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Description of six new species of phytoseiid mites (Acari: Phytoseiidae) from Arunachal Pradesh, India

Shubham Pramanik and Krishna Karmakar*

Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, Nadia, West Bengal, India; Email: pramanikshubham89@gmail.com, acarikarmakar@rediffmail.com

* Corresponding author

Abstract

In this present paper six new mite species of the family Phytoseiidae (Acari: Mesostigmata) are described from Arunachal Pradesh, India: *Euseius arunachalensis* **sp. nov.**, *E. bandispermathecae* **sp. nov.**, *E. bomdilae* **sp. nov.**, *Typhlodromus (Anthoseius) dahungensis* **sp. nov.**, *Phytoseius dorsospinosus* **sp. nov.** and *P. leopardisimilis* **sp. nov.**

Key words: *Euseius*; female; Mesostigmata; *Phytoseius*; taxonomy, *Typhlodromus (Anthoseius)*.

Introduction

The importance of predatory mites has been understood worldwide for its successful utilisation in biological control program for management of phytophagous mites and small insects (McMurtry and Croft 1997). Therefore, a survey was conducted for exploring phytoseiid mites from Arunachal Pradesh. Currently a total of 211 species under 21 genera in three subfamilies of Phytoseiidae are known from India (Karmakar and Gupta 2015). Amblyseiinae is the largest subfamily in number of species described from India (133 species in 15 genera), followed by Typhlodrominae (47 species in 4 genera) and Phytoseiinae (31 species in 2 genera).

The north-eastern states of India constitute an area considered as a hotspot of biodiversity from where only few species have been described and many have yet to be explored. While conducting a survey in Arunachal Pradesh, in that region, 150 specimens of six undescribed species were collected. These species are here described.

Materials and methods

Samples of different plant species were collected by Shubham Pramanik and examined under a stereo-microscope or beating over a glass plate of dark background. Phytoseiid mites were collected and then mounted in Hoyer's medium on microscope slides. The mites were examined and illustrated with an Olympus phase contrast microscope (model BX 41) equipped with a drawing tube (Olympus Optical Co., Ltd. Japan). The classification system follows Chant and McMurtry (2007). Setal nomenclature used in this article follows those proposed by Lindquist and Evans (1965)

as adapted by Rowell *et al.* (1978) for the dorsal surface of the idiosoma and Chant and Yoshida-Shaul (1991) for the ventral surface. Solenostomes and poroids are named after the system of Athias-Henriot (1975). Measurements are given in micrometer (μm) and each measurement corresponds to the average followed in parentheses by the respective ranges (if measurement is variable). The number of teeth indicated in the text for fixed and movable digits of chelicerae do not include the corresponding apical tooth. The type specimens were deposited in the Acarology Laboratory, Department of Agricultural Entomology, Faculty of Agricultural Sciences at Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India.

Results and Discussion

In total, 150 specimens of six new species were collected. These are subsequently described.

Euseius Wainstein, 1962

Euseius, Wainstein, 1962a: 230.

finlandicus group Athias-Henriot, 1957: 23, Chant, 1959: 67.

Amblyseius (*Amblyseius*), section *Euseius* Wainstein, 1962b: 15.

Type species: *Seiulus finlandicus* Oudemans, 1915: 183.

Amblyseius (*Amblyseius*), section *Afrodromus* Wainstein, 1962b: 17.

Amblyseius (*Euseius*), De Leon, 1965a: 121.

Euseius, De Leon, 1967: 86.

Euseius, Moraes *et al.* 2004: 60; Chant and McMurtry, 2007: 120; Demite *et al.* 2014: 572.

Females of this genus are characterized by having dorsal idiosomal setal pattern (Chant and McMurtry 2007):10A:9B (j1, j3 to j6, J2, J5, z2, z4, z5, Z1, Z4, Z5, s4, S2, S4, S5, r3 and R1) and usually JV-3:ZV (JV1, JV2, JV4, JV5, ZV1 to ZV3). Setae r3 and R1 present usually on the lateral unsclerotized cuticle of the idiosoma. Ventrianal shield is usually vase shaped (widest at the level of anal opening). With three pairs of preanal setae (JV1, JV2, ZV2), usually arranged almost in a transverse row, with seta JV1 inserted usually well behind the anterior margin of shield. Peritremes most often relatively short, not extending to the level of setae j1. Posterior margin of sternal shield with a median lobe which may be difficult to discern in weakly sclerotized specimens. Genital shield distinctly wider than ventrianal shield. Chelicerae reduced in size; cheliceral digits with inner margins concave in lateral view; fixed digit with 2–7 small to minute teeth, all on the distal portion; movable digit with 1–2 teeth. Macrosetae usually present on genu IV, tibia IV and tarsus IV, often also on genu II and III, and rarely on genu I.

Euseius arunachalensis sp. nov. (Figs. 1 and 2)

Adult female (n = 10)

Dorsum (Figures 1A & 2A) – Dorsal shield 320 (313–335) long and 226 (223–230) wide, strongly reticulated on the whole dorsum, with six solenostomes (gd1, gd2, gd5, gd6, gd8 and gd9); 17 pairs of setae on the dorsal shield and two pairs of setae on the unsclerotized cuticle: j1 36 (33–38), j3 34 (33–38), j4 14 (13–15), j5 15 (13–18), j6 20

(18–20), J2 18 (18–20), J5 8 (8–10), z2 29 (28–33), z4 29 (25–33), z5 16 (15–18), Z1 21 (20–23), Z4 21 (20–23), Z5 61 (58–65), s4 39 (38–40), S2 26 (25–28), S4 26 (25–30), S5 31 (30–35), r3 17 (15–20), R1 15 (13–18). All setae smooth except Z5, slightly serrated.

Peritreme – Extending forward to level between bases of j3 and z2.

Venter (Figs. 1B and 2B) – All shields smooth. Sternal shield with 96 (90–100) long and 81 (78–85) wide at level setae ST2, with three pairs of setae and two pairs of lyrifissures; one pair of setae (ST4) on unsclerotized membrane; posterior margin not clearly outlined in all specimens. Distances between ST1–ST3 93 (90–95), ST2–ST2 67 (65–70), ST5–ST5 70 (69–72). Two pairs of metapodal shields, primary shield 20 (18–20) long, 6 wide and secondary shield 10 (8–10) long. Ventrianal shield 92 (88–100) long, 45 (40–50) wide at level of JV2 setae and 78 (75–80) wide at level of anus; with three pairs of preanal setae, JV1, JV2 and ZV2, and one pair of large elliptical preanal pores. Membrane surrounding ventrianal shield with four pairs of setae: ZV1, ZV3, JV4 and JV5; the latter 42 (38–50) long, smooth.

Chelicera (Figs. 1D and 2C) – Fixed digit 22 (20–25) long, with four teeth; movable digit 21 (18–23), toothless.

Spermatheca (Figs. 1E and 2D) – Calyx fundibular, elongated, 17 (15–18) long, wider at base of calyx and gradually tapering towards atrium, minor duct and major duct distinct.

Legs – Legs IV (Figures 1C and 2E) with three smooth macrosetae pointed distally and of the following lengths: genu 39 (38–40), tibia 37 (35–40), basitarsus 62 (58–65). Chaetotactic formula of genu II: 1–2/0, 1/1–1; genu III: 1–1/1, 2/1–1. Length of leg I: 395–410, leg II: 308–325, leg III: 313–326, leg IV: 375–433.

Material examined

Holotype female (AINP/Acar.lab/BCKV/5696/2015), collected from jackfruit, *Artocarpus heterophyllus* (Moraceae), at Dahung: 27° 12' 9" N, 92° 29' 29" E, 1262 m above mean sea level, West Kameng, Arunachal Pradesh State, on 01.v.2015; 9 paratype females (AINP/Acar.lab/BCKV/5698–5706/2015) with same collection data as holotype; 3 paratype females (AINP/Acar.lab/BCKV/5716–5718/2015) from *Jatropha carcus* (Euphorbiaceae) at Tezpur: 26° 38' 32" N, 92° 46' 58" E, 49 m above mean sea level, Assam State, on 26.iv.2015; 1 paratype female (AINP/Acar.lab/BCKV/5721/2015) *Prunus persica* (Rosaceae) at the same locality as holotype on 30.iv.2015.

Remarks

The dorsal shield of *E. arunachalensis* **sp. nov.** is distinctly reticulated and with prominent poroids. It is close to *Euseius densus* (Wu, 1984) but the shape of dorsal shield and ventrianal shield varies. The posterior margin of the dorsal shield is rectangular in shape in the former species while it is more circular in the latter species. The anterior margin of the ventrianal shield is rounded in former species while it is straight in latter species. Also the ventrianal shield is wider at the anal region in the former species while it is narrower in the latter species. The ratio of length to width of ventrianal shield is 95:78 in *E. arunachalensis* **sp. nov.** while it is 75:53 in *E. densus*. *E. arunachalensis* **sp. nov.** is also close to *E. kalimpongensis* (Gupta, 1969), but the latter species differs from the former by the shape of the ventrianal shield which is strongly concave laterally, presence of one tooth in movable digit, one macroseta on basitarsus of leg IV and smooth dorsal shield which does not match with the former

species.

Etymology

The epithet *arunachalensis* refers to the northeastern Indian state, Arunachal Pradesh, where the types of this species were collected.

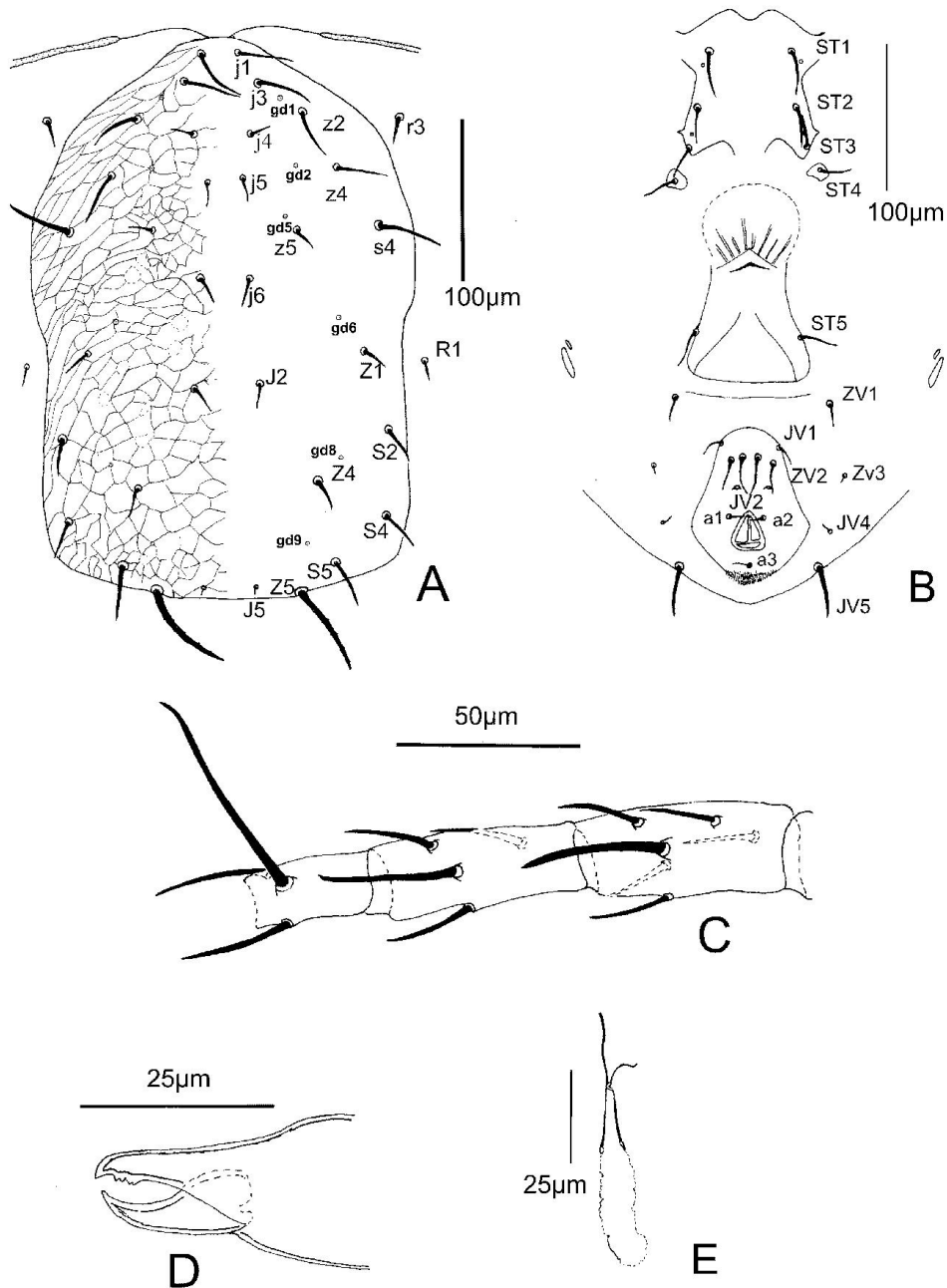


Figure 1. *Euseius arunachalensis* sp. nov. (female) – A. Dorsal view of idiosoma; B. Ventral view of idiosoma; C. Genu, tibia and basitarsus IV; D. Chelicera; E. Spermatheca.

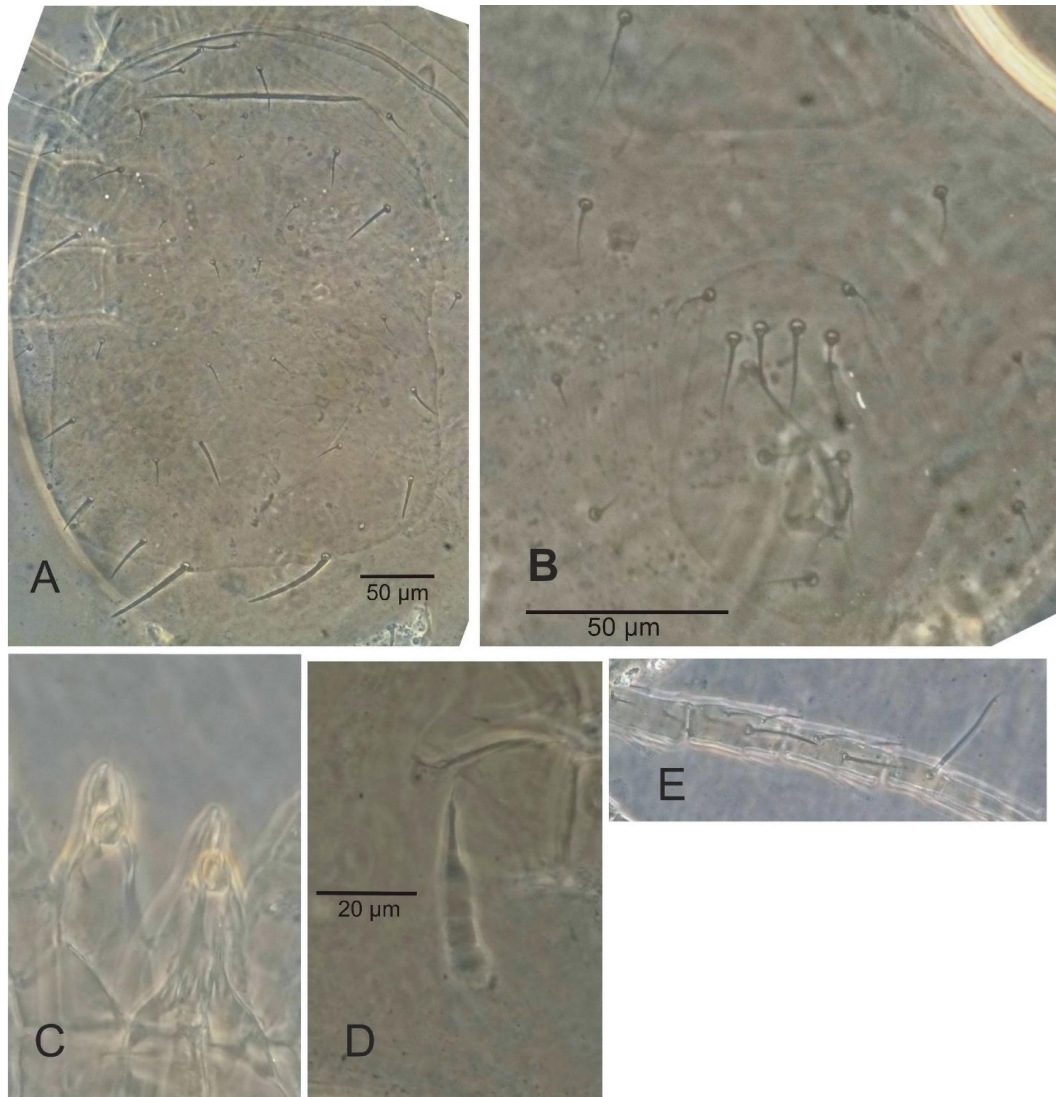


Figure 2. *Euseius arunachalensis* sp. nov. (female) – A. Dorsal Shield; B. Ventrianal plate; C. Chelicera; D. Spermatheca; E. Leg IV.

***Euseius bandispermathecae* sp. nov. (Figs. 3 and 4)**

Adult female (n = 10)

Dorsum (Figs. 3A and 4A) – Dorsal shield 343 (330–358) long and 258 (250–265) wide, strongly reticulated with lateral lines on the whole dorsum, 25 pairs of rugose patches or sigilla (see Walter 2005) on dorsal shield, with five pairs of solenostomes (gd2, gd5, gd6, gd8 and gd9); 17 pairs of setae on the dorsal shield and one pair of setae on the unsclerotized cuticle and one pair on dorsal shield: j1 33 (33–35), j3 29 (28–35), j4 14 (13–15), j5 13 (10–15), j6 17 (15–18), J2 19 (18–20), J5 8, z2 23 (18–25), z4 26 (23–30), z5 15 (13–18), Z1 19 (18–20), Z4 20 (18–23), Z5 68 (60–73), s4 36 (33–40), S2 26 (25–28), S4 30 (28–33), S5 35 (33–38), r3 19 (18–20), R1 17 (15–18) inserted on dorsal shield. All the dorsal shield setae are smooth while the seta Z5 is minutely serrated.

Peritreme – Extending forward almost upto level of j3.

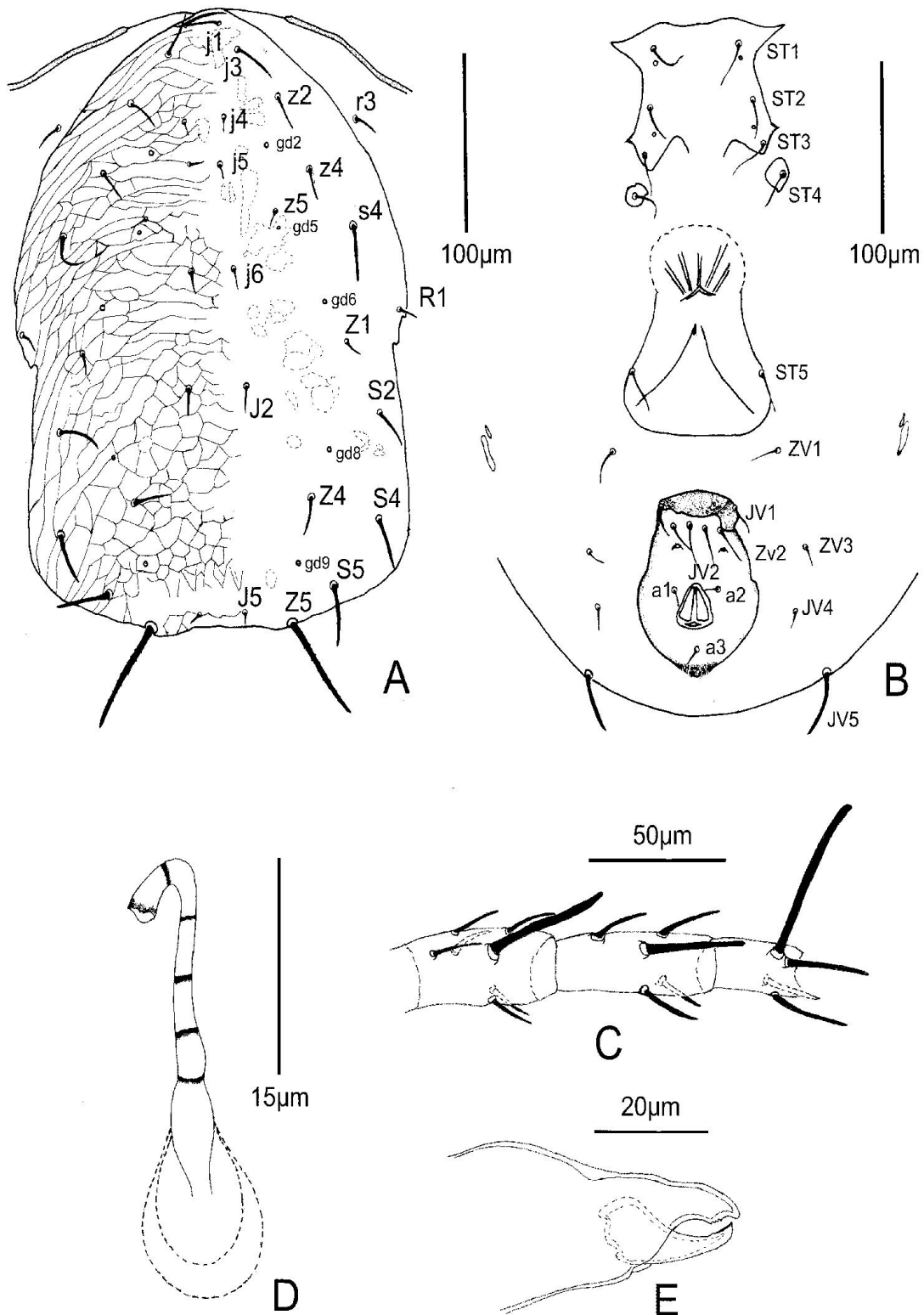


Figure 3. *Euseius bandispermathecae* sp. nov. (female) – A. Dorsal view of idiosoma; B. Ventral view of idiosoma; C. Genu, tibia and basitarsus IV; D. Spermatheca; E. Chelicera.

Venter (Figs. 3B and 4B) – All shields smooth. Sternal shield with 104 (103–105) long and 82 (80–85) wide at level setae ST2, with three pairs of setae and two pairs of

lyrifissures; one pair of setae (ST4) on the membrane; posterior margin not clearly outlined in all specimens. Distances between ST1-ST3 93 (93–95), ST2-ST2 68 (68–70), ST5-ST5 85 (83–88). Two pairs of metapodal shields, primary shield 23 long, 6 wide and secondary shield 10 long. Ventrianal shield 106 (105–108) long, 54 (50–58) wide at level of JV2 setae and 81 (77–83) wide at level of anus; with three pairs of preanal setae, JV1, JV2 and ZV2, and one pair of large elliptical preanal pores. Membrane surrounding ventrianal shield with four pairs of setae ZV1, ZV3, JV4 and JV5; the latter 36 (33–40) long, smooth.

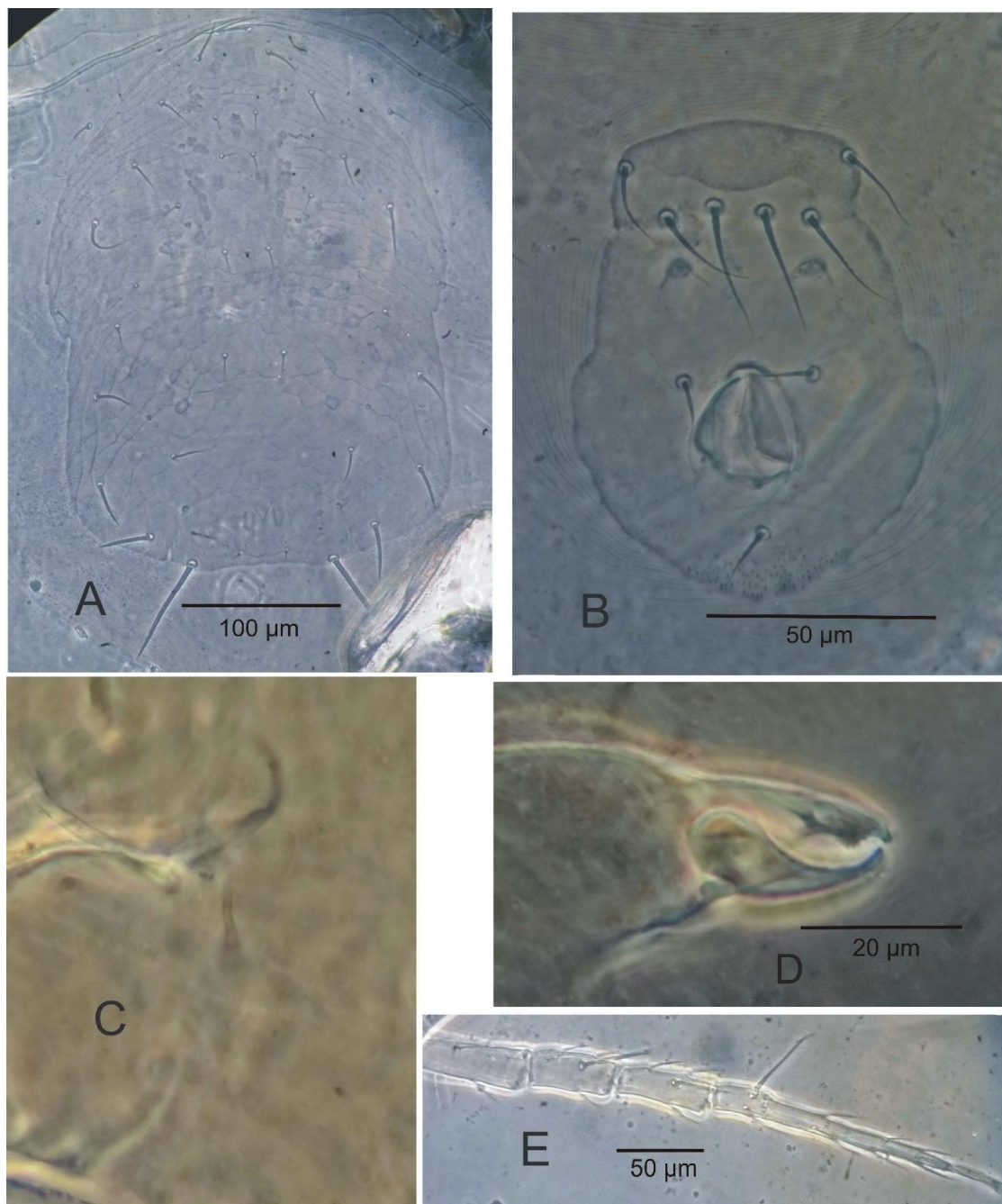


Figure 4. *Euseius bandispermataecae* sp. nov. (female) – A. Dorsal Shield; B. Ventrianal plate; C. Spermatheca; D. Chelicera; E. Leg IV.

Chelicera (Figs. 3E and 4D) – Fixed digit 27 (25–28) long, with four teeth; movable digit 24 (23–25) long, with one tooth.

Spermatheca (Figs. 3D and 4C) – Calyx tubular, looped, elongated, with dark transverse narrow bands, 15 long; atrium, minor and major ducts indistinct.

Legs – Legs IV (Figs. 3C and 4E) with three smooth macrosetae blunt distally and of the following lengths: genu 46 (45–48), tibia 36 (35–38), basitarsus 56 (53–58). Chaetotactic formula of genu II: 1–2/0, 1/1–1; genu III: 1–1/1, 1/1–1. Length of leg I: 380–400, leg II: 275–300, leg III: 310–325 and leg IV: 425–440.

Material examined

Holotype female (AINP/Acar.lab/BCKV/5722/2015), collected from wild tomato, *Lycopersicon* sp. (Solanaceae), from Tezpur: 26° 38' 32" N, 92° 46' 58" E, 48 m above mean sea level, Assam State, on 26.iv.2015; 6 paratype females (AINP/Acar.lab/BCKV/5723–5729/2015), same collection data as holotype; 5 paratype females (AINP/Acar.lab/BCKV/5734–5738/2015), collected from *Jatropha curcas* (Euphorbiaceae), from Bhalukpong: 27° 0' 40" N, 92° 38' 44" E, 213 m above mean sea level, West Kameng, Arunachal Pradesh State on 28.iv.2015.

Remarks

Euseius bandispermathecae **sp. nov.** is unique within the genus by the shape of the calyx of the spermatheca, with transverse dark bands. The pot shaped ventrianal shield of the *E. bandispermathecae* **sp. nov.** resembles with the ventrianal shield of *E. querci* (Liang and Ke, 1983); *Euseius vulgaris* (Liang and Ke, 1983) and *E. longiverticalis* (Liang and Ke, 1983) but their shape varies from the former species and also the former species differs from the latter species by the shape of spermatheca. The margins of ventrianal shield of *E. bandispermathecae* **sp. nov.** is thickened with sclerotization which is also not match with its close species.

Etymology

The name of the species *bandispermathecae* refers to the unique dark banded calyx of the spermatheca.

***Euseius bomdilae* sp. nov. (Figs. 5 and 6)**

***Adult female* (n = 5)**

Dorsum (Figs. 5A & 6A) – Dorsal shield 333 (325–350) long and 228 (225–235) wide, with anterolateral diagonal lines with 30 pairs of sigilla on dorsal shield; five pairs solenostomes (gd2, gd4, gd6, gd8 and gd9) and one pair lyrifissure; 17 pairs of dorsal setae and two pairs of sublateral setae: j1 30 (28–33), j3 18, j4 10, j5 14 (10–20), j6 14 (13–15), J2 18, J5 11 (10–13), z2 14 (13–15), z4 16 (13–18), z5 11 (10–13), Z1 17 (15–18), Z4 17 (15–18), Z5 51 (48–53), s4 21 (18–23), S2 17 (15–18), S4 18 (18–20), S5 17 (15–18), r3 18, R1 15. All setae smooth.

Peritreme – Extending forward to level between j3 and z2.

Venter (Figs. 5B and 6B) – All shields smooth. Sternal shield with 88 (87–90) long and 80 (75–88) wide at level setae ST2, with three pairs of setae and two pairs of lyrifissures; one pair of setae (ST4) on the membrane; posterior margin not clearly discernible. Distances between ST1–ST3 90, ST2–ST2 65, ST5–ST5 83. Two pairs of metapodal shields, primary shield 18 (18–20) long, 6 wide and secondary shield 8 long.

Ventrianal shield 103 (100–105) long, 49 (45–53) wide at level of JV2 setae and 67 (65–68) wide at level of anus; with three pairs of preanal setae, JV1, JV2 and ZV2, and one pair of large elliptical preanal pores. Membrane surrounding ventrianal shield with four pairs of setae ZV1, ZV3, JV4 and JV5; the latter 24 (23–25) long, smooth.

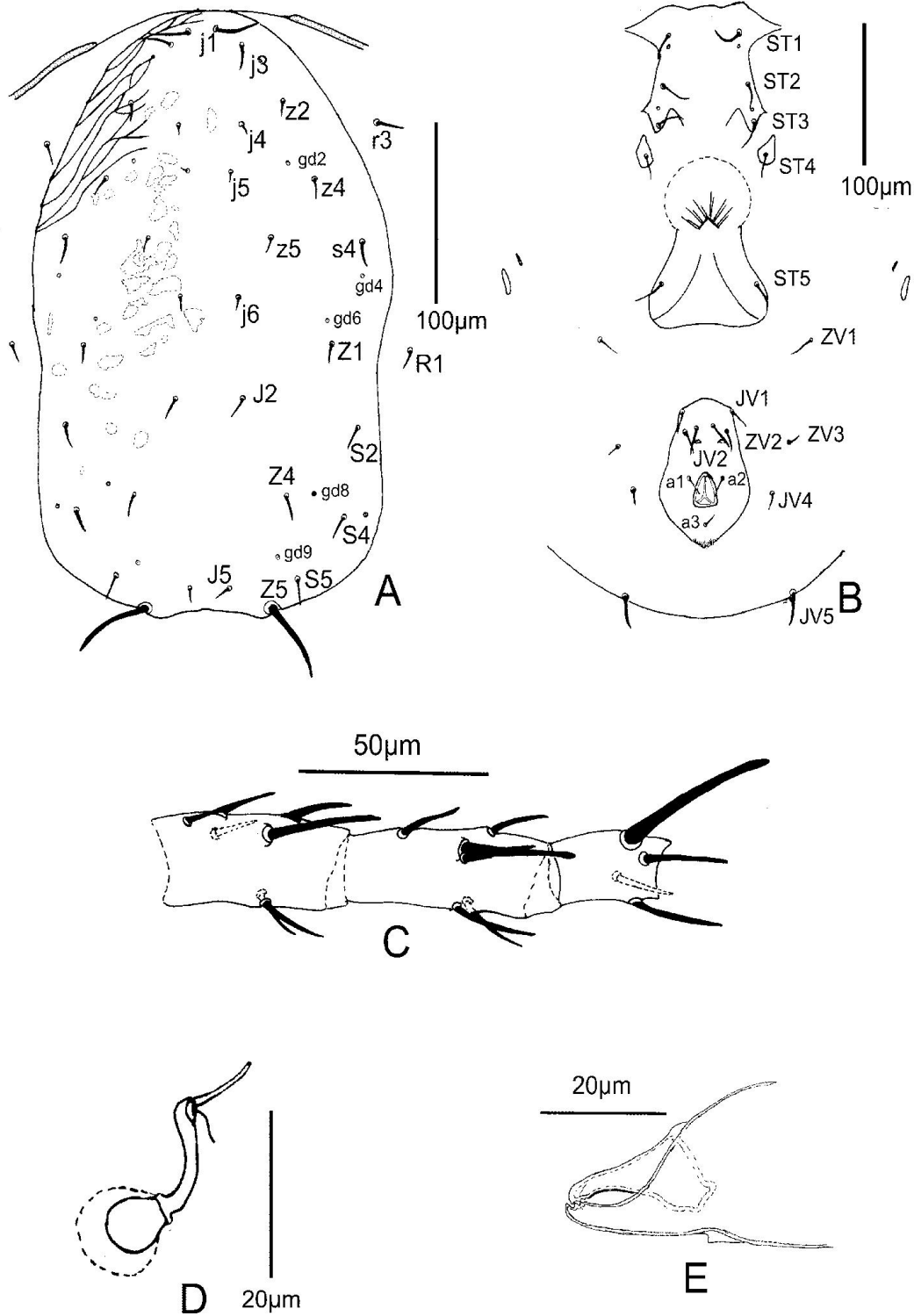


Figure 5. *Euseius bomdilae* sp. nov. (female) – A. Dorsal view of idiosoma; B. Ventral view of idiosoma; C. Genu, tibia and basitarsus IV; D. Spermatheca; E. Chelicera.

Chelicera (Figs. 5E and 6C) – Fixed digit 27 long, with three teeth; movable digit 24 long, with two teeth.

Spermatheca (Figs. 5D and 6D) – Calyx tubular 8 long, flared at the base of vesicle. Atrium distinct with major and minor duct.

Legs – Legs IV (Figs. 5C and 6E) with three smooth macrosetae with blunt tips and of the following lengths: genu 31 (30–33), tibia 31 (30–33), basitarsus 45 (43–48). Chaetotactic formula of genu II: 2–2/0, 2/0–1; genu III: 1–2/1, 2/0–1. Length of leg I: 343–363, leg II: 280–300, leg III: 285–310, leg IV: 375–400.

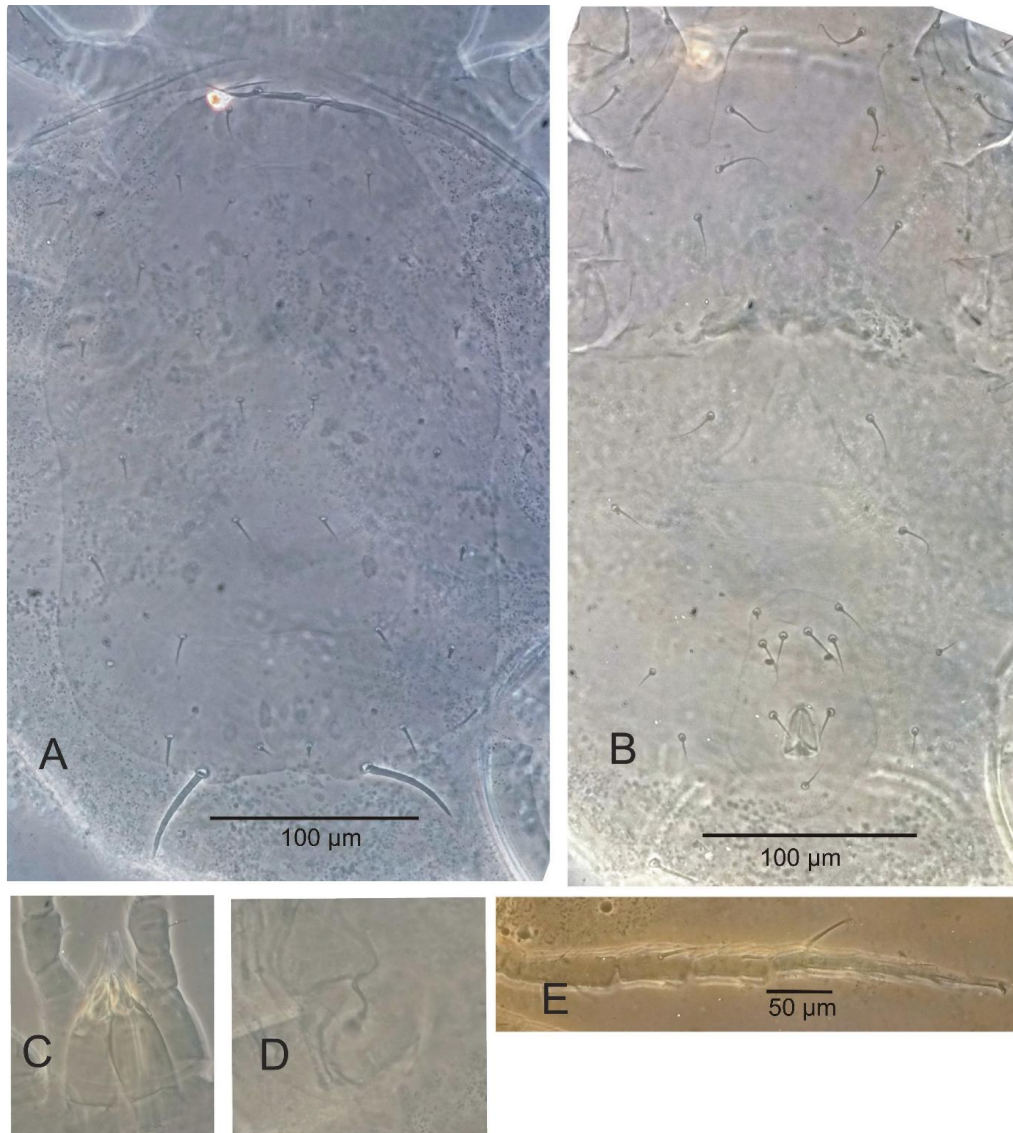


Figure 6. *Euseius bomdilae* sp. nov. (female) – A. Dorsal Shield; B. Ventral shield; C. Chelicera; D. Spermatheca; E. Leg IV.

Material examined

Holotype female (AINP/Acar.lab/BCKV/5744/2015), collected on *Rosa chinensis* (Rosaceae), from Bomdila: 27° 15' 53" N, 92° 25' 8" E, 2528 m above mean sea level, West Kameng, Arunachal Pradesh, on 27.v.2014; 4 paratype females (AINP/Acar.lab/BCKV/ 5745–5748/2014) with same collection data as holotype.

Remarks

Euseius bomdilae **sp. nov.** is close to *E. aizawai* (Ehara and Bhandhufalck, 1977) and *E. australis* (Wu and Li, 1983) differing by the longer j5, J2, J5, Z1 and Z4 setae in latter species. This new species also differs from *E. aizawai* and *E. australis* by the shape of the spermatheca which are short and fundibular calyx in comparison to longer and tubular calyx in the new species and by the longer and narrower ventrianal shield. *E. bomdilae* **sp. nov.** further differs from *E. aizawai* by having rugose patches on dorsal shield and which is smooth in *E. australis*.

Etymology

The epithet *bomdilae* refers to the locality of Arunachal Pradesh of India where the types of this species were collected.

Typhlodromus (Anthoseius) De Leon, 1959

Anthoseius De Leon, 1959: 258.

Type species: *Anthoseius hebetis* De Leon, 1959: 258

Amblydromella Muma, 1961: 294.

Clavidromus Muma, 1961: 296.

Typhlodromella Muma, 1961: 299.

Chanteius (Colchodromus) Wainstein, 1962b: 19.

Mumaseius De Leon, 1965b: 23.

Orientiseius Muma and Denmark, 1968: 238.

Typhlodromus (Anthoseius), Van der Merwe, 1968: 20.

Indodromus Ghai and Menon, 1969: 348.

Berethria Tuttle and Muma, 1973: 35.

Vittoseius Kolodochka, 1988: 42.

Typhlodromus rhenanus group, Chant, 1959: 62.

Typhlodromus barkeri group, Chant, 1959: 60.

Females of this subgenus are characterized by having most often dorsal idiosomalsetal pattern 12A:8A (j1, j3 - j6, J2, J5, z2- z5, Z4, Z5, s4, s6, S2, S4, S5, r3 and R1), occasionally 12A:7B (which differs from the previous by the absence of seta S4) and 11D:8B (which differs from the first by the absence of z3) and usually JV:ZV (JV1-JV5, ZV1-ZV3); occasionally JV-3:ZV (which differs from the previous by the absence of JV3) or JV-4:ZV (which differs from the first by the absence of JV4). Ventrianal shield is usually pentagonal or subquadrate, with four pairs of preanal setae (JV1, JV2, JV3, ZV2), peritremes relatively long extending beyond the level of setae j1. Chelicerae with few teeth, fixed digit with 2–7 small to minute teeth, all on the distal portion; movable digit with 1–2 teeth. Macrosetae usually present on genu IV, tibia IV and tarsus IV, often also on genu II and III, and rarely on genu I.

***Typhlodromus (Anthoseius) dahungensis* sp. nov. (Figs. 7–10)**

Adult female (n = 4)

Dorsum (Figures 7A & 8A) – Dorsal shield 330 (323–338) long and 197 (193–200) wide, strongly reticulated on the whole dorsum, with four pairs solenostomes (gd5, gd6, gd8, and gd9), six pairs lyrifissures (id2, idx2, idm6, idl2, idl3 and idl4); 18 pairs of

setae on dorsal shield and two pairs of setae on unsclerotized cuticle: j1 11 (8–13), j3 18 (13–20), j4 11 (10–13), j5 12 (10–15), j6 16 (13–20), J2 19 (18–23), J5 10, z2 14 (13–15), z3 17 (15–18), z4 18 (15–20), z5 14 (13–15), Z4 25 (23–33), Z5 43 (35–53), s4 19 (18–23), s6 23 (23–25), S2 23 (23–25), S4 23 (20–28), S5 16 (15–18), r3 18 (18–20), R1 16 (15–18). All setae smooth, except Z4 and Z5 barbed; tip of Z5 bulbous.

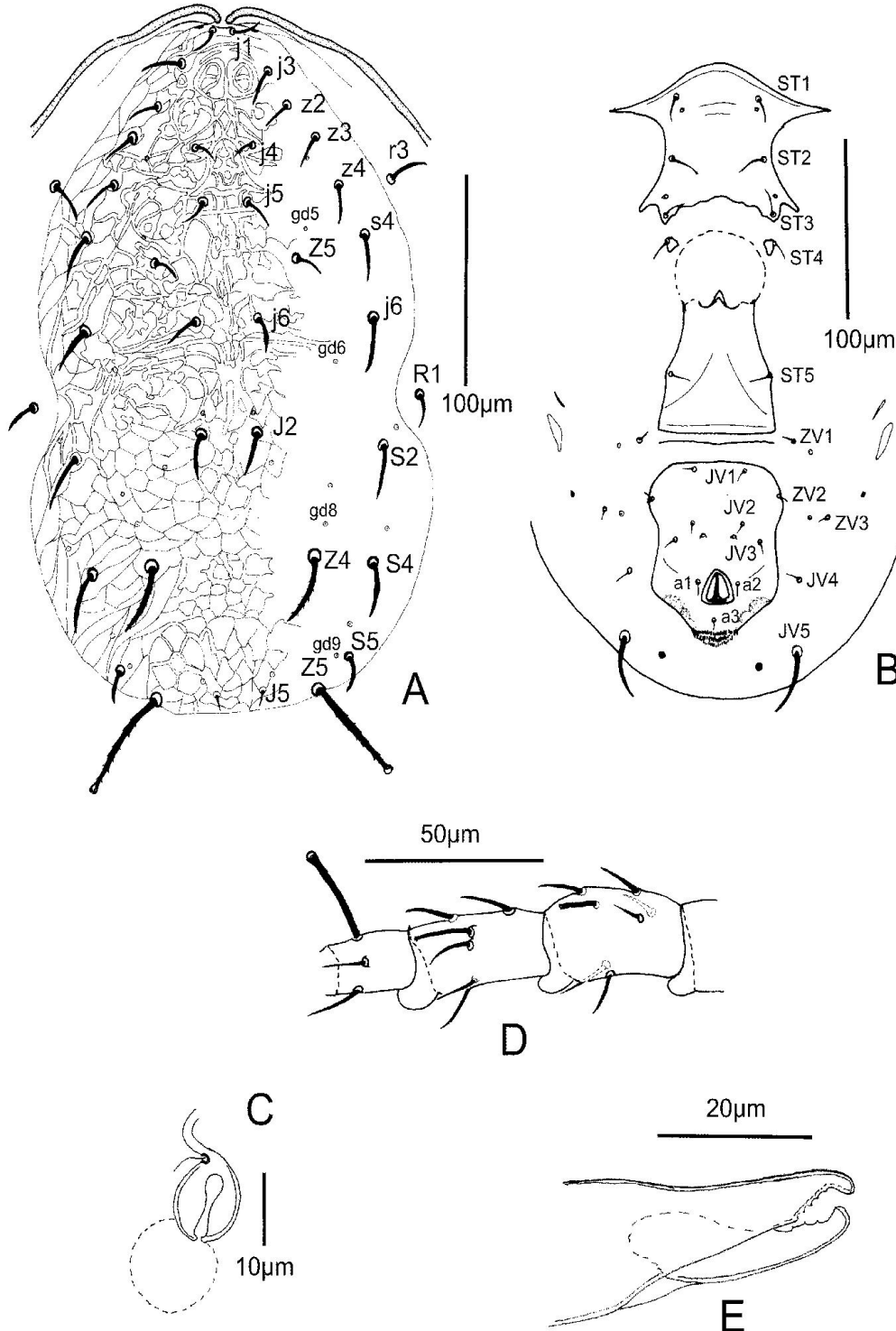


Figure 7. *Typhlodromus (Anthoseius) dahungensis* sp. nov. (female) – A. Dorsal view of idiosoma; B. Ventral view of idiosoma; C. Spermatheca; D. Genu, tibia and basitarsus IV; E. Chelicera.

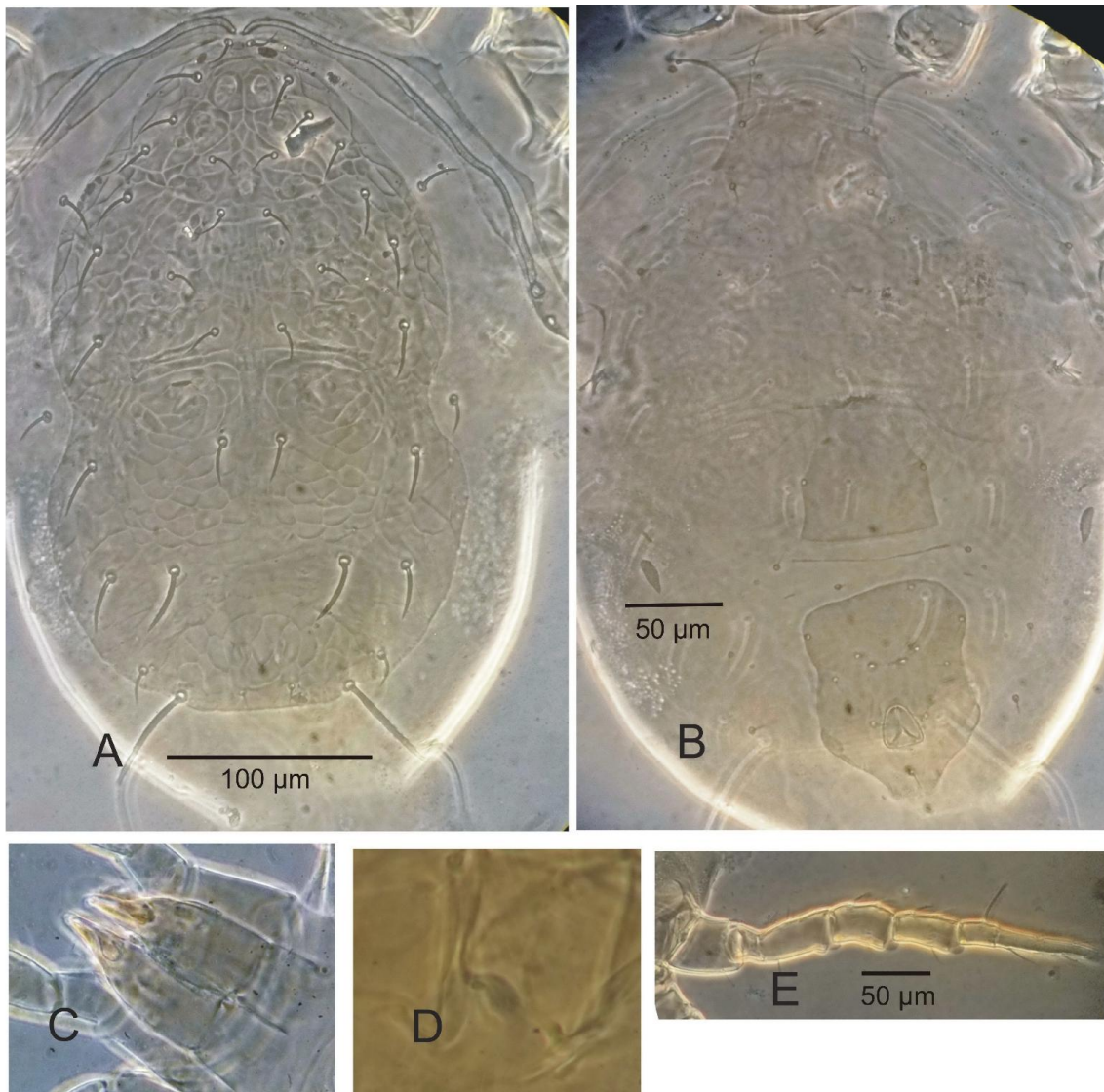


Figure 8. *Typhlodromus (Anthoseius) dahungensis* sp. nov. (female) – A. Dorsal shield; B. Ventral shield; C. Chelicerae; D. Spermatheca; E. Leg IV.

Peritreme- Extending forward beyond level of j1.

Venter (Figs. 7B and 8B) – All shields smooth. Sternal shield with 86 (85–88) long and 63 (63–65) wide at level setae ST2, with three pairs of setae and two pairs of lyrifissures; one pair of setae (ST4) on unsclerotized membrane; posterior margin concave and wavy. Distances between ST1-ST3 87 (85–88), ST2-ST 258 (58–60), ST5-ST5 59 (58–60). Two pairs of metapodal shields, primary shield 23 (18–25) long, 6 wide and secondary shield 11 (8–13) long and distinct. Ventrianal shield 101 (98–105) long, 66 (50–80) wide at level of JV2 setae and 73 (70–78) wide at level of anus; with four pairs of preanal setae, JV1, JV2, JV3 and ZV2, and one pair of large elliptical preanal pores. Membrane surrounding ventrianal shield with four pairs of setae ZV1, ZV3, JV4 and JV5; the latter 33 (30–35) long, smooth.

Chelicera (Figs. 7E and 8C) – Fixed digit 27 long, with five teeth; movable digit 24 long, with three teeth.

Spermatheca (Figs. 7C and 8D) – Calyx saccular, 4 long, with distinct atrium,

minor and major duct.

Legs – Legs IV (Figures 7D and 8E) with three smooth macrosetae with bulbous tip and of the following lengths: genu 11 (10–13), tibia 15, basitarsus 35 (30–40). Chaetotactic formula of genu II: 0–2/0, 2/1–2; genu III: 1–1/0, 2/1–2. Length of leg I: 268–293, II: 238–250, III: 233–255, IV: 300–320.

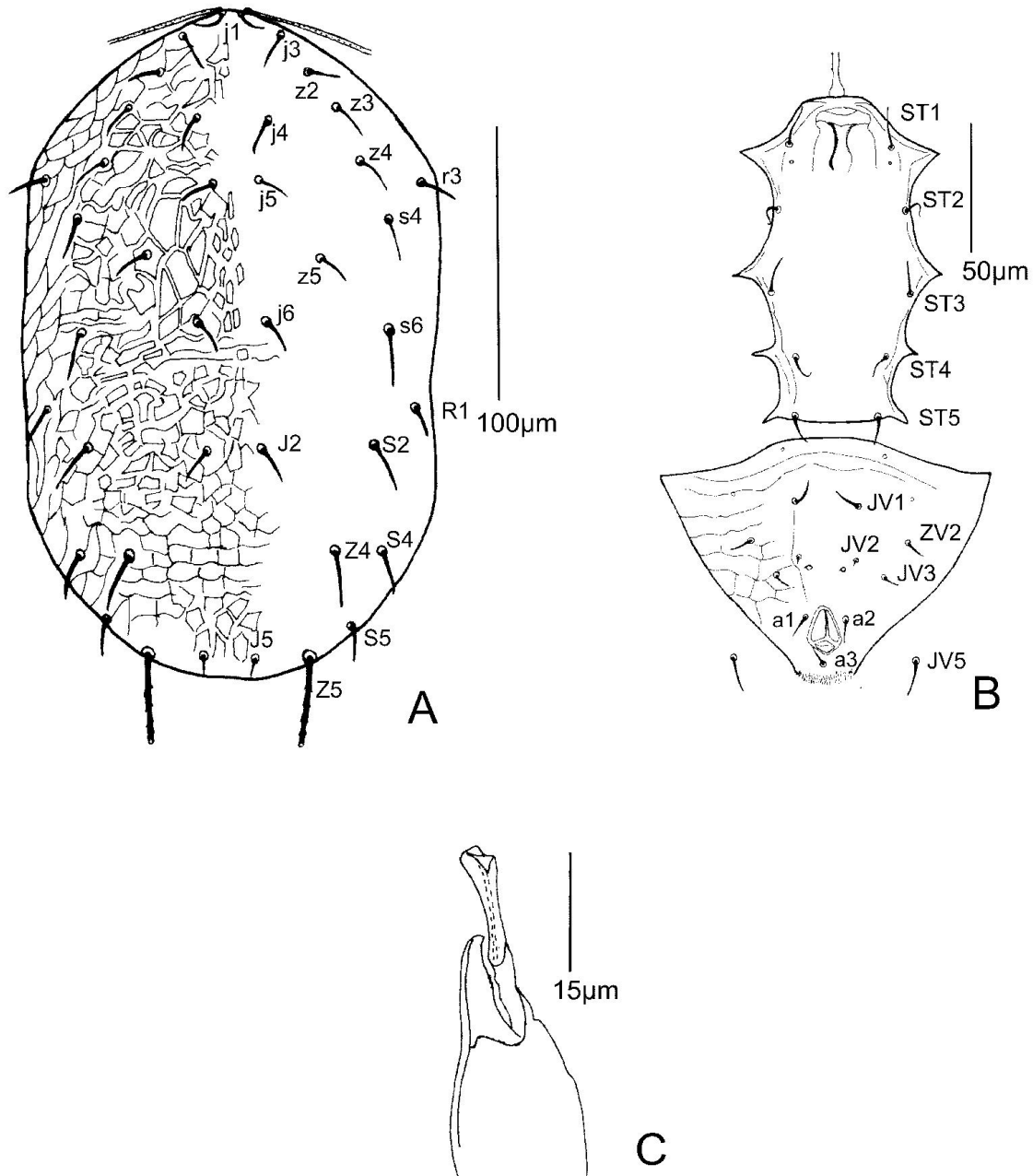


Figure 9. *Typhlodromus (Anthoseius) dahungensis* sp. nov. (male) – A. Dorsal shield; B. Ventral surface; C. Spermatodactyl.

Adult male (n = 3)

Dorsum (Figs. 9A and 10A) – Dorsal shield 243 (240–248) long and 156 (155–157) wide, reticulated on the whole dorsum, solenostomes not distinguishable; 18 pairs of setae on dorsal shield and two pairs of setae on unsclerotized cuticle: j1 13 (13–14), j3

18, j4 13, j5 13, j6 15, J2 18, J5 10 (9–10), z2 13, z3 15 (15–16), z4 15, z5 13, Z4 22, Z5 33 (32–33), s4 17 (17–18), s6 21 (20–21), S2 20, S4 17 (17–18), S5 12 (12–13), r3 17 (16–17), R1 15. All setae smooth, except Z4 and Z5 serrated; tip of Z5 bulbous.

Peritreme – Extending beyond level of j1.



Figure 10. *Typhlodromus (Anthoseius) dahungensis* sp. nov. (male) – A. Dorsal shield; B. Ventral shield; C. Chelicerae.

Venter (Figs. 9B and 10B) – The sternogenital shield with few lateral lines and ventrianal shields reticulated. Sternogenital shield with five pairs of setae and one pair

of distinguishable lyrifissures. Ventrianal shield 94 long, 117 wide at the level of JV2 setae, with four pairs of preanal setae, JV2, JV3, JV4 and ZV2, one pairs of poroids and two pairs of distinguishable lyrifissures. Unsclerotized membrane surrounding ventrianal shield with one pair of setae, JV5, at level with anal opening.

Legs – Leg IV with three smooth macrosetae bulbous at the tip and of following lengths; genu 11, tibia 11, basitarsus 16 (16–17). Chaetotactic formula of genu II and genu III are identical to the female. Length of leg I: 223–233, leg II: 185–190, leg III: 183–188, leg IV: 218–250.

Chelicera (Figs. 9C and 10C) – Spermatodactyl with an elongated shaft terminating with a wide toe, 15 long.

Material examined

Holotype female (AINP/Acar.lab/BCKV/5684/2015), collected from *Artocarpus heterophyllus* (Moraceae), from Dahung: 27°12' 9" N 92° 29' 29" E, 1262 m above mean sea level, West Kameng, Arunachal Pradesh State, on 30.iv.2015; 1 paratype male (AINP/ Acar.lab/BCKV/5693/2015) same collection data as holotype; 1 paratype male (AINP/Acar.lab/BCKV/5685/2015), same collection data as holotype; 3 paratype females (AINP/Acar.lab/BCKV/5687–5789/2015) and 1 paratype male (AINP/Acar.lab/BCKV/5686/2015) from *Rosa chinensis* (Rosaceae), same locality as holotype, 01.v.2015.

Remarks

Typhlodromus (Anthoseius) dahungensis **sp. nov.** is close to *T. (A.) fujianensis* (Wu and Liu, 1991), and *T. (A.) brisbanensis* (Schicha, 1978). It differs from *T. (A.) fujianensis* in the posterior margin of sternal shield which is concave, smooth and ST3 out of shield while it is concave wavy and ST3 on sternal shield in case of the *T. (A.) dahungensis* **sp. nov.** The shape of spermatheca varies which is fundibular in *T. (A.) fujianensis* while it is saccular in former species. The new species also varies from the latter in all the dorsal shield setae those are shorter in the former species than the latter species and also varies in the shape of male spermatodactyl which is beak shaped in *T. (A.) dahungensis* **sp. nov.** and L-shaped in *T. (A.) fujianensis*. The male ventrianal plate is wide and triangular with smooth lateral margin in the former species while there are notch on anterior lateral margins in the latter species. The posterior margin of sternal shield forms a loop, the tip of JV5 is bulbous and with 3 backwardly directed pointed teeth in the movable digit in *T. (A.) brisbanensis* while it is concave and wavy, the tip of JV5 is pointed and 3 straight teeth in movable digit of chelicerae in the former species.

Etymology

The epithet *dahungensis* refers to the locality where the types of this species were collected.

***Phytoseius* Ribaga, 1904**

Phytoseius Ribaga, 1904: 177. *Gamasus plumifer* Canestrini and Fanzago, 1876: 130.

By subsequent designation (Vitzthum 1941).

Phytoseius (Phytoseius), Wainstein, 1959: 1361.

Phytoseius (Dubininellus), Wainstein, 1959: 1361.

Dubininellus, Muma, 1961: 293.

Phytoseius (Pennaseius), Pritchard and Baker, 1962: 223.
Pennaseius, Schuster and Pritchard, 1963: 299.
Typhlodromus (Phytoseius), van der Merwe, 1968: 100.
Phytoseius (Euryseius), Wainstein, 1970: 1726.

Females of this genus are characterized by having dorsal idiosomal setal pattern 12A:3A (j1, j3-j6, z2-z5, s4, s6, r3, J5, Z4 and Z5), 12A:4A (which differs from the previous by the presence of seta R1) or 12A:5A (which differs from the previous by the presence of J2 and R1), opisthogastric region with JV-3, 4:ZV; peritreme extend beyond or up to base of j1; preanal setae usually inserted on the lateral margins of the female ventrianal shield in a vertical row; female ventrianal shield of most species long, narrow, sole-shaped, with a distinct waist; with seta JV2 present. Chelicerae with fewer teeth, Ge II with 7 setae and tip of macrosetae of leg IV are variable.

***Phytoseius dorsospinosus* sp. nov. (Figs. 11–13)**

***Adult female* (n = 3)**

Dorsum (Figs. 11A, 12A, B & 13) – Dorsal shield 296 (290–302) long and 159 (153–163) wide, strongly reticulated, with spine-like structures on dorso-median region (Fig. 13), with one pair solenostomes (gd5); 15 pairs of setae on dorsal shield: j1 33 (30–35), j3 38, j4 5, j5 5, j6 8, J5 8, z2 21 (20–23), z3 36 (33–38), z4 14 (13–15), z5 8, Z4 107 (105–108), Z5 78 (75–85), s4 144 (141–148), s6 99 (98–101), r3 49 (48–50). All setae are serrated, while the setae j4, j5, j6, J5, z4 and z5 are short and smooth.

Peritreme – Extending forward beyond level of j1.

Venter (Figs. 11B and 12E) – All shields smooth. Sternal shield with 113 long and 80 wide at level of setae ST2, with three pairs of setae and two pairs of lyrifissures; one pair of setae (ST4) on the unsclerotized membrane; posterior margin not clearly outlined in all specimens. Distances between ST1-ST3 89 (88–90), ST2-ST2 66 (65–68), ST5-ST5 82 (80–83). Metapodal shields not distinguishable. Ventrianal shield vase shaped, 94 (93–95) long, 35 (33–38) wide at level of JV2 and 54 (53–55) wide at level of anus; with three pairs of preanal setae (JV1, JV2 and ZV2), arranged at the anterolateral margin of the shield with one pair of preanal pores. Membrane surrounding ventrianal shield with three pairs of setae ZV1, ZV3, and JV5; the latter 59 (58–60) long and serrated.

Chelicera (Figs. 11E and 12C) – Fixed digit 23 long, with two teeth; movable digit 20 long, with one tooth.

Spermatheca (Figs. 11D and 12D) – Calyx of spermatheca short, pocular, 5 long; atrium bifurcate.

Legs – Legs IV (Figs. 11C and 12F) with three smooth macrosetae with rounded tips and of the following lengths: genu 15 (13–18), tibia 51 (50–53), basitarsus 28 (28–30). Chaetotactic formula of genu II: 1–2/0, 2/1–1; genu III: 1–2/0, 2/1–0. Length of leg I: 288–303, leg II: 250, leg III: 248–250, leg IV: 445–450.

Material examined

Holotype female (AINP/Acar.lab/BCKV/5690/2015), collected from Sadabansh (*Bambusa* sp.), Dahung: 27° 12' 9" N 92° 29' 29" E, 1262 m above mean sea level, West Kameng, Arunachal Pradesh State, on 28.iv.2015; 2 paratype females (AINP/

Acar.lab/BCKV/5691–5692/2015), collected from *Bambusa* sp., at the same locality and date.

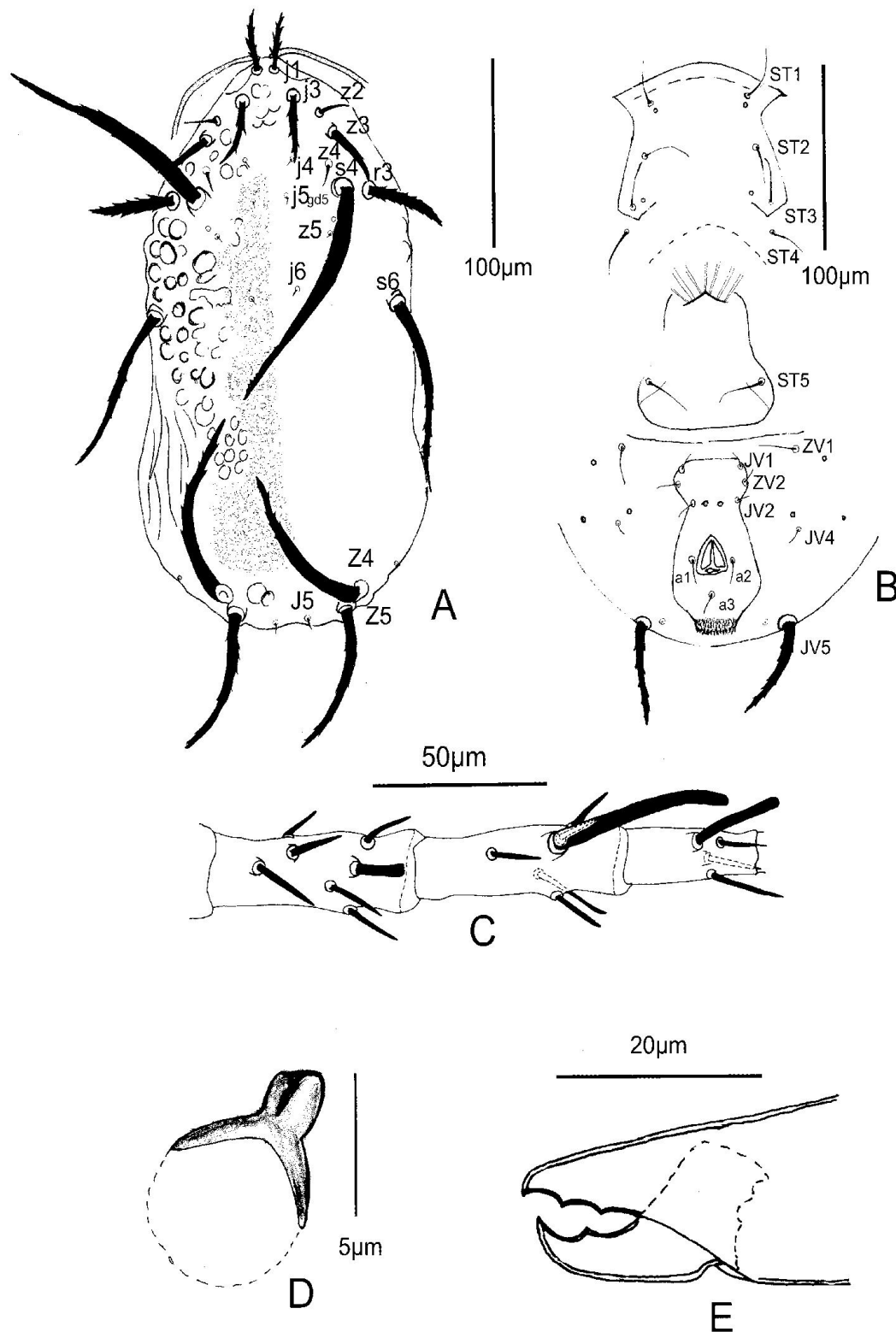


Figure 11. *Phytoseius dorsospinosus* sp. nov. (female) – A. Dorsal view of idiosoma; B. Ventral view of idiosoma; C. Genu, tibia and basitarsus IV; D. Spermatheca; E. Chelicera.

Remarks

Phytoseius dorsospinosus **sp. nov.** is close to *P. rubiginosae* Schicha, 1984 and *P. rubii* Xin, Liang and Ke, 1982 all belong to the *Phytoseius horridus* species group but both differ from the new species by having calyx of spermatheca long, tubular and by not having atrium bifurcate. The former species having 3 macrosetae with rounded tip on leg IV differs from the *P. rubiginosae* with 4 macrosetae on leg IV and bulbous tip. The new species is characterized by having profuse spine-like structures on dorso-median region (Fig. 13) those are absent in the latter species.

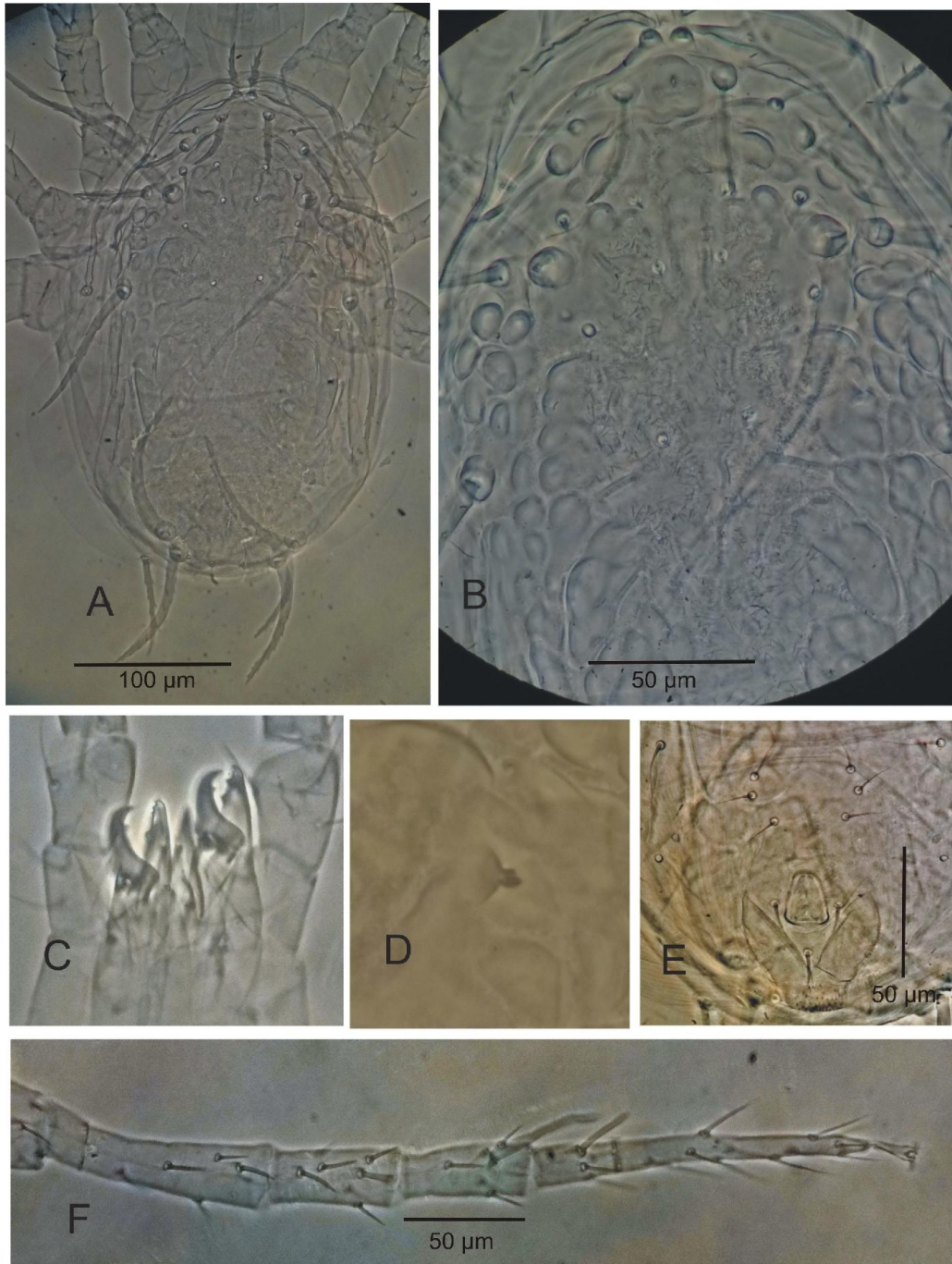


Figure 12. *Phytoseius dorsospinosus* **sp. nov.** (female) – A. Dorsal shield; B. Dorsal surface showing spines; C. Chelicerae; D. Spermatheca; E. Ventrianal shield; F. Leg IV.

Etymology

The epithet *dorsospinosus* refers to profuse spine-like structures on dorso-median region of the dorsal shield.

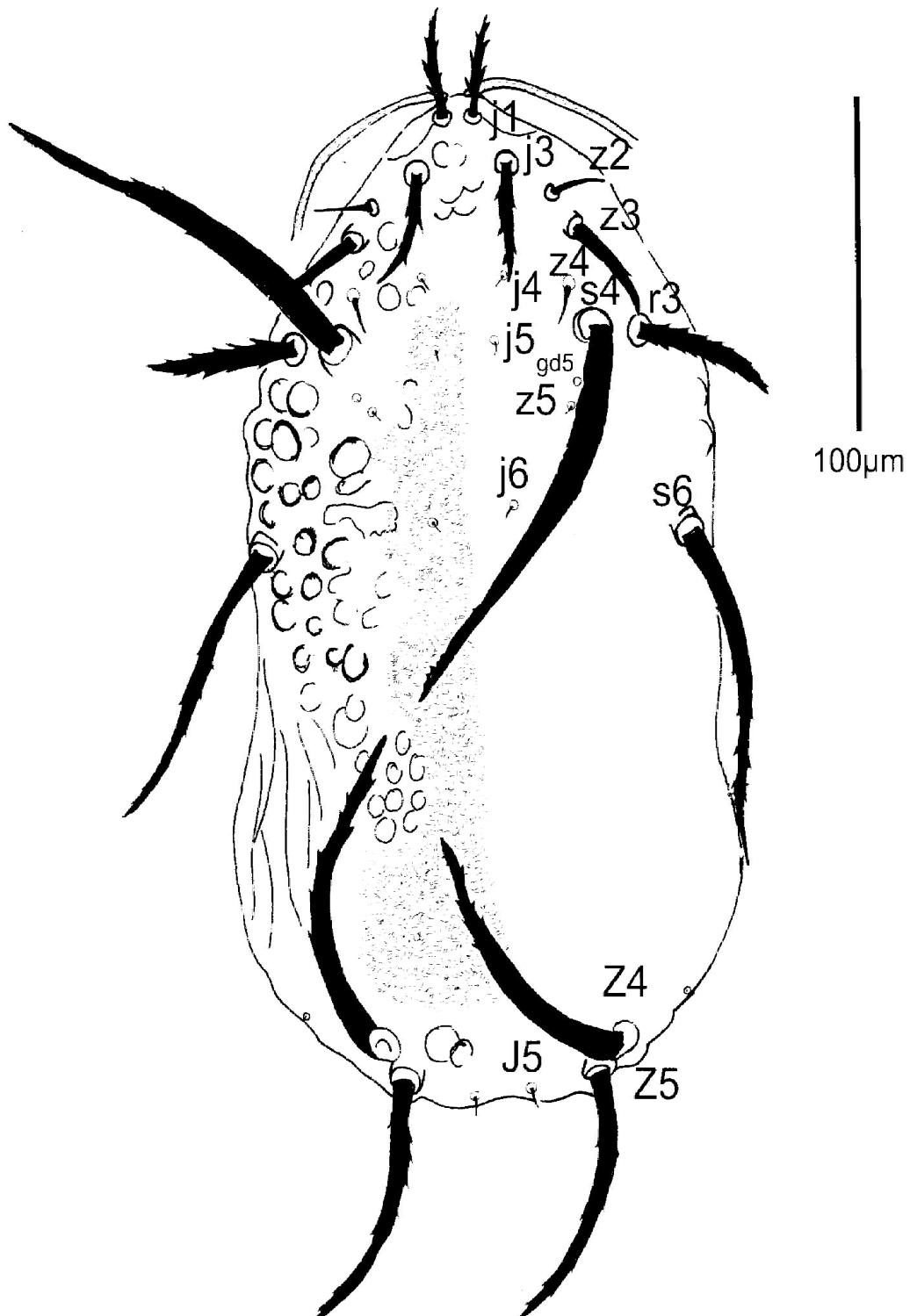


Figure 13. *Phytoseius dorsospinosus* sp. nov. (female) – Showing dorsal shield with profuse spine like structure.

Phytoseius leopardisimilis sp. nov. (Figs. 14 and 15)

Adult female (n = 2)

Dorsum (Figs. 14A and 15A) – Dorsal shield (283–285) long and 153 wide, strongly imbricated dorsal idiosoma with characteristic leopard skin like design; with two pairs solenostomes (gd5 and gd6); 15 pairs of setae on the dorsal shield: j1 35, j3 40, j4 8, j5 8, j6 10, J5 20, z2 (20–23), z3 35, z4 (20–23), z5 10, Z4 (75–78), Z5 (80–83), s4 80, s6 (85–90), r3 45 inserted on dorsal shield. All setae are serrated, while the setae j4, j5, j6 and z5 are short and smooth.

Peritreme – Extending forward upto level of j1.

Venter (Figs. 14B and 15B) – All shields smooth. Sternal shield with 115 long and 80 wide at level setae ST2, with three pairs of setae and two pairs of lyrifissures; one pair of setae (ST4) on the membrane; posterior margin obscure in all specimens. Distances between ST1-ST3 (85–88), ST2-ST2 60, ST5-ST5 (65–68). Ventrianal shield vase shaped, with anterior margin straight, 93 long, 33 wide at level of JV2 setae and 80–84 wide at level of anus; with two pairs of preanal setae (JV1 and JV2) and one pairs of lyrifissures. Membrane surrounding ventrianal shield with four pairs of setae, ZV1, ZV2, ZV3 and JV5; the latter (68–70) long, serrated.

Chelicera (Figs. 14E and 15C) – Fixed digit 25 long, with three teeth; movable digit 23 long, with one tooth.

Spermatheca (Figs. 14D and 15D) – Calyx of spermathecal fundibular, 5 long; atrium nodular, major duct visible and minor duct obscure.

Legs – Legs IV (Figs. 14C and 15E) with three smooth macrosetae with pointed tip on both genu and tibia and blunt on tarsus IV; of the following lengths: genu 20, tibia (33–35), basitarsus 35. Chaetotactic formula of genu II: 1–2/0, 2/1–1; genu III: 1–2/0, 2/1–0. Length of leg I: 285–300, leg II: 245–250, leg III: 245–250, leg IV: 440–456.

Material examined

Holotype female (AINP/Acar.lab/BCKV/5694/2015), collected from Badampata (*Terminalia catappa*), at Chilipam: 27° 11' N, 92° 23' E, 2217 m above mean sea level, West Kameng, Arunachal Pradesh State, on 30.iv.2015; 1 paratype female (AINP/Acar.lab/BCKV/5695/2015) collected from Sadabansh (*Bambusa* sp.), at the same locality, on 28.iv.2015.

Remarks

Phytoseius leopardisimilis sp. nov. is close to *P. severus* Wainstein and Vartapetov, 1972 but the reticulation pattern of dorsal shield of the latter is rounded granular, the setae s4 117, Z4 92 and Z5 90 are longer, and the calyx of its spermatheca is wide and saccular while it is leopard skin like design, shorter s4 80, Z4 75 and Z5 80 and fundibular calyx in the former species. The seta z2 20 is long and serrated in the former species while z2 13 is short and smooth in the latter species and also the macroseta on tibia of leg IV is much longer than the former species.

Etymology

The epithet *leopardisimilis* refers to the reticulation pattern of the dorsal idiosomal shield, which looks like that of the skin of a leopard.

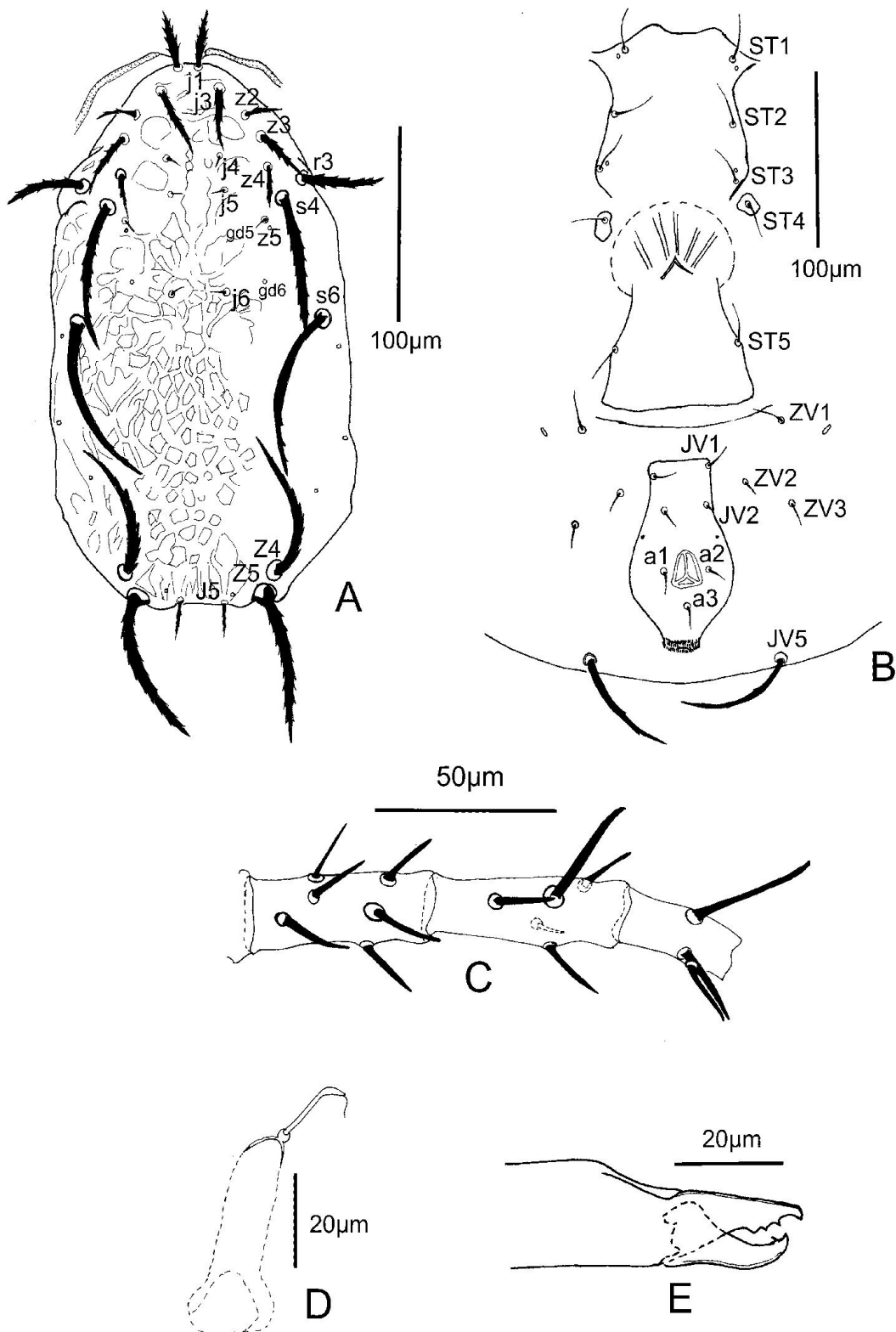


Figure 14. *Phytoseius leopardisimilis* sp. nov. (female) – A. Dorsal view of idiosoma; B. Ventral view of idiosoma; C. Genu, tibia and basitarsus IV; D. Spermatheca; E. Chelicera.

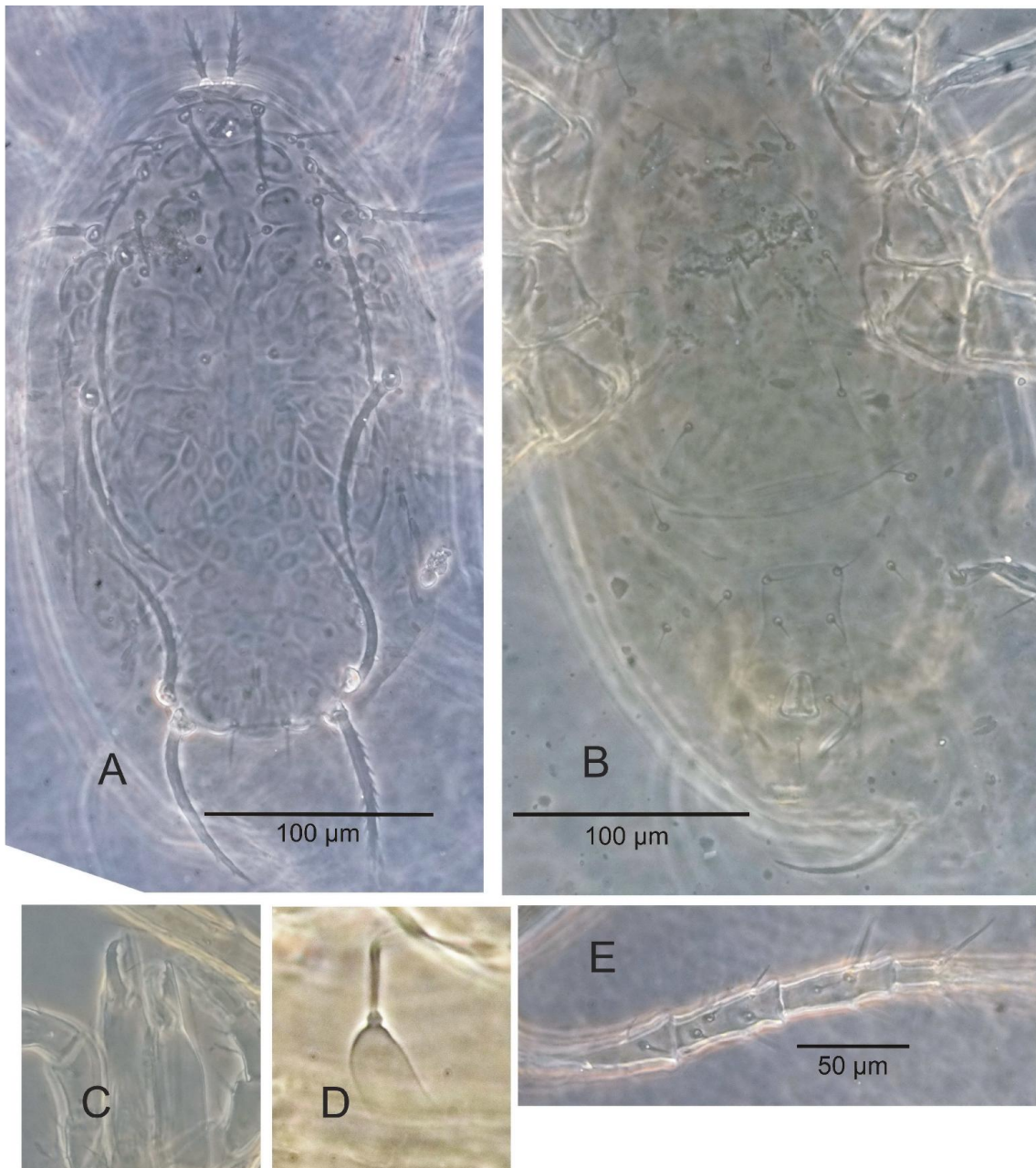


Figure 15. *Phytoseius leopardisimilis* sp. nov. (female) – A. Dorsal Shield; B. Ventral shield; C. Chelicerae; D. Spermatheca; E. Leg IV.

Acknowledgements

The authors are grateful to the Indian Council of Agricultural Research, New Delhi and to the Vice-Chancellor and Director of Research, Bidhan Chandra Krishi Viswavidyalaya, for providing infrastructure facilities; Dr. Vikram Prasad (West Bloomfield, MI, USA) for his kind inspiration and continuous support and to Prof. Gilberto J. de Moraes, (Departamento de Entomologia e Acarologia, USP/ESALQ, Piracicaba, Brazil) for providing information, suggestion and guidance to bring this manuscript in shape.

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Received: 6 February 2016

Accepted: 12 May 2016

Published: 15 July 2016

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توصیف شش گونه از کنه‌های فیتوزئید (Acari: Phytoseiidae) از اروناچال پرادش، هند

شوبهام پرامانیک و کریشنا کارمکار*

گروه حشره‌شناسی کشاورزی؛ بیدهان چاندراکریشی ویسواویدیا لایا، موهانپور-۷۴۱۲۵۲، نادیا،
بنگال غربی، هند؛ رایانامه‌ها: pramanikshubham89@gmail.com ، acarikarmakar@rediffmail.com

* نویسنده مسئول

چکیده

در این مقاله شش گونه از کنه‌های خانواده Phytoseiidae (Acari: Mesostigmata) از
اروناچال پرادش هند به نام‌های زیر توصیف می‌شوند: *Euseius arunachalensis* sp. nov. ،
Typhlodromus (Anthoseius) bomdilaie sp. nov. ، *bandispermathecae* sp. nov.
.P. leopardisimilis sp. nov. و *Phytoseius dorsospinosus* sp. nov. ، *dahungensis* sp. nov.

واژگان کلیدی: *Euseius* ؛ ماده؛ Mesostigmata ؛ *Phytoseius* ؛ آرایه‌شناسی؛ *Typhlodromus*
(*Anthoseius*)

تاریخ دریافت: ۱۳۹۴/۱۱/۱۷

تاریخ پذیرش: ۱۳۹۵/۲/۲۳

تاریخ چاپ: ۱۳۹۴/۱۰/۲۵