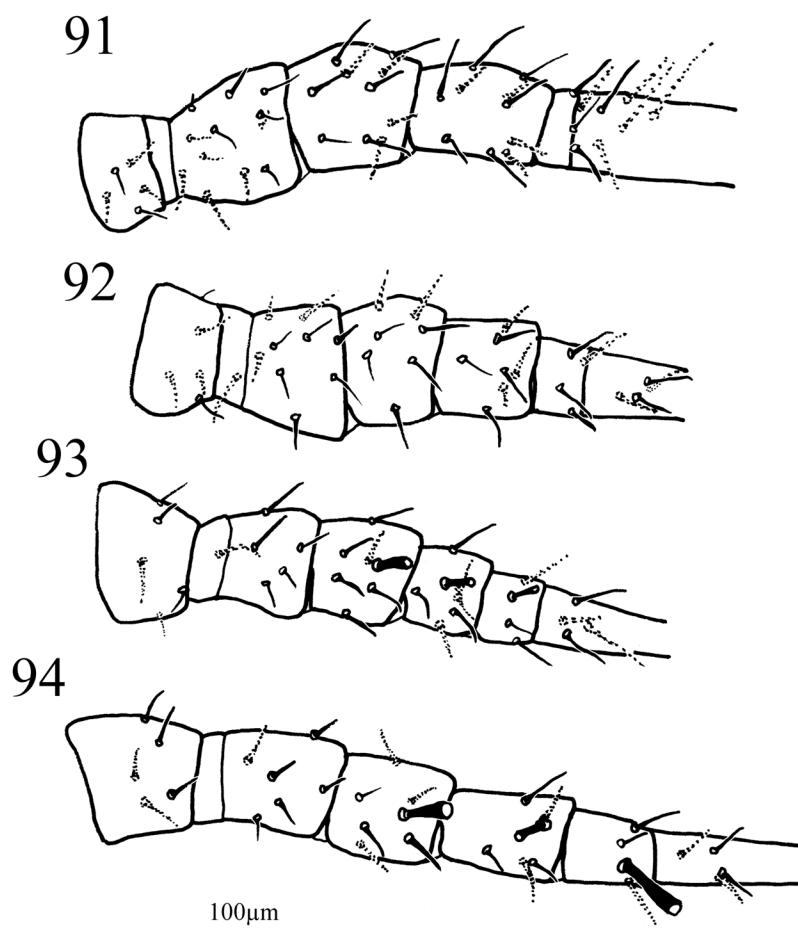


FIGURES 88–90. *Typhlodromus (Anthoseius) tridentiger* Tseng, 1975, male. 88. Dorsal shield; 89. Ventral idiosoma; 90. Chelicera and spermatodactyl.

Specimens examined

Hongtuo Water Plant, Lanyu Township, Taitung County (22° 02.042' N, 121° 33.040' E, 71 m), five females three males (no. 461–2, 3, 4, 5, 6, 7, 8, 9) from *Macaranga sinensis* (Euphorbiaceae), 4 Apr 2010, J. R. Liao & C. C. Ho (NTU); Lanyu Township, Taitung County, two females from *Macaranga tanarius* (Euphorbiaceae), 16 June 1987, C. C. Ho (TARL); Lanyu Township, Taitung County, one female two males from *Morus alba* (Moraceae), 16 June 1987, C. C. Ho (TARL); Luda Township, Taitung County, one female (TAL078C0027) from *Hibiscus tiliaceus* (Malvaceae), 16 June 1987, C. C. Ho (TARL); Lanyu Township, Taitung County (22° 00.791' N, 121° 34.034' E, 25

m), one male (no. 425–7) from *Macaranga tanarius* (Euphorbiaceae), 2 Apr 2010, J. R. Liao & C. C. Ho (NTU); Lanyu Township, Taitung County (22° 04.513' N, 121° 30.477' E, 95 m), two females (no. 440–5, 6) from *Mallotus japonicus* (Euphorbiaceae), 3 Apr 2010, J. R. Liao & C. C. Ho (NTU); Lanyu Township, Taitung County (22° 04.788' N, 121° 30.782' E, 67 m), one female (no. 443–1) from *Aglaia chittagonga* (Meliaceae), 3 Apr 2010, J. R. Liao & C. C. Ho (NTU); Dongqing Water Plant, Lanyu Township, Taitung County (22° 03.549' N, 121° 33.569' E, 81 m), three females (no. 448–1, 2, 3) from *Morus* sp. (Moraceae), 3 Apr 2010, J. R. Liao & C. C. Ho (NTU); Lanyu Weather Station, Lanyu Township, Taitung County (22° 02.128' N, 121° 33.552' E, 308 m), six females (no. 450–1, 2, 3, 4, 5, 6) from *Acacia confusa* (Fabaceae), 3 Apr 2010, J. R. Liao & C. C. Ho (NTU); Lanyu Township, Taitung County (22° 00.881' N, 121° 33.970' E, 33 m), one female (no. 462–15) from *Morus alba* (Moraceae), 4 Apr 2010, J. R. Liao & C. C. Ho (NTU); Lanyu Township, Taitung County (22° 00.791' N, 121° 34.034' E, 26 m), one female (no. 463–19) from *Trema orientalis* (Cannabaceae), 4 Apr 2010, J. R. Liao & C. C. Ho (NTU); Lanyu Township, Taitung County (22° 00.791' N, 121° 34.034' E, 26 m), one female (no. 468–7) from *Premna serratifolia* (Verbenaceae), 4 Apr 2010, J. R. Liao & C. C. Ho (NMNS); Lanyu Township, Taitung County (22° 00.978' N, 121° 33.830' E, 19 m), one female (no. 1207–2) from *Morus* sp. (Moraceae), 6 Apr 2011, Y. J. Lu (NCHU).



FIGURES 91–94. *Typhlodromus (Anthoseius) tridentiger* Tseng, 1975, male, legs. 91. Leg I posterior view; 92. Leg II dorsal view; 93. Leg III dorsal view; 94. Leg IV dorsal view.

Distribution

Asia: Taiwan [(Lanyu Island (Tseng 1975), Ludaο (present study)].

Remarks

This species was described by Tseng (1975) from Lanyu Island on an unknown plant. Most specimens we collected were also found in the type locality and others found in neighboring islands Ludaο. These specimens are morphologically similar to the original description of the species, however, two differences were observed: (1) Tseng (1975) reported as oppose to two macrosetae on genu IV and three macrosetae on tibia IV, but our observation indicated to presence of only one macrosetae on each of these segments; (2) we observed two additional teeth on proximal end of the fixed digit, well away from *pilus dentilis* in female specimens.

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