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# A new species and a new record of *Leioseius* Berlese (Acari: Mesostigmata: Ascidae) from Russia, with a review of the Russian species of the genus

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## Original research

### ABSTRACT

A new predatory mite species of the genus *Leioseius* Berlese, *L. subarcticus* Joharchi **n. sp.**, is described and illustrated on the basis of morphological characters of adults collected in the subarctic zone of northern Tyumen, from the soil covered with lichens. We also provide additional morphological information and new illustrations for *L. changbaiensis* Yin & Bei. The species known only from the type series, was found under bark in China (Changbai Mountains, Jilin Province) and is now recorded for the first time in the Altai Republic, Russia, close to type locality from the same habitat. In addition, an identification key to all known Russian species of the genus is presented.

**Keywords** Parasitiformes; Ascoidea; systematics; Ascinae; first record; Asian Russia; soil-inhabiting mites

**Zoobank** <http://zoobank.org/E22C69A6-5A6A-4811-A85E-D3FAAD4316E5>

## Introduction


Mesostigmata is a large, cosmopolitan order of mites found in soil, litter, rotting wood, compost, dung, carrion, nests, house dust, and similar detritus-based niches. They also live in association with plants and fungi (Lindquist *et al.* 2009). The mite family Ascidae includes 17 genera and just over 370 described species in two subfamilies, Ascinae and Arctoseiinae (Moraes *et al.* 2016; Lindquist and Moraza 2018; Santos and Moraes 2016; Kazemi 2019; Joharchi *et al.* 2021). Within the subfamily Ascinae, *Leioseius* is considered a group of predatory mites of small arthropods or nematodes based on their cheliceral morphology (Lindquist and Moraza 2018). The genus includes 23 nominal species that occur in either soil and litter habitats or marine debris and niches throughout most of the world, with the exception of high alpine and polar regions (Lindquist and Moraza 2018; Santos and Moraes 2016; Kazemi 2019; Joharchi *et al.* 2021). Prior to the present study, only four species of *Leioseius* were reported from Russia (Lindquist and Moraza 2018; Marchenko 2012, 2017; Joharchi *et al.* 2021). During a study of edaphic predatory mites of Russia, a new species of *Leioseius* was collected from lichen-covered soil in the subarctic zone of northern Tyumen, western Siberia. The new species is described and illustrated on the basis of morphological characters of adult females and males. We also present the first record of *L. changbaiensis* Yin & Bei, 1991 from Russia with additional morphological information and new illustrations based on specimens collected in the Altai Republic near the type locality. This species, known only from the type series, was

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found under bark in China (Changbai Mountains, Jilin Province). In addition, an identification key for all known Russian species of the genus is presented.

## Material and methods

Samples were collected over a four-year period (2019-2022) in different regions of Russia in search of edaphic predatory mites. Mites were extracted from soil and decayed tree stump using the Berlese-Tullgren funnels, then cleared in lactic acid solution and mounted in Hoyer's medium (Walter and Krantz 2009). The examinations of the specimens were performed with Zeiss Axio Imager A2 compound microscope equipped with differential interference contrast optical systems, attached to camera AxioCam ICc 5. Most images were captured in stacks (with focal depth manually controlled). Selected images were combined using Helicon Focus 7.6.4 Pro (Helicon Soft Ltd., 2000). Digital drawings were prepared using Adobe Photoshop CS2 software based on the original pencil line drawings. Images and morphological measurements were taken via ZEN 2012 software (version 8.0). Photomicrographs were taken with an AxioCam 506 camera (Carl Zeiss, Germany). Measurements of structures are expressed as ranges (minimum–maximum) in micrometers ( $\mu\text{m}$ ). The length and width of the dorsal shield were taken from the anterior to the posterior margins along the midline, and at the level of *s3* respectively. Length and width of the sternal shield were measured at the maximum length and broadest points (at level between coxae II and III) respectively. The length of the epigynal shield was measured along the midline from the anterior margin of the hyaline extension to the posterior margin of the shield, and its width where maximal, posterior to epigynal setae *st5*. Ventrianal shield was measured along the midline from the anterior to posterior margins, including the cribrum; its width was measured at the broadest point. The length of the second cheliceral segment was measured from its base to the apex of the fixed digit, and that of the movable digit from the base to the apex. Leg length was measured from the base of the coxa to the apex of the tarsus (excluding the pre-tarsus). The notation for idiosomal setae follows Lindquist and Evans (1965) modified slightly by Lindquist (1994), and for leg and palp setae follows that of Evans (1963, 1964), and other anatomical structures mostly follow Evans and Till (1979). Distinction of pore-like structures on the idiosomatic integument as either poroids/lyrifissures or gland pores follows mostly that of Athias-Henriot (1971, 1975), with small additions for gland pores *gvb1*, *gvb2* (Makarova *et al.* 2021). Notation for pore-like structures of the peritrematal region follows that of Lindquist and Moraza (2018). The holotype and paratypes are deposited at the Acarological Collection of the Tyumen State University Museum of Zoology, Tyumen, Russia (TUMZ).

## Taxonomy

### Family Ascidae Oudemans

#### Genus *Leioseius* Berlese

*Lasioseius* (*Leioseius*) Berlese, 1916: 45.

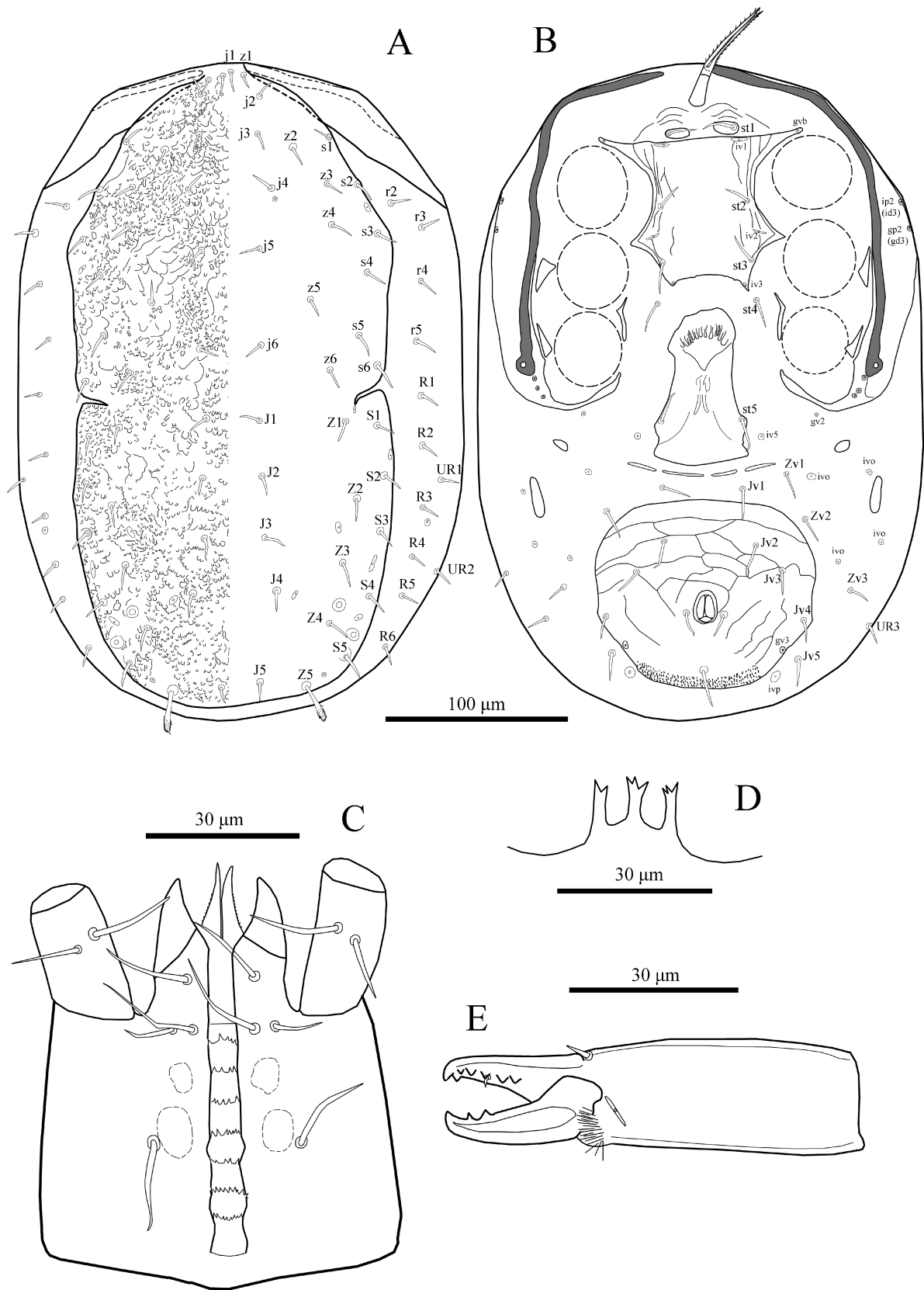
Type species: *Ameroseius minusculus* Berlese, 1905, by original designation.

#### Diagnosis

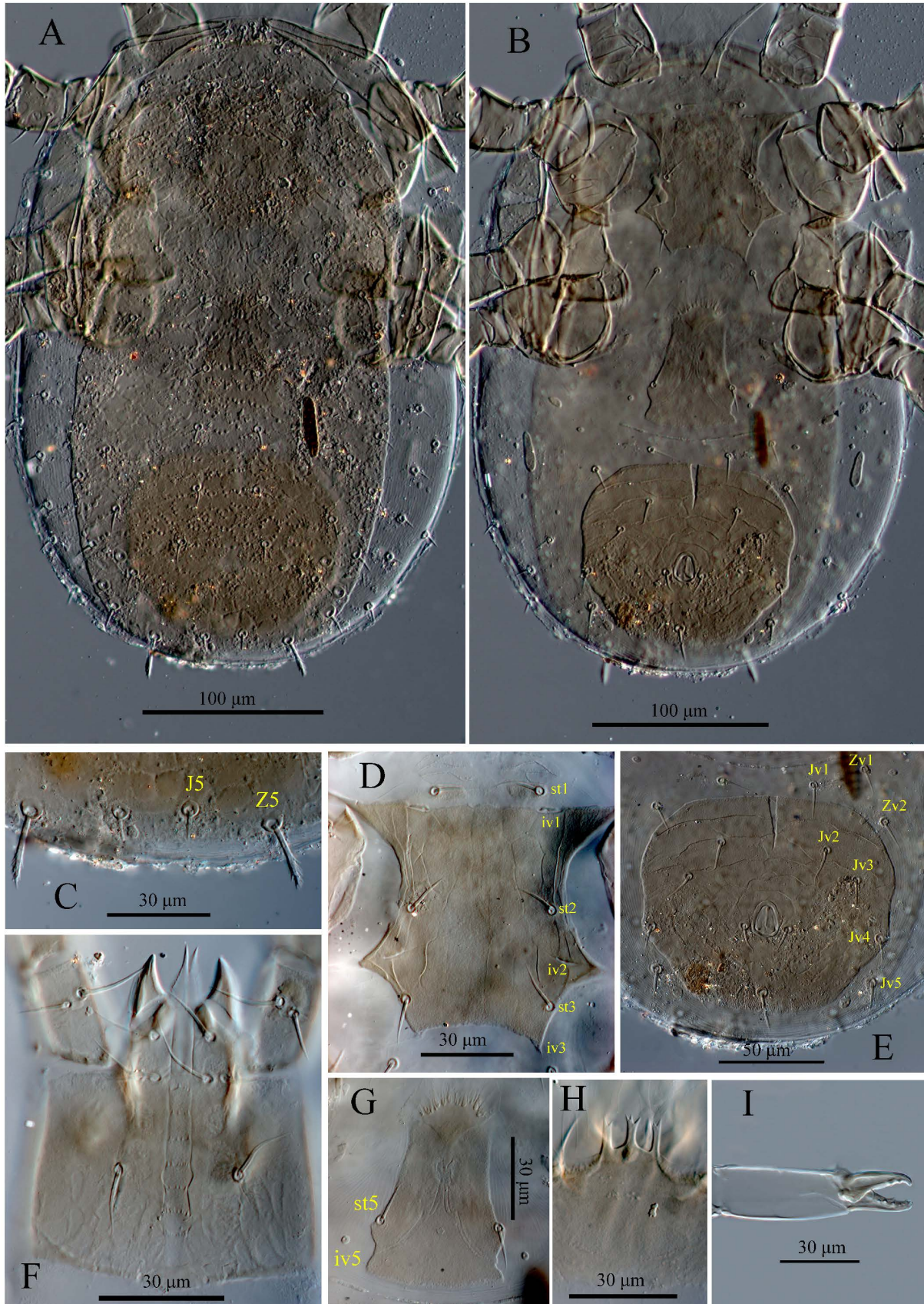
The concept of *Leioseius* used here is based on that of Moraes *et al.* (2016) and Lindquist and Moraza (2018) with modifications by Kazemi *et al.* (2019).

#### *Leioseius changbaiensis* Yin & Bei, 1991

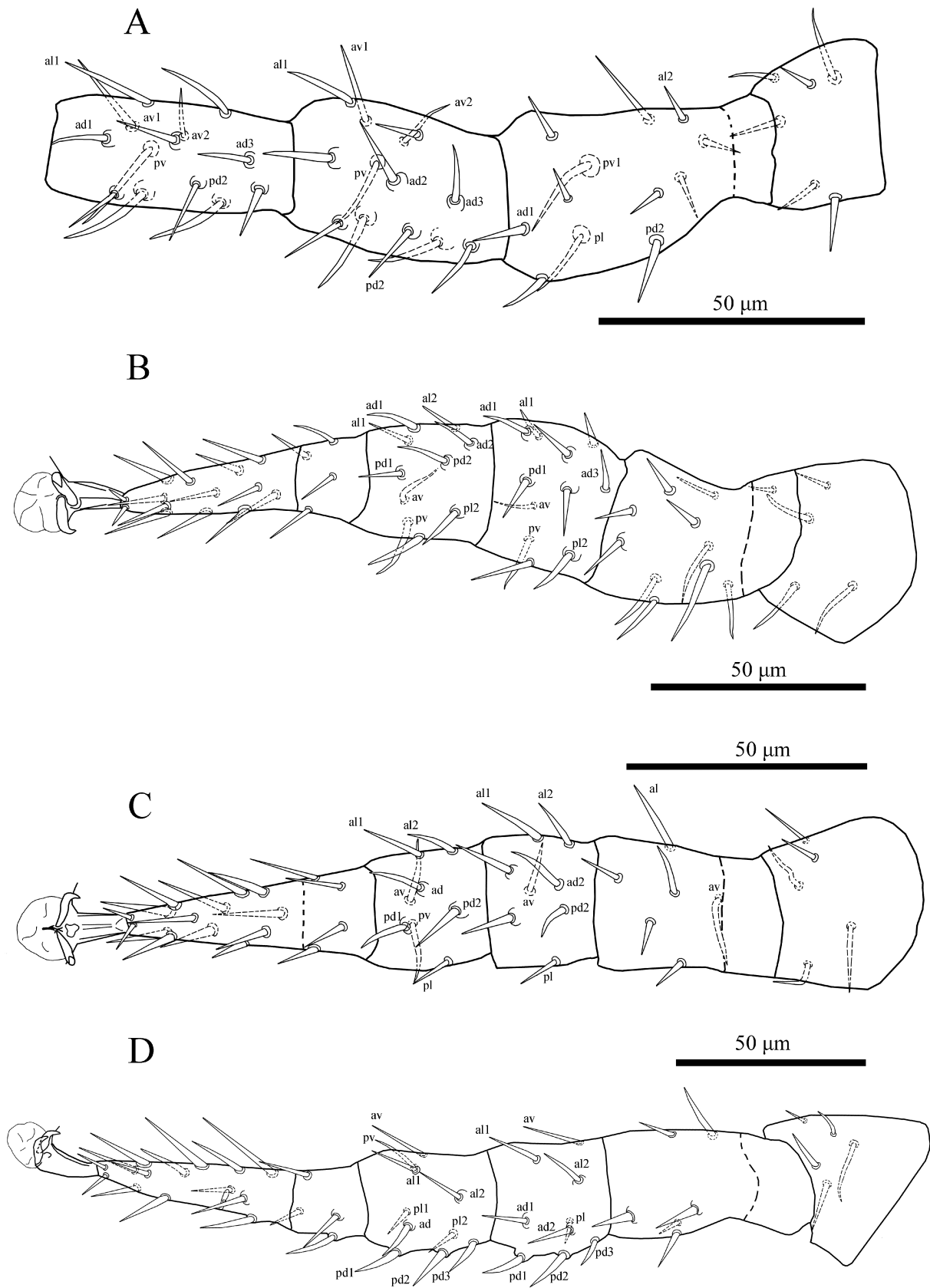
*Leioseius changbaiensis* Yin & Bei, 1991: 147. *Leioseius changbaiensis*. Lindquist & Moraza 2018: 1988.



**Figure 1** Figure 1. *Leioseius changbaiensis* Yin & Bei, 1991, adult female: A – Dorsal idiosoma; B – Ventral idiosoma; C – Subcapitulum; D – Epistome; E – Chelicera.



**Figure 2** DIC micrographs of *Leioseius changbaiensis* Yin & Bei, 1991, female. A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – General view of caudal setae J5 and Z5; D – Presternal platelets and sternal shield; E – Ventrianal shield; F – Subcapitulum; G – Epigynal shield; H – Epistome; I – Chelicera.



**Figure 3** *Leioseius changbaiensis* Yin & Bei, 1991, adult female: A – Leg I (trochanter-tibia); B – Leg II (trochanter-tarsus); C – Leg III (trochanter-tarsus); D – Leg IV (trochanter-tarsus).

(Figures 1–3)

**Specimens examined** — Two females, Ulaganskiy Rayon, Altai Republic, Russia, 50°24'23.4"N 87°35'58.8"E, 19 July 2021, alt. 1827 m, O. Joharchi, I. Döker, V.A. Khaustov coll., under bark of rotten stump.

**Remarks** — *Leioseius changbaiensis* was originally described from Changbai Mountains, Jilin Province, China (Yin and Bei 1991). This species, known only from the type series, was found under the bark of a tree, and is now recorded in the Altai Republic, Russia, very close to type locality in China from the same habitat. Our female specimens (Figure 1) agree well with the original description given by Yin and Bei (1991). We were unable to locate the types of *L. changbaiensis* but the following ecological, geographic and morphological features suggests that the specimens which we examined are conspecific with those described by Yin and Bei (1991): (1) habitat-specific, found under the bark of tree; (2) distributed in Northeast Asia (China and Altai Republic); (3) morphological features. However, the original description is brief and its illustrations are incomplete, lacking most important details, especially those concerning leg chaetotaxy. We herein provide additional morphological characters to complement the previous description (Yin and Bei 1991) of *L. changbaiensis* based on specimens from Russia, but also in comparison with the original description.

**Dorsal idiosoma** — (Figures 1A & 2A) — Dorsal shield strongly reticulated over entire surface, somewhat scabrid, with short lateral incisions between setae *s6* and *S1*, setae *s2* on shield's anterolateral margins (Figures 1A & 2A), with 33 pairs of setae, including 18 pairs on podonotal region (*j1–6*, *z1–6*, *s1–6*), including *s2* on its anterolateral margins and 15 pairs on opisthonotal region, all marginal *r-R*-setae on soft cuticle, setae all of similar short, smooth, except clunal setae (*Z5*) thicker, hardly ciliated and slightly longer than adjacent setae (Figures 1A, 2A & 2C). Lateral soft cuticle with about 12 of setae, *r2–5* and *R1–6*, two or three submarginal *UR*'s posterolaterally and a pair of poroids (*idRp*) (Figures 1A & 2A).

**Ventral idiosoma** — (Figures 1B, 2B, 2D, 2E & 2G) — Presternal region with a pair of smooth platelets which bear setae *st1* (Figures 1A, 2B & 2D). Epigynal shield somewhat vase form, anterior margin of shield convex, not overlapping posterior area of sternal shield, posterior margin truncate, protruding at level setae *st5*, paragenital poroids on soft cuticle beside posterolateral margins of epigynal shield (Figures 1B, 2B & 2G). Peritrematal shields anteriorly united with dorsal shield at anterior level of setae *z1*, and posteriorly united with parapodal strips behind coxae IV and exopodal fragments alongside coxae II–IV; shields bearing five pairs of discernible pore-like structures: two pairs of gland pores and three pairs of poroids, *gv2* on soft cuticle behind coxae IV (Figures 1B & 2B). Opisthogaster with nine pairs of setae in addition to circumanal setae [not seven pairs which has been shown in the original description, see Yin and Bei 1991; this aspect was viewed as an exception to the diagnosis concept of the *Leioseius* genus by Moraes *et al.* (2016: 26)], ventrianal shield with three pairs of opisthogastric setae (excluding circumanals), *Zv2*, *Zv3*, *Jv5* on adjacent soft cuticle (Figures 1B, 2B & 2E). Spermathecal system not discernible.

**Gnathosoma** — (Figures 1C–E, 5F, 2H & 2I). Subcapitulum with seven rows of deutosternal denticles, each similarly narrow, with five to ten denticles (Figures 1C & 2F); subcapitular setae *h1* and *h3* similar in length, clearly longer than capitular setae *pc*, and *h2* setae (Figure 1C & 2F). Epistome trifid, with denticulate apices (Figures 1D & 2H). Fixed digit with tiny offset subapical tooth, short pilus dentilis and row of four or five well-spaced teeth; movable digit bidentate (Figures 1E & 2I).

**Legs** — (Figure 3). Legs II (Figure 3B) and III (Figure 3C) short, legs I (Figure 3A) longer than legs IV (Figure 3D), and shorter than dorsal shield. Complement of setae on leg segments for coxae I–II–III–IV: 2, 2, 2, 1; for trochanters: 6, 5, 5, 5; for femora: 12, 11, 6, 6; chaetotactic formulae for genua I–IV, respectively: (2-3/2, 3/1-2) (2-3/1, 2/1-2) (2-2/1, 2/1-1) (2-2/1, 3/0-1); tibiae: (2-3/2, 3/1-2) (2-2/1, 2/1-2) (2-1/1, 2/1-1) (2-1/1, 3/1-2); genu I and tibia I with *av-2* (Figure 3A), genu IV with nine setae, *pd3* present (Figure 3D); tibia III with *al-2*, without *pl-2* (Figure 3C). Tarsi II–IV with 18 setae, all setae on tarsi II–IV similar in form and moderate length to most other tarsal setae; not differentiated in curved whip-like form, setae (*v-1*) and



(*v*-2) similar in form and moderate length to most other tarsal setae; (*d*-2) not differentiated in curved whip-like form; (*d*-1) less than half as long as pretarsus to bases of claws; shape of setae on leg segments as Figures 3A–D.

## ***Leioseius subarcticus* Joharchi n. sp.**

Zoobank: [9B264648-6944-43BC-9F71-57EB992FE9CC](https://doi.org/10.24349/9B264648-6944-43BC-9F71-57EB992FE9CC)

(Figures 4–7)

### **Type material**

Holotype, female, Yamalo-Nenets Autonomous Okrug, Purovsky District, Russia, 65°05'17.5"N 78°10'59.6"E, 17 July 2022, A.A. Khaustov coll., from the soil covered with lichens. Paratypes, ten females and three males, same data as holotype.

### **Diagnosis (adult)**

Dorsal shield tuberculate-reticulate over nearly entire surface, with well-formed lateral incisions between setae *s*6 and *S*1; shield with 33 pairs of smooth setae, except *Z*5, *J*4, *J*5 with a few barbs, clunal setae (*Z*5) longest. Epistome trifid, with denticulate apices. Postanal seta on ventrianal shield with a few barbs. Leg I tibia and genu each with 13 setae (*av*2 present); leg III genu with eight setae, *pv* absent; all setae on tarsi II–IV similar in form and moderate length to most other tarsal setae; not differentiated in curved whip-like form. Female: presternal area comprises with a few transverse curved lines anteriorly and a pair of sclerotized smooth platelets posteriorly which bear setae *st*1. Ventrianal shield with three pairs of opisthogastric setae (*J*v2–4) (excluding circumanals). Fixed digit with row of four or five well-spaced teeth; movable digit bidentate. Male: ventrianal shield with seven pairs of opisthogastric setae (excluding circumanals), setae *Z*v3 off shield; postgenital groove with strip of four platelets, as in female. Spermatodactyl apex narrowed and strongly incurved.

### **Description (adult female)**

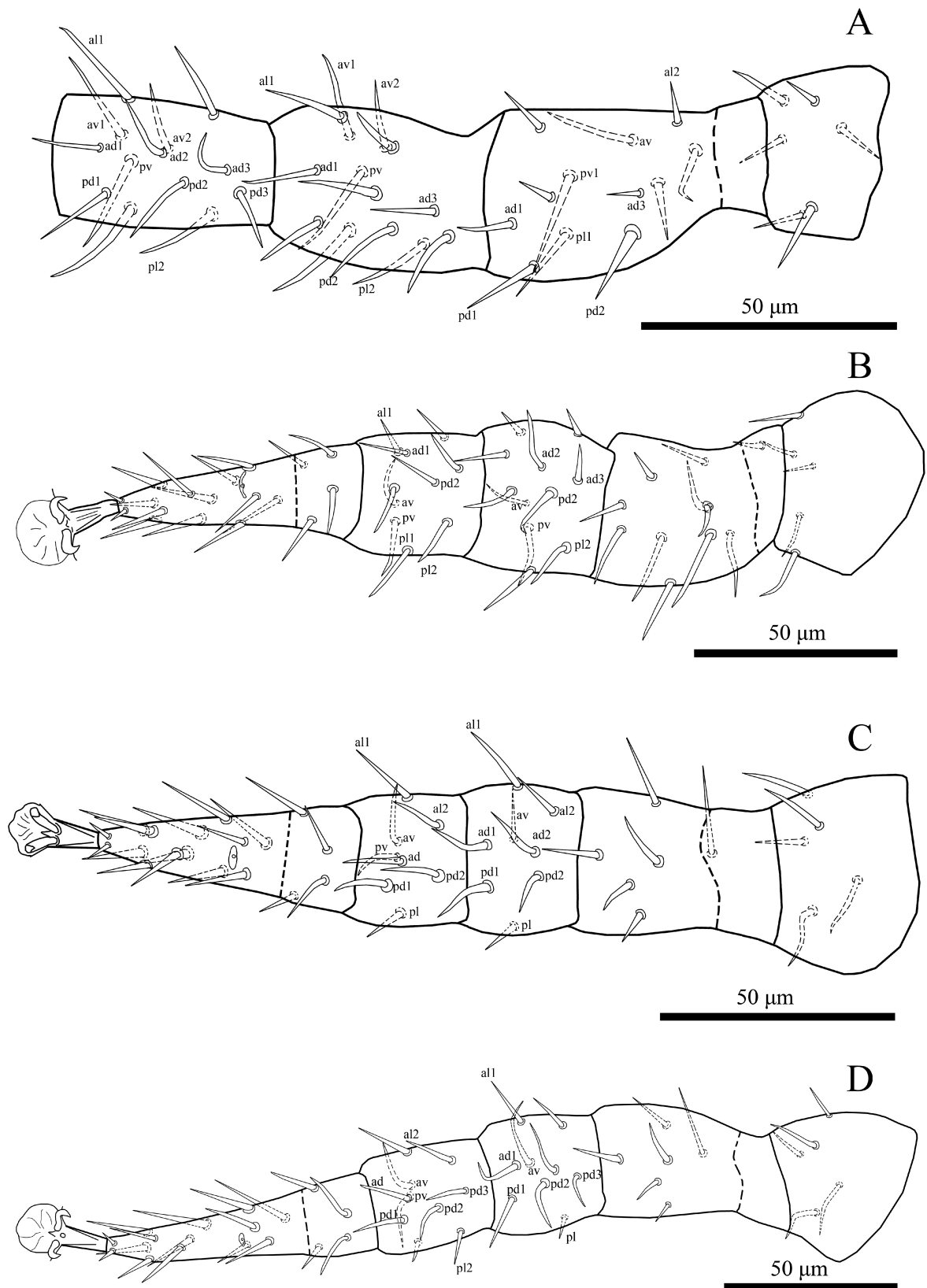
(Figures 4–5 & 7A–H)

Six specimens measured.

**Dorsal idiosoma** — (Figures 4A, 7A & 7C) — Dorsal idiosoma 370–402 long, 210–220 wide (at level of *r*3), dorsal shield 370–402 long, 183–193 wide, tuberculated in reticulate pattern over nearly entire surface (Figures 4A & 7A), with lateral incisions between setae *s*6 and *S*1, barely reaching to transverse level of *Z*1. Shield with 33 pairs of setae, including 18 pairs on podonotal region (*j*1–6, *z*1–6, *s*1–6), including *s*2 on its anterolateral margins and 15 pairs on opisthonotal region, all marginal *r*-*R*-setae on soft cuticle, setae generally similar in short (15–22), smooth, pointed form; setae *J*1–4 similar in short length to *J*5 (14–17), about half as long as longitudinal intervals between their bases; *Z*5, *J*4, *J*5 with a few barbs (Figure 7C), clunal setae (*Z*5) longest (30–33). Shield with complement of 23 pairs of discernible pore-like structures, including seven pairs of gland openings (*gd*1–2, *gd*4–6, and *gd*8–9) and 16 poroids (*id*1, *id*2, *id*4–*id*5, *id*m1–*id*m5, *id*x, and *id*l1–*id*l5) (Figures 4A & 7A), gland pores *gd*8 and *gd*9 conspicuously enlarged (Figure 7C). Lateral soft cuticle with about 12 of setae, *r*2–5 and *R*1–6, two or three submarginal *UR*'s posterolaterally and a pair of poroids (*idRp*). Muscle-marks (sigillae) as illustrated and showed in Figures 4A & 7A.

**Ventral idiosoma** — (Figures 4B, 7B, 7D & 7J) — Tritosternum with paired pilose laciniae (47–52), fused basally (6–9), columnar base 18–21 × 9–12 wide; presternal area comprises with a few transverse curved lines anteriorly and a pair of sclerotized smooth platelets posteriorly which bear setae *st*1 (16–20). Sternal shield length 88–95, narrowest between coxae II (50–60), widest (85–90); bearing two pairs of smooth and subequal in length setae (17–20) (*st*2, *st*3), two pairs of lyrifissures (*iv*1, *iv*2) and one pair of sub-oval poroids on posterolateral corners of shield margin (*iv*3), endopodals between coxae I–II fused with sternal shield, shield reticulated over entire surface, gland pores *gvb*1, *gvb*2 and *gv*1 not discernible (Figures 4B & 7B). Setae





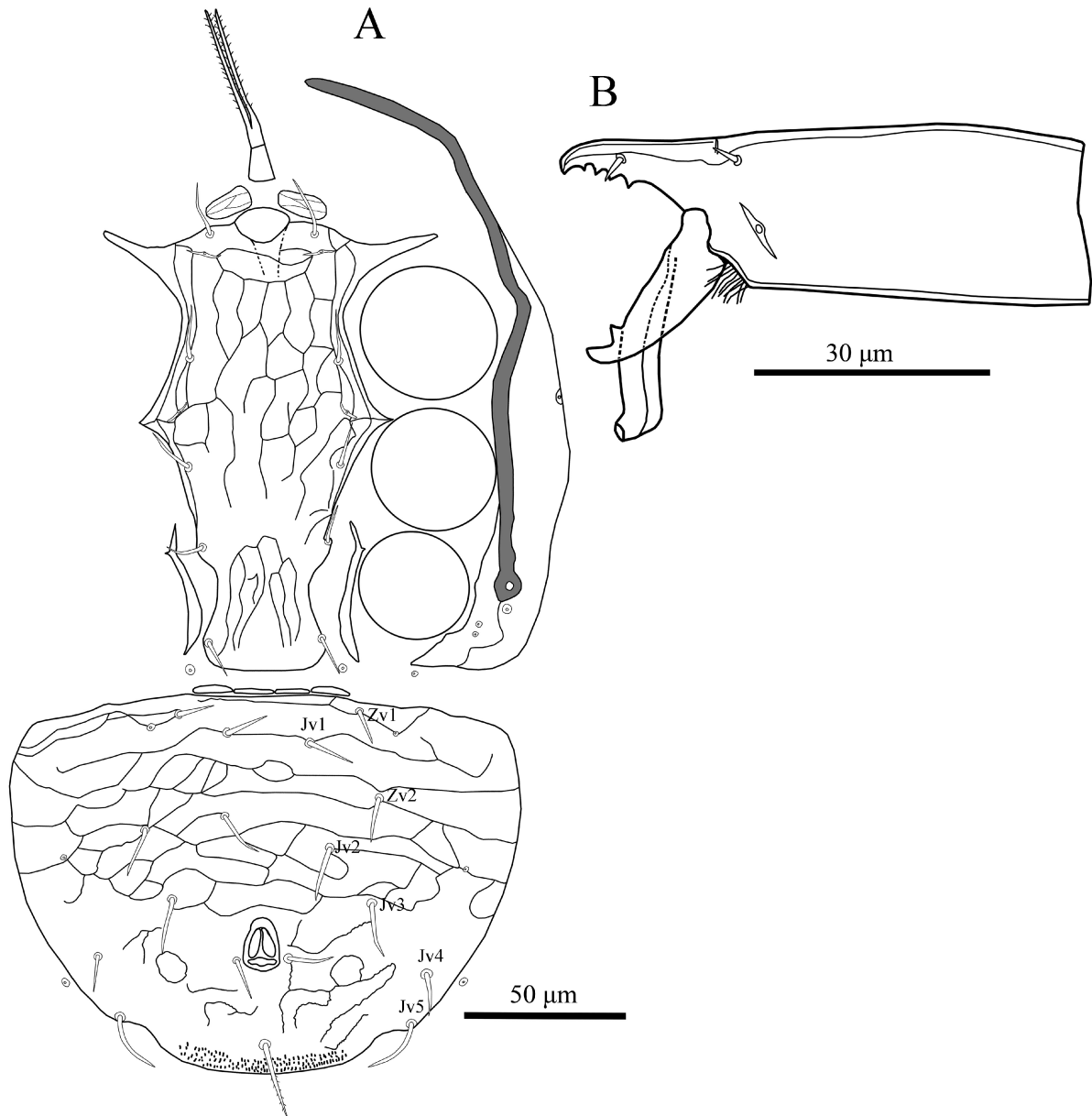
**Figure 5** *Leioseius subarcticus* Joharchi n. sp., adult female: A – Leg I (trochanter-tibia); B – Leg II (trochanter-tarsus); C – Leg III (trochanter-tarsus); D – Leg IV (trochanter-tarsus).

*st4* (15–18) on soft cuticle. Endopodal strips narrow between coxae III and IV. Epigynal shield reticulated/lineated, its rounded hyaline anterior margin not overlapping posterior area of sternal shield, its lateral margins slightly concave, narrowed anterior to setae *st5* (18–21), and its posterior margin slightly convex, with corners rounded at the level *st5*; shield 75–90 long, 28–32 at narrowest width between legs IV, 50–58 at widest level posteriorly. Paragenital poroids (*iv5*) located on soft cuticle beside posterolateral margins of shield (near seta *st5*), postgenital groove with strip of four platelets. Ventrianal shield inversely subtriangular, anterior margin of shield somewhat flat and slightly convex lateral margins tapered posteriorly, shield length 115–125, width 130–150 at *Jv3* level (broadest point) and width 94–100 at *Jv5* level; shield reticulated over most of surface, lines punctate posteriorly, with three pairs of opisthogastric setae (*Jv2–4*) (16–22) (excluding circumanals), and one pair of gland pores (*gv3*), plus para-anal (16–19) and postanal (25–30) setae, postanal seta with a few barbs (Figures 4B, 7B & 7D). Opisthogastric soft cuticle with six pairs of opisthogastric setae flanking ventrianal shield, *Jv1*, *Zv1*, *Zv2* (14–22) anteriorly and *Zv3*, *Zv4* (17–20), *Jv5* (24–27) laterally; two pairs of well-spaced metapodal platelets [elongate lateral pair 22–25 long, 6–8 wide, small inner pair dimensions 7–10 by 3–5], and six pairs of poroids (including *ivp*) (Figures 4B, 7B & 7D). Peritremes long, extending to level of paravertic setae (*z1*). Peritrematal shields anteriorly united with dorsal shield at anterior level of setae *z1*, and posteriorly united with parapodal strips behind coxae IV and exopodal fragments alongside coxae II–IV; shields bearing five pairs of discernible pore-like structures: two pairs of gland pores and three pairs of poroids, *gv2* on soft cuticle behind coxae IV (Figures 4B & 7B).

**Spermathecal system** (Figure 7J): sperm access system consists of unsclerotized structures, leading by way of a long, uniformly narrow tubulus from an infundibulum on either side at the inner bases of legs III–V to a single, more visually evident, oval receptaculum, from which a more conspicuous duct leads to rather circular sacculus.

**Gnathosoma** — (Figures 4C–E & 7E–H). Epistome anterior margin triramous, with denticulate apices (Figures 4D & 7G). Hypostomal groove with seven transverse rows of denticles, each row with 2–8 denticles, with smooth anterior and posterior transverse lines (Figures 4C & 7F), subcapitular setae *h1* and *h3* similar in length (18–22), clearly longer than capitular setae *pc* (14–17), and *h2* (10–13) (Figures 4C & 7F). Corniculi subparallel, robust and horn-like, with bluntly pointed tips, shorter than internal malae. Supralabral process not distinguishable. Internal malae with one pair of fimbriate projections (Figures 4C & 7F); labrum markedly longer than internal malae with pilose surface. Palptarsal claw two-tined, all setae on palps smooth and needle-like except setae *al* and *d3* on femur, *all–2* on genu somewhat spine-like; palptarsus without long setae (Figure 7E). Second segment of chelicera (including the fixed digit) 85–90 long, fixed digit of chelicera with tiny offset subapical tooth, short pilus dentilis and row of four or five well-spaced teeth, dorsal cheliceral seta matchstick-shape, arthroal membrane with a rounded flap and some filaments, cheliceral lyrifissures distinct; movable digit of chelicera (32–36) bidentate (Figures 4E and 7H).

**Legs** — (Figure 5). Legs II (Figure 5B) (215–225) and III (Figure 5C) (185–205) short, legs I (Figure 5A) (270–285) longer than legs IV (Figure 5D) (255–270), and shorter than dorsal shield. Complement of setae on leg segments for coxae I–II–III–IV: 2, 2, 2, 1; for trochanters: 6, 5, 5, 5; for femora: 12, 11, 6, 6; chaetotactic formulae for genua I–IV, respectively: (2-3/2, 3/1-2) (2-3/1, 2/1-2) (2-2/1, 2/1-1) (2-2/1, 3/0-1); tibiae: (2-3/2, 3/1-2) (2-2/1, 2/1-2) (2-1/1, 2/1-1) (2-1/1, 3/1-2); genu I and tibia I with *av-2* (Figure 5A), genu IV with nine setae, *pd3* present (Figure 5D); tibia III with *al-2*, without *pl-2* (Figure 5C). Tarsi II–IV with 18 setae, all setae on tarsi II–IV similar in form and moderate length to most other tarsal setae; not differentiated in curved whip-like form, setae (*v-1*) and (*v-2*) similar in form and moderate length to most other tarsal setae; (*d-2*) not differentiated in curved whip-like form; (*d-1*) less than half as long as pretarsus to bases of claws; shape of setae on leg segments as Figures 5A–D.



**Figure 6** *Leioseius subarcticus* Joharchi n. sp., adult male: A – Ventral idiosoma; B – Chelicera.

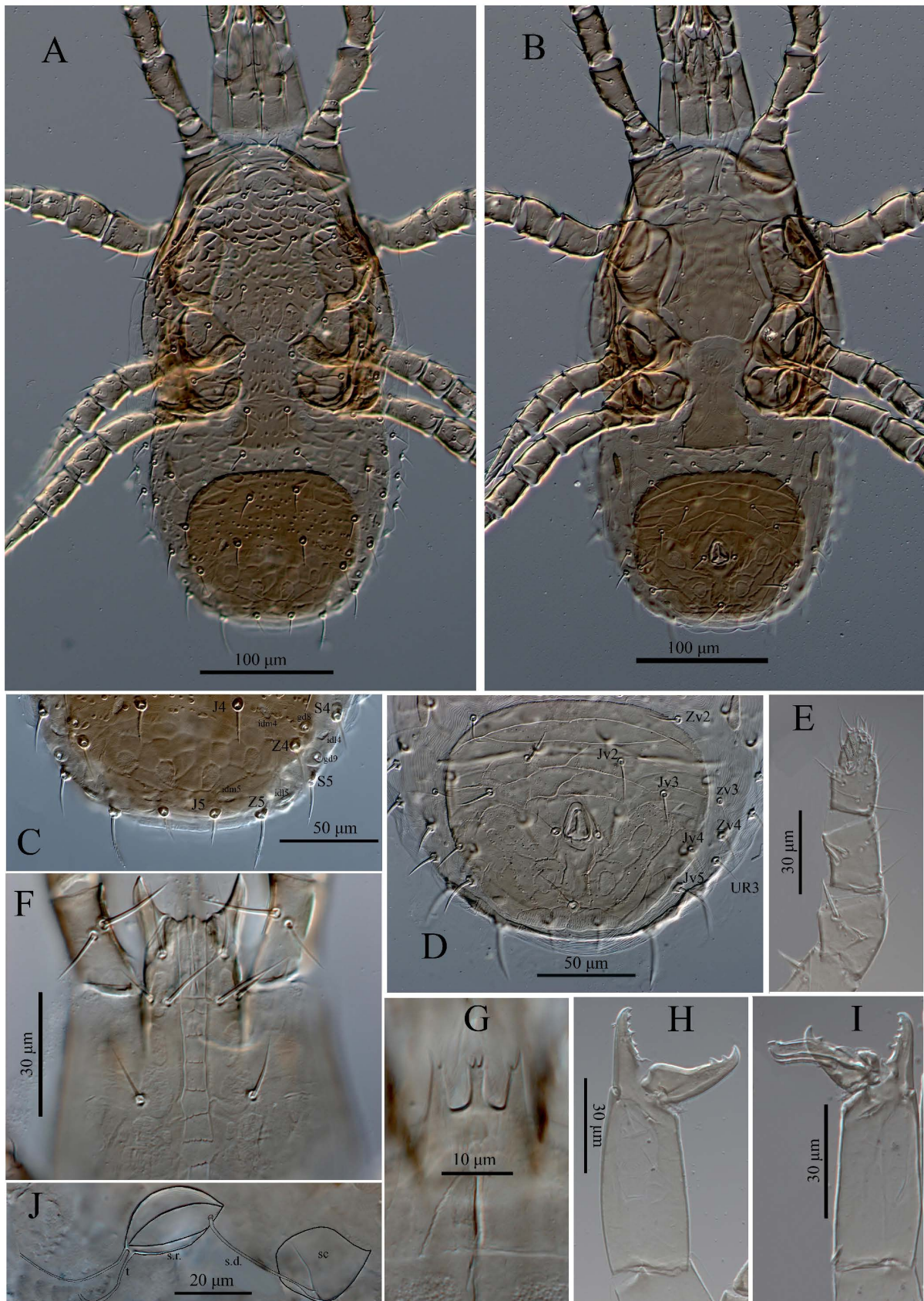
**Description (adult male)**

(Figures 6 & 7I)

Three specimens measured.

**Dorsal idiosoma** — Dorsal shield 320–335 long, 160–170 wide; shield ornamentation, complement of pore-like structures and setation as in female.

**Ventral idiosoma** — (Figures 6A) — Tritosternum formed as in female, with paired pilose laciniae (47–52), fused basally (6–8), columnar base 12–14 × 8–10 wide. Presternal region with a pair of distinct platelets flanking genital opening. Sternitigenital shield length 140–145, narrowest between coxae IV (25–30), widest at level between coxae II–III (77–83); posterior margin width 32–36; shield reticulated over nearly entire surface, free from endopodal strips beside coxae III–IV; setae *st1*, *st2* similar in lengths (18–20), *st3–st5* slightly shorter (10–13).



**Figure 7** DIC micrographs of *Leioseius subarcticus* Joharchi **n. sp.**, female. A – Idiosoma, dorsal view; B – Idiosoma, ventral view; C – General view of some opisthotal setae; D – Ventrianal shield; E – Palp; F – Subcapitulum; G – Epistome; H – Female chelicera; I – Male chelicera; J – Spermathecal system. Abbreviations: sc, sacculus; s.d., sperm duct; s.r., sperm reservoir; t, tubulus.

Poroids *iv5* on soft cuticle behind posterolateral corners of sternitigenital shield (Figure 6A). Postgenital groove with strip of four platelets, as in female. Ventrianal shield reticulated over most of surface, with lines punctate posteriorly, anterior margin flat, and posterolateral margins gradually tapered; shield wider (163–12) than long (123–12), with seven pairs of opisthogastric setae, *Zv3* (10–12) off shield; *Jv1* and *Zv1*(11–13), *Jv2*, *Jv3*, *Zv2* (14–17), *Jv4* (11–13), *Jv5* (20–23); postanal seta (24–27) with a few barbs and about 1.5 as long as paranal setae (13–16). Peritremes, peritrematal shield and exopodal fragments as in female.

**Gnathosoma** — (Figures 6B & 7I) — Fixed digit with offset subapical tooth, pilus dentilis and row of about five teeth similar as in female; movable digit (22–25) unidentate; spermatodactyl (24–27) apex narrowed and strongly incurved (Figures 6B & 7I). Form and length of other gnathosomatic structures as in female.

**Legs** — Legs similar to those of female, without dimorphism in thickness or spine-like setal modifications. Lengths I 251–255, II 195–205, III 150–160, IV 207–215.

**Immature stages** — Unknown.

**Etymology**

The specific name is derived from the name of the region (subarctic zone) in which the type locality occurs.

**Remarks**

According to Lindquist and Moraza (2018) and the identification key to *Leioseius* species provided in this publication, *L. subarcticus* Joharchi most resembles *Leioseius tuberculatus* Lindquist & Moraza, 2018 (couplet 19 in the identification key), but *L. subarcticus* can easily be distinguished from this species by having a pair of platelets bearing setae *st1* in presternal region, while platelets absent in *L. tuberculatus*; leg I tibia and genu each with 13 setae (*av2* present), while in *L. tuberculatus* tibia and genu of leg I each with 12 setae, *av2* absent; postanal seta on ventrianal shield with a few barbs, while completely smooth in *L. tuberculatus*; ventrianal shield of male with seven pairs of opisthogastric setae (setae *Zv3* off shield), while in *L. tuberculatus* ventrianal shield of male with eight pairs of opisthogastric setae including *Zv3*. The following key is based on direct examination of all species.

**Key to species of *Leioseius* occurring in the Russia, partly from Lindquist and Moraza 2018**

- 1. Ventrianal shield with two pairs of opisthogastric setae ..... 2
  - Ventrianal shield with three or four pairs of opisthogastric setae ..... 3
  
- 2. Lateral incisions of dorsal shield shallow, not reaching transverse level of setae *Z1*; ventrianal shield with opisthogastric setae *Jv2*, *Jv3* (*Jv4* and *Jv5* off shield, on soft cuticle), clunal setae *Z5* not elongated, less than twice as long as other *Z*-series setae .....
  - ..... *L. minusculus* (Berlese, 1905)
  - Lateral incisions of dorsal shield twice as deep as level to setae *Z1*; ventrianal shield with opisthogastric setae *Jv3*, *Jv5* (*Jv2* and *Jv4* on soft cuticle close to anterior margin of shield), dorsal shield with elongated clunal setae *Z5*, at least twice as long as other *Z*-series setae .....
    - ..... *L. mirabilis* Nikolsky, 1981
  
- 3. Ventrianal shield with four pairs of opisthogastric setae ..... *L. naglitschi* Karg, 1965
  - Ventrianal shield with three pairs of opisthogastric setae ..... 4
  
- 4. Ventrianal shield subtrapezoidal, its lateral margins not bearing setae *Jv4* but diverging posteriorly to bear setae *Jv5* ..... *L. elongatus* Evans, 1958
  - Ventrianal shield inversely subtriangular to subcircular, with lateral margins rounded to bear

setae *Jv4*; setae *Jv5* on soft cuticle close to posterolateral corners of ventrianal shield . . . . . 5

5. Dorsal shield strongly reticulated over entire surface, somewhat scabrid (Figures 1A & 2A), clunal setae *Z5* thicker and hardly ciliated (Figures 1A & 2C), postanal seta of ventrianal shield smooth (Figures 1B, 2E) . . . . . *L. changbaiensis* Yin & Bei, 1991  
 — Dorsal shield tuberculate-reticulate over nearly entire surface (Figure 7A), postanal and clunal (*Z5*) setae with a few barbs (Figures 4B & 7D) . . . . . *L. subarcticus* Joharchi **n. sp.**

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