Acarina 33 (1): 17–36

FEATHER MITES (ACARIFORMES: PSOROPTIDIA) ASSOCIATED WITH THE COMMON CRANE *GRUS GRUS* (GRUIFOMES: GRUIDAE)

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ABSTRACT: Four feather mite species have been collected from the Common Crane *Grus grus* (Gruidae). Of them, *Pseudogabucinia malovichkoae* sp.n. (Kramerellidae) is described as a new species, and *Geranolichus gruis* (Trouessart, 1884) (Pterolichidae) is redescribed. Two other recovered species are *Megniniella gruophila* Mironov and Malovichko, 2023 (Analgidae) and *Brephosceles* sp. (Alloptidae). The fauna of feather mites recovered from the Common Crane is taxonomically most similar to that recovered from the Sandhill Crane, *Antigone canadensis*, and includes close species of the same three genera: *Brephosceles* Hull, 1934, *Geranolichus* Gaud, 1968 and *Pseudogabucinia* Černý, 1961. The taxonomy and the species composition of the feather mite genera recovered from the Common Crane are briefly discussed.

KEY WORDS: feather mites, *Brephosceles*, *Geranolichus*, *Megniniella*, *Pseudogabucinia*, systematics, host associations

DOI: 10.21684/0132-8077-2025-33-1-17-36

INTRODUCTION

Feather mites (Psoroptidia: Analgoidea and Pterolichoidea) are ectosymbionts (commensals and parasites), permanently living on birds (Gaud and Atyeo 1996; Dabert and Mironov 1999; Proctor and Owens 2000; Proctor 2003; OConnor 2009; Mironov 2016). These mites are highly specialized, predominately occupying various microhabitats in the flight and body feathers of their avian hosts (although representatives of some taxa inhabit the skin and the nasal cavities of birds). Because birds provide numerous and varied microhabitats for these mites, each bird species usually carries a complex of several specific mite species.

The world fauna of feather mites currently includes about 2,600 species, distributed across 500 genera and 36–38 families; however, the number of extant species is estimated to be up to ten times greater (Peterson 1975; Gaud and Atyeo 1996; Mironov 2016). To date, representatives of these mites have been collected from birds of all recognized avian orders, although the primary origin of the feather mites collected from the representatives of the orders Sphenisciformes and Rheiformes remains disputable. Feather mites are also highly host-specific, both at the species level and at higher taxonomic levels, and often display co-evolutionary trends with their hosts (Gaud and Atyeo 1982, 1996; Dabert 2005).

The extant orders of birds have been explored unevenly in regards to feather mite diversity (Gaud and Atyeo 1996; Proctor 2003). For instance, while the order Gruiformes currently includes about 145 species arranged in six families (Gill *et al*. 2025), only the feather mite fauna of rails (Rallidae)—and mainly of those distributed across Europe and Africa—has been examined to any meaningful extent (Dubinin 1956; Gaud and Mouchet 1959a, b, 1963; Gaud 1960, 1968; Peterson and Atyeo 1968; Atyeo and Peterson 1976; Gaud and Atyeo 1981; Mironov 1981; Mironov and Galloway 2002; Mironov *et al*. 2024; Waki *et al*. 2024). The data on feather mites associated with the remaining families of gruiforms (Aramidae, Gruidae, Heliornithidae, Psophidae and Sarothruridae) are quite fragmentary (Gaud and Mouchet 1963; Gaud 1968; Peterson and Atyeo 1968; Atyeo and Gaud 1977, 1980, 1984; Gaud and Atyeo, 1996).

Among the family of cranes (Gruidae), which currently includes 15 extant species, feather mites are known only from four species: the Common Crane *Grus grus* (Linnaeus), Sandhill Crane *Antigone canadensis* (Linnaeus), Black Crowned Crane *Balearica pavonina* (Linnaeus) and Grey Crowned Crane *B. regulorum* (Bennett). Feather mites of the four families have been recovered from these hosts: Alloptidae and Analgidae, belonging to the superfamily Analgoidea; and Kramerellidae and Pterolichidae from the superfamily Pterolichoidea (Canestrini and Berlese 1882; Trouessart 1884; Berlese 1897; Canestrini and Kramer 1899; Gaud 1958, 1968; Gaud and Mouchet 1959a, 1959b; Atyeo and Windingstad 1979; Mironov and Malovichko 2023).

The Common Crane, also known as the Eurasian Crane, is a medium-sized crane species, widely distributed in the Palearctic, with its breeding range spreading from Western Europe to the Chukotka Peninsula in the east and northern China, Turkey and the Caucasus in the south (Gill *et al*. 2025; Lepage 2025). For a very long time, only one

feather mite species, *Geranolichus gruis* (Trouessart, 1884) (Pterolichidae), has been known from this host. A few years ago, the second feather mite specific to this bird, *Megniniella gruophila* Mironov and Malovichko, 2023 (Analgidae), was described from the Common Crane. The present study reports four feather mite species collected from the Common Crane in European Russia, and includes the description of a new species of the genus *Pseudogabucinia* Černý, 1961 (Kramerellidae) and a redescription of *G. gruis*, based on newly collected material.

MATERIALS AND METHODS

The primary material of this study includes four carcasses of Common Cranes, found deceased in the Stavropolsky Krai, European Russia, in November 2022. The wings and part of the body plumage were removed from the bird carcasses and stored in plastic bags in a freezer. In laboratory conditions, the remiges and covert feathers were examined for the presence of feather mites with a Leica stereomicroscope M60 (Leica Microsystems, Inc.). Dead mites, detected on feathers, were collected manually with a preparation needle and preserved in vials with 96% ethanol. Additionally, all feathers were subjected to a washing technique (Mironov and Galloway 2002; Galloway and Lamb 2014). After washing, the water was passed through a cotton filter and the retained mites were gathered and preserved in ethanol. For identification and description, mites were mounted on microscope slides in the Hoyer's medium (Krantz and Walter 2009) and dried at 60 °C for 5–7 days. The examination of mite specimens, as well as the line drawings and measurements were made with a Leica microscope DM2500, equipped with differential interference contrast optics (DIC), a *camera lucida,* and an ocular micrometer.

The descriptions of mite species are provided according to the formats and measuring techniques used for corresponding taxa of the families Kramerellidae and Pterolichidae (Dabert *et al*. 2008; Dabert and Labrzicka 2009; Mironov *et al*. 2015; Hernandes and Mironov 2015; Hernandes 2020; Waki *et al*. 2023; Mironov 2024). General morphological terms and idiosomal chaetotaxies follow Gaud and Atyeo (1996), with minor corrections by Norton (1998). All measurements are in micrometers (μm). Scientific names of birds and their supraspecific classification follow Gill *et al*. (2025). All mite specimens have been deposited in ZISP—the Zoological Institute of the Russian Academy of Sciences (Saint Petersburg, Russia).

SYSTEMATICS

Superfamily **Pterolichoidea Trouessart and Mégnin, 1984**

Family **Kramerellidae Gaud and Mouchet, 1957**

Genus **Pseudogabucinia Černý, 1961**

Type species: *Pterolichus ciconiae* Canestrini and Berlese, 1882, by original designation.

The genus *Pseudohabucinia* includes only five species, distributed among hosts from four bird orders. These hosts, represented by Ciconiiformes (Ciconiidae), Falconiformes (Falconidae), Gruiformes (Gruidae), and Otidiformes (Otididae) (Canestrini and Berlese 1882; Dubinin 1956; Černý 1961; Gaud and Mouchet 1961; Gaud 1968, 1982, 1983; Atyeo and Windingstad 1979; Chirov and Mironov 2017), are phylogenetically quite distant from each other. Of the genus *Pseudohabucinia*, two species were described from cranes: *Pseudogabucinia moucheti* Gaud, 1968 from the Black Crowned Crane, *Balearica pavonina* (Linnaeus), in Cameroon; and *P. reticulata* Atyeo and Windingstad, 1979 from the Sandhill Crane, *Antigone canadensis tabida* (Peters), in the USA (Gaud, 1968; Atyeo and Windingstad, 1979). The new species described below is the third species of this genus known from cranes.

Such erratic distribution of the *Pseudogabucinia* species raises some doubts about the monophyly of the genus. Extensive studies of feather mite diversity and their host associations will probably help solve this taxonomic issue.

Pseudogabucinia malovichkoae **sp. n.**

(Figs. 1–6)

Type material. Male holotype (ZISP 23768), 19 male and 19 female paratypes (ZISP 23769–23806) from *Grus grus* (Linnaeus, 1758) (Gruiformes: Gruidae), Russia, Stavropolsky Krai, Turkmen District, near Poperechnyi, 45°25′22″N 43°15′28″E, 10 November 2022, coll. L. V. Malovichko.

Description. *Male* (holotype, range for 10 paratypes) (Figs. 1, 2, 5A, 6A–E). Idiosoma strongly widened, length 290 (285–305), greatest

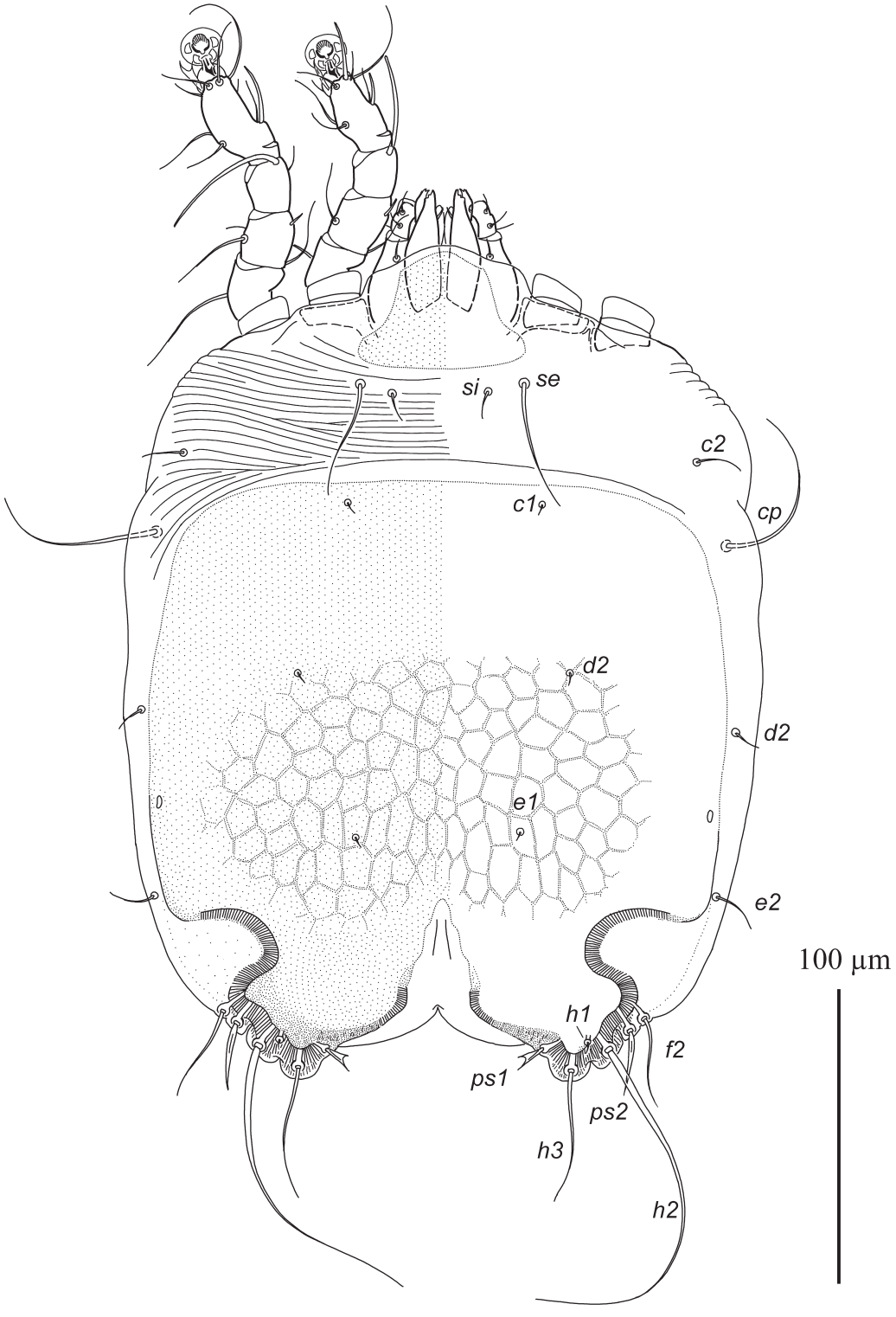

Fig. 1. *Pseudogabucinia malovichkoae* sp.n., dorsal view of male.

width at level of humeral setae 220 (205–220), length of hysterosoma 215 (215–225). Subcapitulum trapezoidal, length excluding palps 30 (30–38), wide at base 68 (55–60). Prodorsal shield roughly trapezoidal in shape, posterior corners rounded, length 43 (38–45), width at posterior margin 68 (65–70), surface without ornamentation. Distances between scapular setae: *se:se* 58 (55–65), *si:si* 35 (35–43). Lateral setae *c2* and *c3* filiform, 20 (15–20) and 28 (23–30) long, respectively. Scapular and

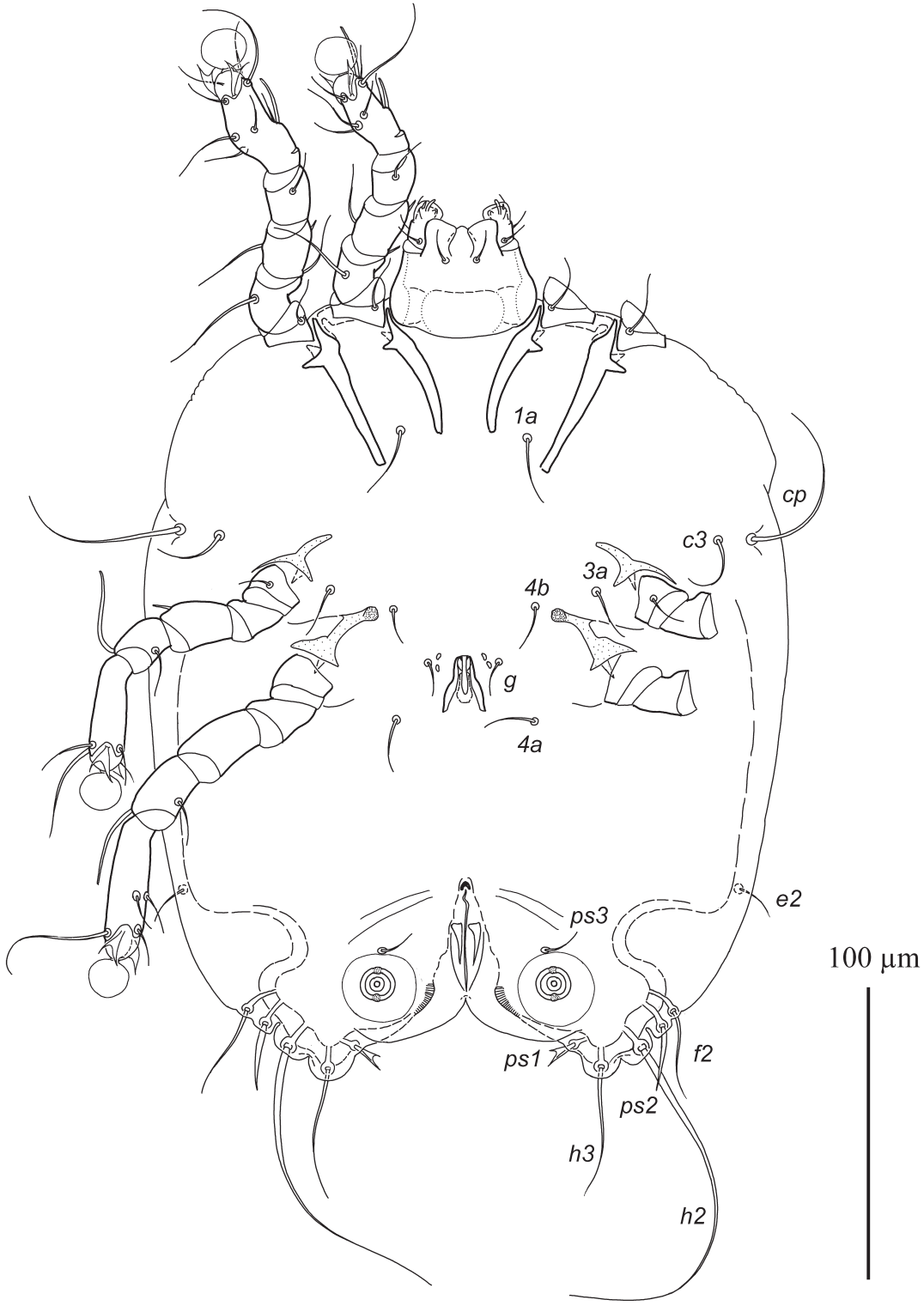

Fig. 2. *Pseudogabucinia malovichkoae* sp.n., ventral view of male.

humeral shields absent. Hysteronotal shield: covering almost entire dorsal surface of hysterosoma, anterior margin straight or slightly convex, anterior corners widely rounded, lateral margins almost straight, posterolateral margins with large and deep semicircular incisions, surface of posterior half with reticulate ornamentation, greatest length 205 (205–220), greatest width at level of setae *d2* 200 (190–205). Lateral sclerotized bands indistinct. Supranal concavity opened posteriorly, with uneven

margins, anterior end extending to level of setae *e2*. Opisthosomal lobes short, bluntly triangular; posterolateral margin and apex of each lobe with two semi-rounded projections bearing macrosetae *h2* and *h3*, respectively. Terminal cleft short, bluntly angular, with membranous margin, anterior end extending to level of setae *f2*, length 25 (25–32), width (distance between apical projections bearing setae *h3*) 80 (80–88). Setae *ps1* bifurcate with membrane between branches, 10 (10–12) long, situated on margins of terminal cleft near apical projections of lobes. Setae *f2* filiform; setae *ps2* narrowly lanceolate, 23 (20–23) long. Setae *h1* minute filiform, situated anteromesal to bases of setae *h2*. Distances between setae and gland openings: *c2:d2* 90 (80–90), *d2:e2* 60 (60–78), *d2:gl* 30 (30–42), *e2:h3* 65 (64–70), *d1:d2* 18 (10–18), *e1:e*2 20 (18–22), *h2:h2* 120 (120–140), *h3:h3* 98 (95–105), *ps1:ps*1 75 (72–75), *ps2:ps2* 140 (135–150).

Epimerites I slightly curved, posterior ends not divergent. Epimerites II almost straight. Genital apparatus situated at level of trochanters IV. Genital arch small, 20 (20–22) × 16 (16–18); aedeagus straight, slightly thickened distally, 15 (15–16) long. Genital papillae at level of genital arch apex. Setae *4b* posterior level of setae *3a*. Setae *g* at level of genital arch apex. Setae *4a* posterior to genital arch apex and widely separated from each other, approximately as widely as setae *1a*. Adanal suckers 13 (13–15) in diameter; corolla with a pair of thickenings, on anterior and posterior margins, respectively. Distances between setae: *3a:4b* 6 (5–8), *4b:g* 20 (18–22), *g:4a* 18 (18–23), *4a:ps3* 82 (75–83), *ps3:h3* 40 (38–45), *ps3:ps3* 58 (56–60).

Ventral margins of tarsi I, II noticeably convex. Trochanters of legs III and IV far distant from lateral margins of hysterosoma. Legs IV with ambulacral disc extending only to bases of setae *f2*. In tarsus IV, setae *d* and *e* button-like, situated in distal part of this segment; tibial solenidion φIV approximately half as long as tarsus IV. Lengths of tarsi: I 31 (31–33), II 35 (35–38), III 35 (35–39), IV 43 (43–48). Lengths of solenidia: ω1I 10 (9–12), ω1II 20 (19–21), σI 5 (4–6), σII 4 (3.5–4), σIII 7 (6–8), φIV 30 (25–30).

Female (range for 10 partypes) (Figs. 3, 4, 5B, 6F–H). Idiosoma strongly widened, length 315–365 × 220–250, length of hysterosoma 235–280. Subcapitulum trapezoidal, 40–44 long, 65–70 wide at base. Prodorsal shield shaped as in the male, length 48–55, wide at posterior margin 75–80, surface without ornamentation. Distances between scapular setae: *se:se* 68–78, *si:si* 44–54. Lateral setae *c2* and *c3* filiform, 20–23 and 24–30 long, respectively. Scapular and humeral shields absent. Hysteronotal shield: covering most dorsal area of hysterosoma except posterior quarter, anterior margin straight, anterior corners widely rounded, lateral margins almost straight, posterolateral margins with a pair of angular incisions separated by median extension, surface of posterior half with reticulate ornamentation, length 200–230, greatest width at level of setae *e2* 200–220. Lateral sclerotized bands poorly distinct on ventrolateral areas of opisthosoma. Posterior end of opisthosoma widely rounded. Setae *c1, d1, e1* and hysteronotal gland openings *gl* on hysteronotal shield. Setae *d2* and *e2* on soft tegument near lateral margins of hysteronotal shield. Setae *h1* on soft tegument, approximately at level of setae *f2*. Distances between setae and gland openings: *c2:d2* 98–110, *d2:e2* 60–78, *d2:gl* 35–45, *e2:h3* 75–80, *d1:d2* 7–15, *e1:e2* 15–25, *h1:h3* 23–30, *h2:h2* 87–100, *h3:h3* 63–70.

Epimerites I bow-shaped, posterior ends divergent. Epimerites II straight. Epigynum thick bow-shaped, almost touching tips of epimerites I, 12–15 × 35–40. Genital papillae at level of setae *3a*. Setae *g* at level of setae *3a* or slightly posterior. Copulatory opening immediately posterior to anal opening. Spermatheca and spermaducts as in Fig. 6H; secondary spermaducts 5 long. Distances between ventral setae: *4b:3a* 12–14, *g:4a* 38–42.

Legs I, II as in the males. Legs IV with ambulacral disc not extending to level of setae *f2*. Lengths of tarsi: I 36–38, II 43–45, III 42–44, IV 48–52. Lengths of solenidia: ω1I 10–12, ω1II 20–25, σI and σII 6–7, σIII 7–8, *φ*III 32–35, φIV 20–24.

Differential diagnosis. Of two *Pseudogabucinia* species, previously known from cranes, the new species, *Pseudogabucinia malovichkoae* sp.n., is the closest to *P. reticulata* Atyeo and Windingstad, 1979. The above species share the following characters: in both sexes, the idiosoma is strongly widened, with the length/width ratio about 1.5; legs III and IV are far distant from the lateral margins of idiosoma; in male, the genital apparatus is situated at the level of trochanters IV, and genital setae *g* are widely separated from each other; in females, the hysteronotal shield is approximately as wide as it is long. The new species differs from *P. reticu-*

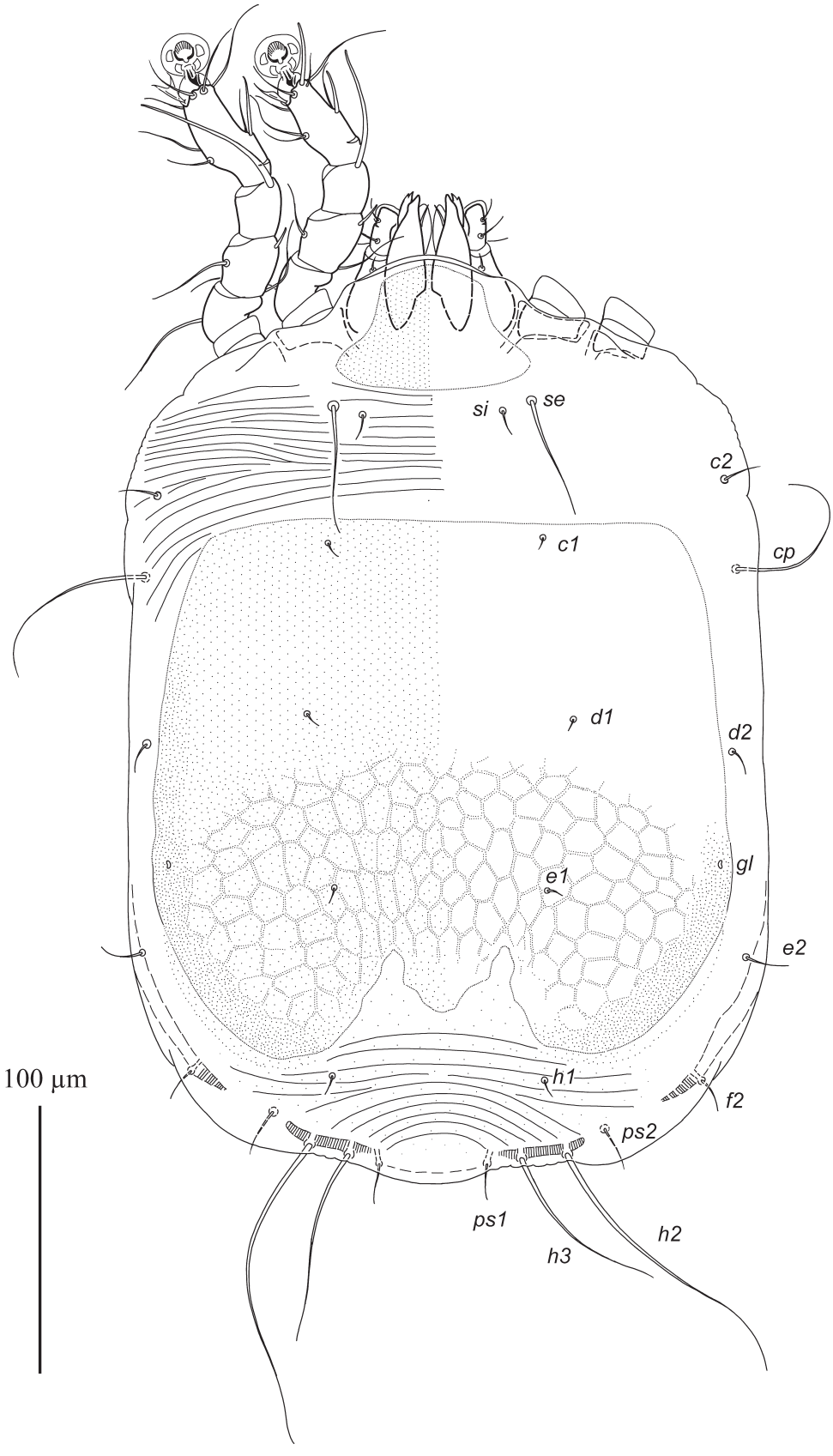

Fig. 3. *Pseudogabucinia malovichkoae* sp.n., dorsal view of female.

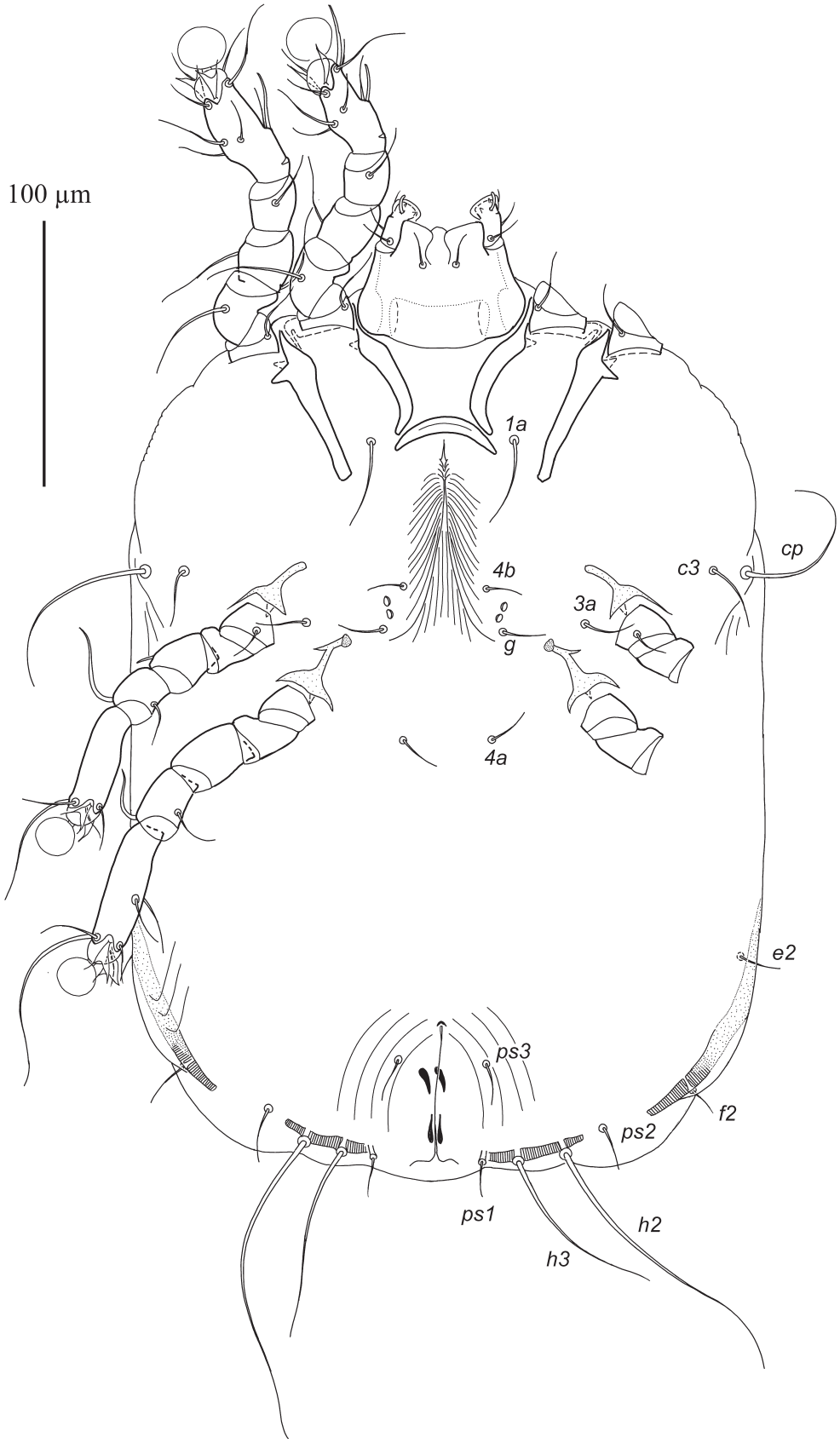

Fig. 4. *Pseudogabucinia malovichkoae* sp.n., ventral view of female.

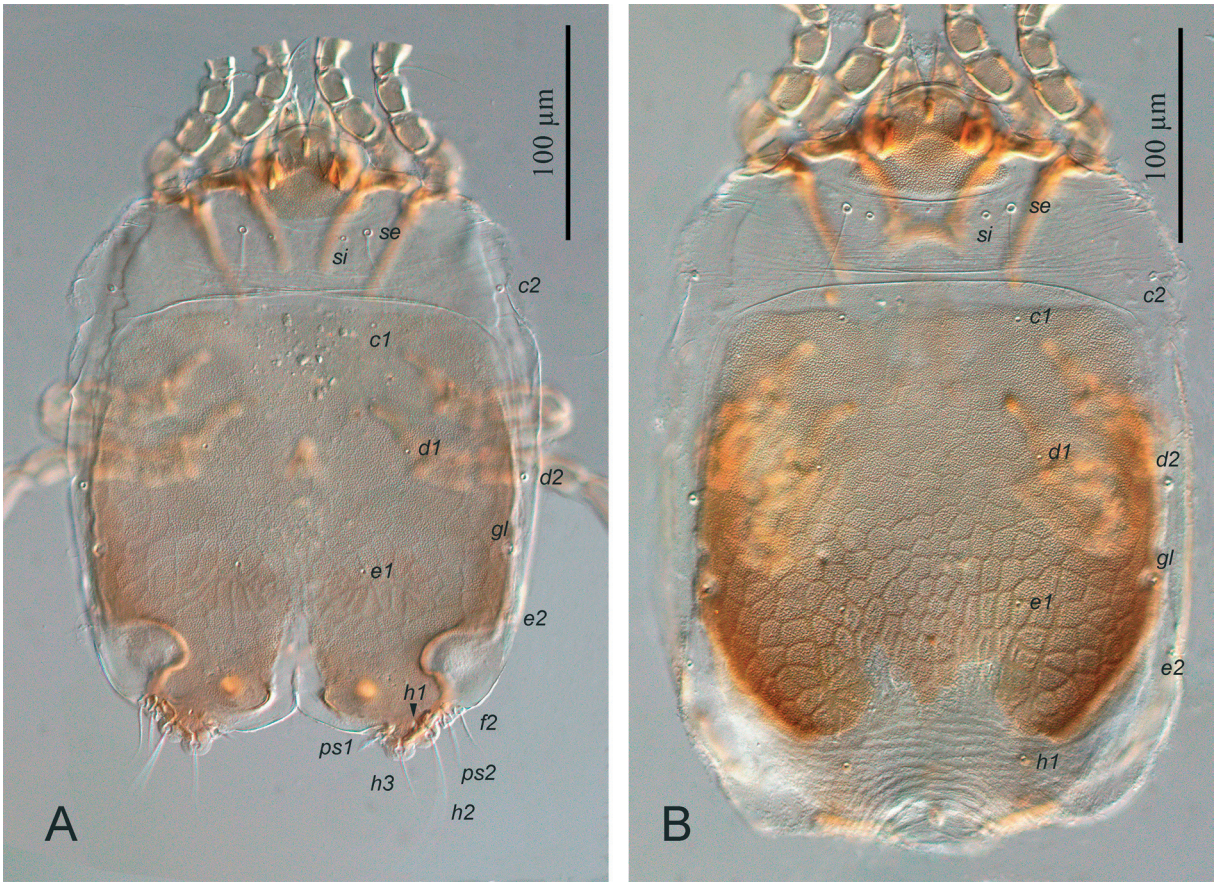

Fig. 5. *Pseudogabucinia malovichkoae* sp.n., dorsal view of idiosoma, A—male, B—female.

lata in the following features: in both sexes of *P. malovichkoae*, only the posterior half of the hysteronotal shield has a distinct reticulate ornamentation; in males, the posterolateral margins of the hysterononotal shield have a large semi-ovate incision with a strongly sclerotized border, and the terminal cleft is shorter (25–30 long), extending to the level of setae *f2*; in females, setae *f2* anterior to the level of setae *ps2*. In both sexes of *P. reticulata*, the entire surfaces of the prodorsal and hysteronotal shields are covered with a reticulate pattern; in males, the posterolateral margins of the hysteronotal shield reach the posterolateral margins of the opisthosomal lobes and do not have any incision, the terminal cleft is large (about 40 long), triangular, and extends to the level of adanal suckers; in females, setae *f2* and *ps2* are approximately at the same transverse level.

Etymology. The species is named in honor of Prof. Lyubov V. Malovichko, a famous Russian ornithologist (Russian State Agrarian University, Moscow Timiryazev Agricultural Academy, Russia), who suddenly passed away in October 2024.

Family **Pterolichidae Trouessart and Mégnin, 1984**

Subfamily **Pterolichinae Trouessart and Mégnin, 1984**

Genus ***Geranolichus* Gaud, 1968**

Type species: *Pterolichus* (*Pseudalloptes*) *gruis* Trouessart, 1884, by original designation.

The genus *Geranolichus* is restricted in its host distribution to cranes (Gruidae). It was established by Gaud (1968) and originally included three species: *Geranolichus gruis* (Trouessart, 1884) from the Common Crane *Grus grus*, *G. brachychaetus* Gaud 1968 from the Black Crowned Crane *Balearica pavonina* (Linnaeus) and *G. tetrachaetus* Gaud, 1968 from the Grey Crowned Crane *B. regulorum* (Bennet). Further, Atyeo and Windingstad (1979) described *G. canadensis* Atyeo and Windingstad, 1979 from the Sandhill Crane *Antigone canadensis tabida* (Peters, JL). Soon after, each of the two mite species from crowned cranes (*Balearica*) has been placed in separate monobasic

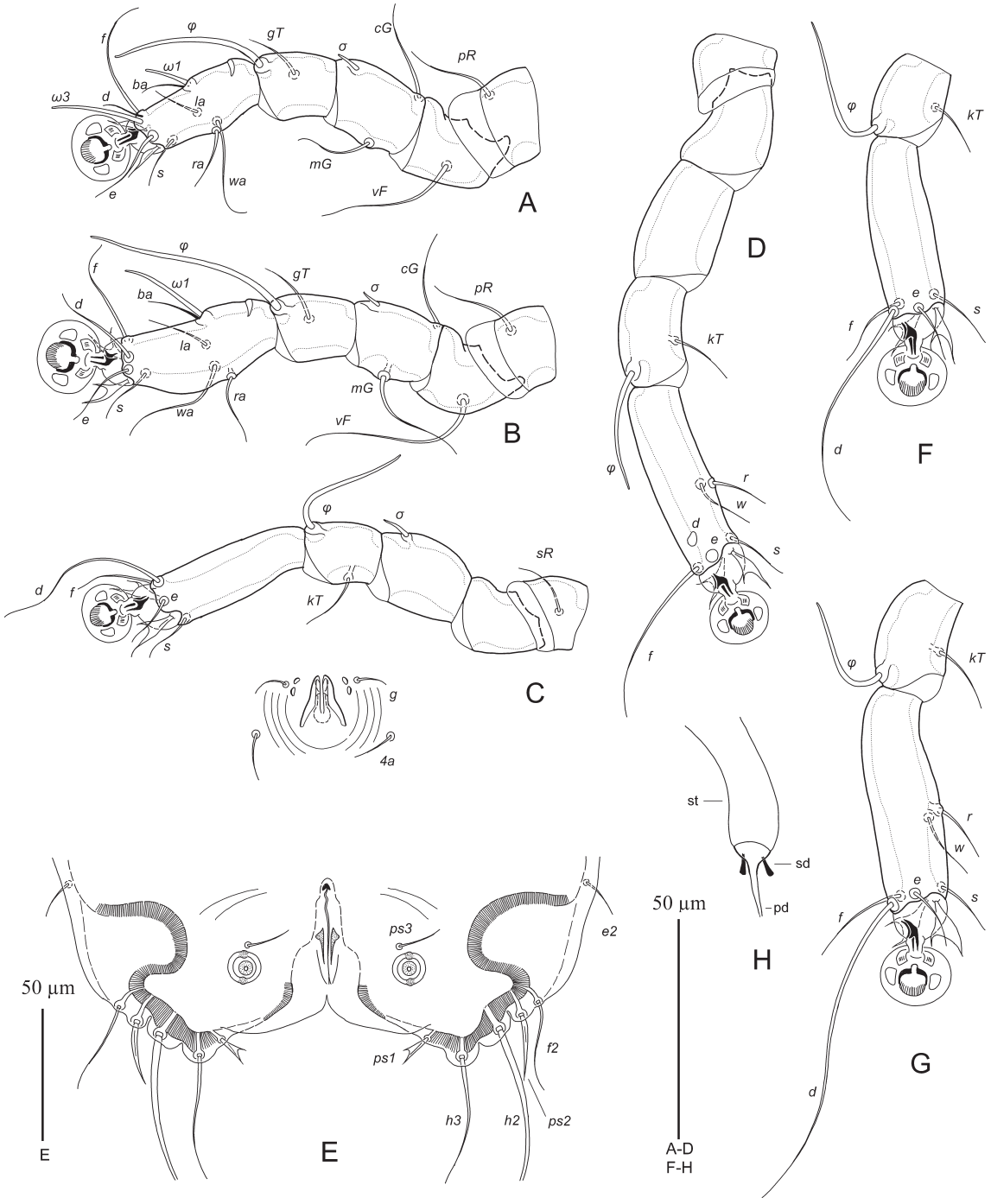

Fig. 6. *Pseudogabucinia malovichkoae* sp.n., details. A–D—legs I–IV of male, respectively, E—genital apparatus and opisthosoma of male, ventral view, F, G—tibiae and tarsi III, IV of female, respectively; H—spermatheca. Abbreviations: pd—primary spermaduct, sd—secondary spermaduct, sp—spermatheca.

genera, *Apatelacarus* Atyeo and Gaud, 1980 and *Doleracarus* Atyeo and Gaud, 1980, respectively (Atyeo and Gaud, 1980).

Geranolichus gruis, the type species of the genus, is provided herein with a modern description based on the newly collected material from the Common Crane in the south of European Russia. Although this species is well known to researchers, it was illustrated only by Berlese (1897). Dubinin (1956) reported *Geranolichus*

gruis from *Grus grus* from several localities in Russia (Leningradskaya Oblast, Mordovia, Transcaucasia and Zabaykalsky Krai) and briefly redescribed it, but provided illustrations which were modified from Berlese's (1897) drawings.

Geranolichus gruis (Trouessart, 1884)

(Figs. 7–10)

Pterolichus (*Pseudalloptes*) *gruis* Trouessart, 1884: 572; Trouessart and Mégnin 1885: 66; Berlese 1897: fasc. 81, No 4; Canestrini and Kramer 1899: 59.

Thecarthra gruis: Oudemens 1904: 192.
Pseudalloptes gruis: Radford 1953: 203, 1958: 124.
Pseudalloptinus gruis: Dubinin 1956: 169, fig. 53.
Geranolichus gruis: Gaud 1968: 90; Atyeo and Windingstad 1979: 651; Atyeo and Gaud 1980: 488.

Material examined. 15 males and 20 females (ZISP 23807–23841) from *Grus grus* (Linnaeus, 1758) (Gruiformes: Gruidae), Russia, Stavropolsky Krai, Turkmen District, near Poperechnyi, 45°25′

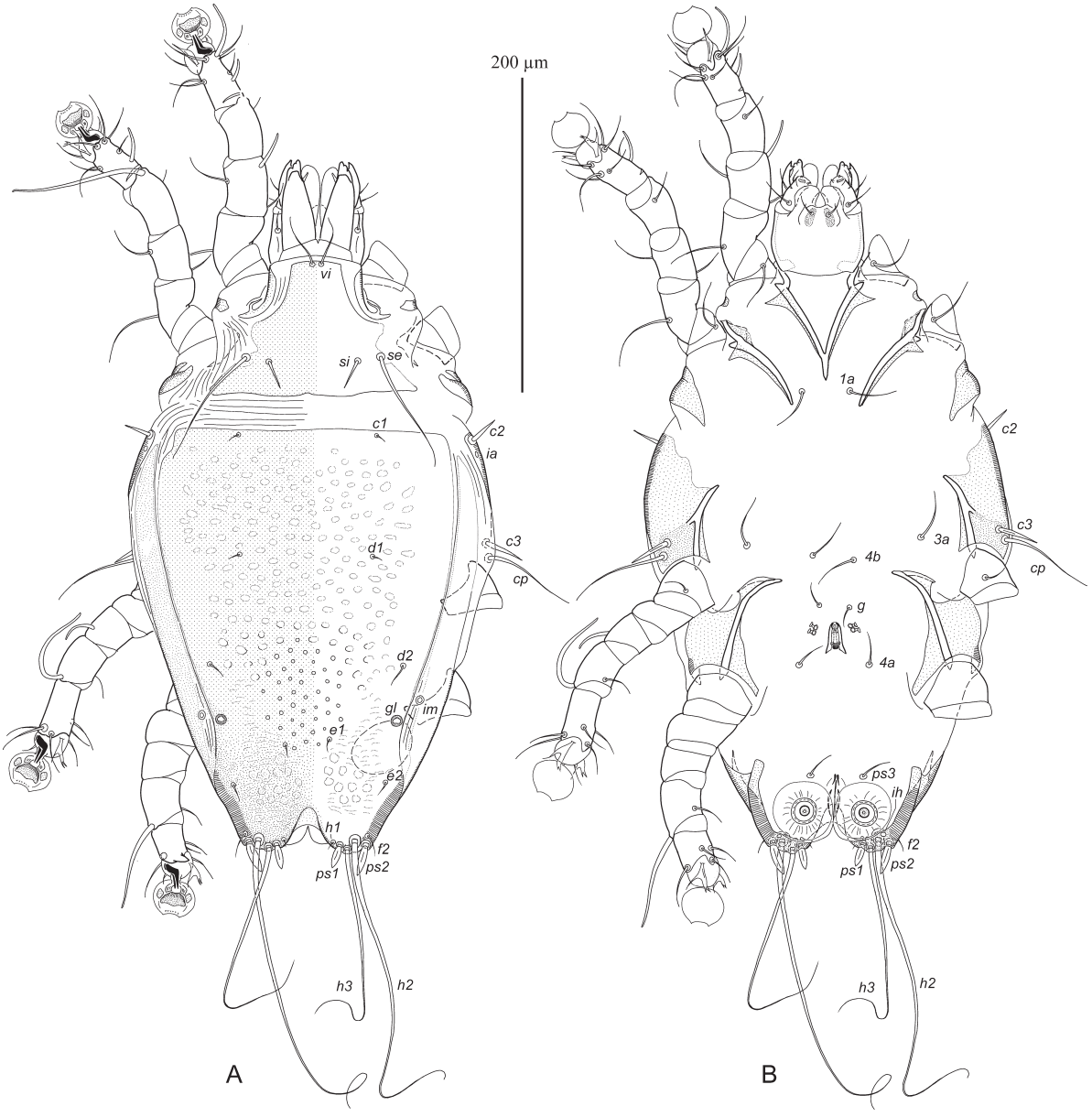

Fig. 7. *Geranolichus gruis* (Trouessart, 1884), male. A—dorsal view, B—ventral view.

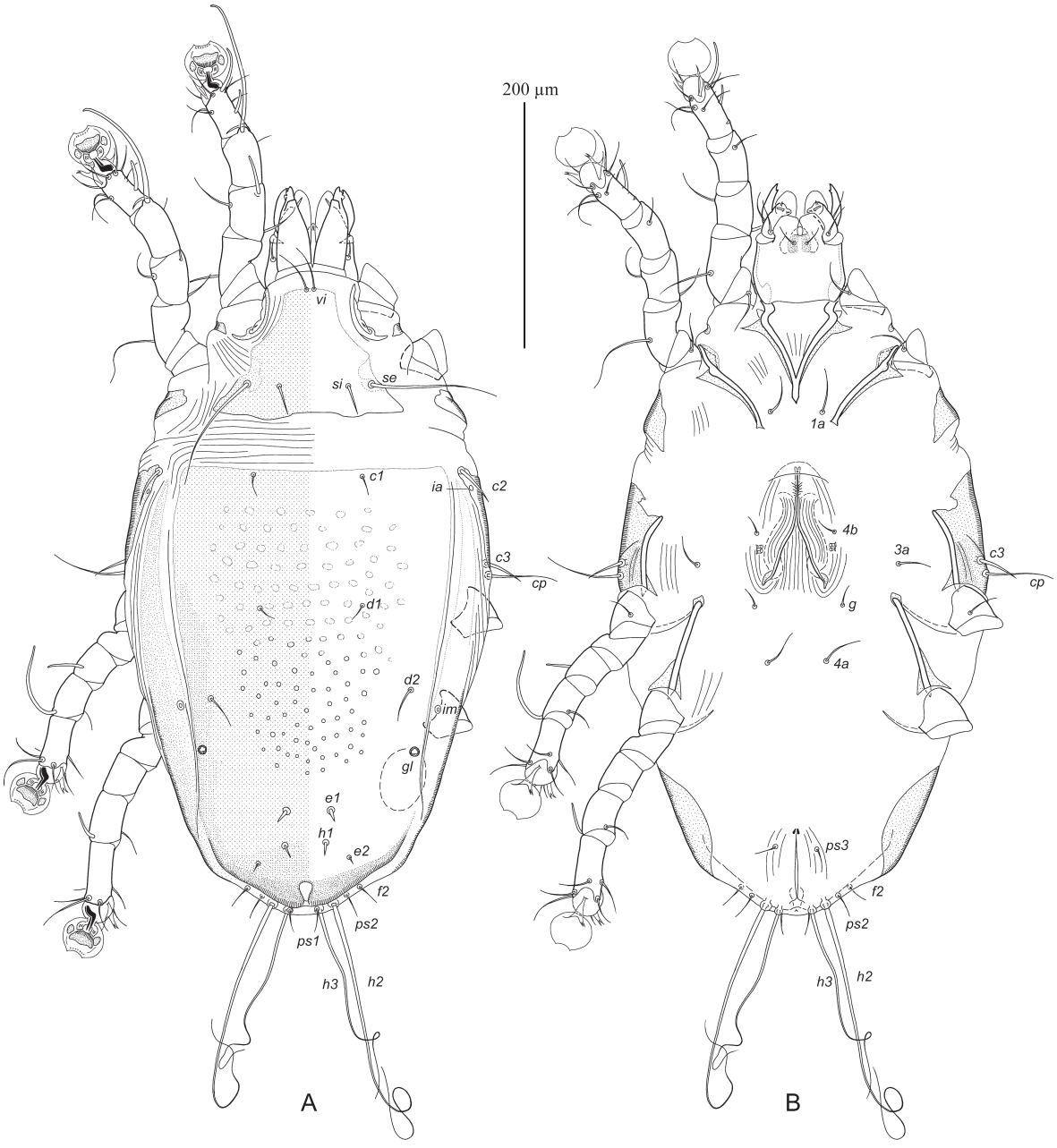

Fig. 8. *Geranolichus gruis* (Trouessart, 1884), female. A—dorsal view, B—ventral view.

22″N 43°15′28″E, 10 November 2022, coll. L. V. Malovichko.

Description. *Male* (range for 10 specimens) (Figs. 7, 9A, B, 10A–E). Odiosoma ovate, length × width, 365–385 × 220–235; length of hysterosoma 270–280. Subcapitulum trapezoidal, 45–50 × 62–65. Prodorsal shield nearly triangular in shape, anterolateral extensions short and rounded, lateral margins with small incision anterior to bases of setae *se*, posterior margin straight, posterior corners pointed, length along midline 80–90, width at posterior margin 125–135. Setae *vi* filiform, 28–35 long. Distance between scapular setae *se* 85–90. Setae *si* thin spiculiform, 15–18 long, separated by 58–65. Scapular shields small. Humeral shields fused ventrally with epimerites III. Setae *c2* small, spiculiform, 18–20 long, situated in anterior end of humeral shields. Subhumeral setae *c3* thick, spiculiform, 20–28 long. Hysteronotal shield: covering almost entire surface of dorsal hysterosoma; anterior margin straight; lateral margins slightly convex at level of humeral shield and

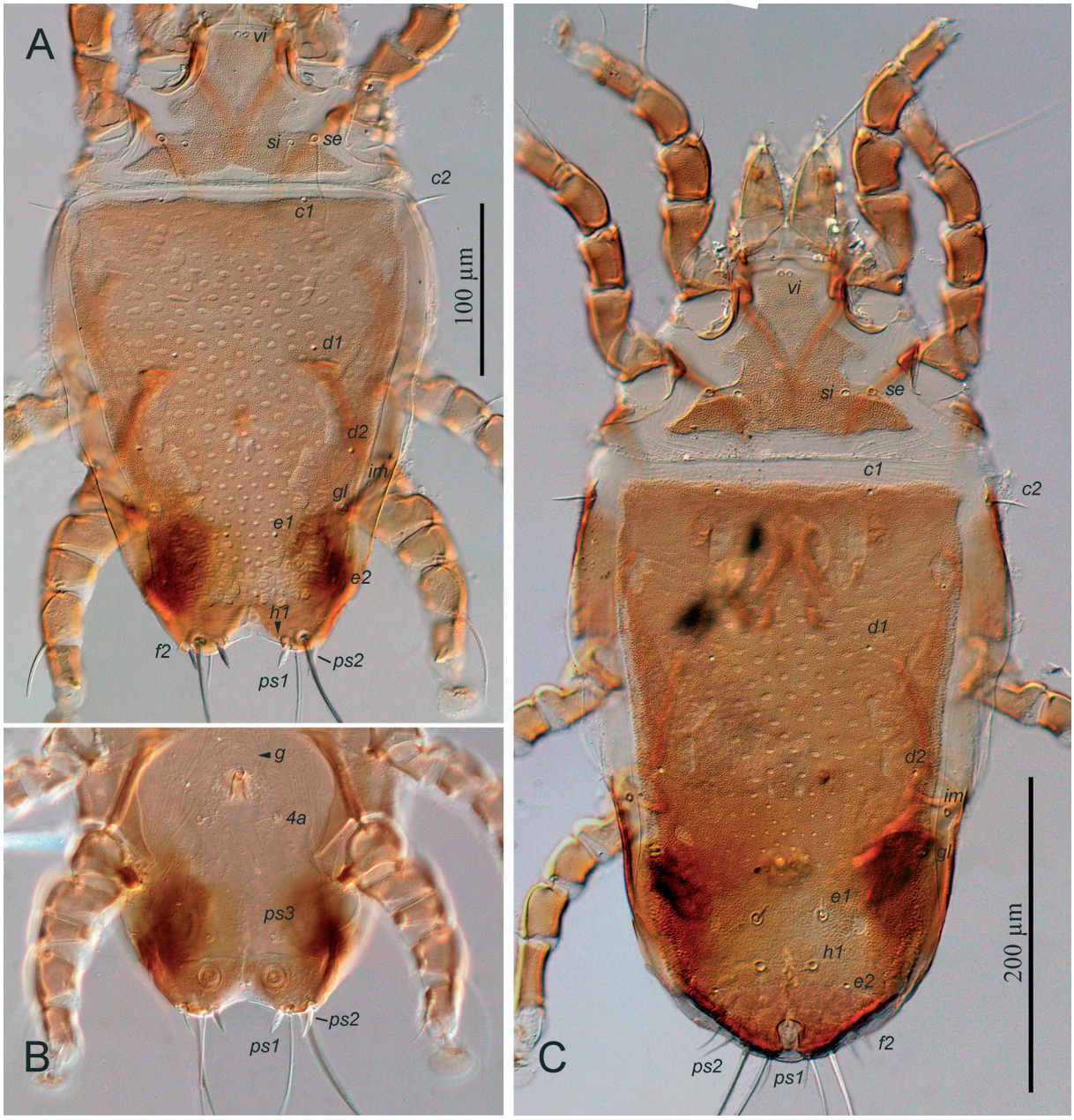

Fig. 9. *Geranolichus gruis* (Trouessart, 1884). A—dorsal view of male idiosoma, B—ventral view of male hysterosom, C—dorsal view of female idiosima.

gradually attenuate to posterior end of opisthosoma; entire surface with small circular lacunae, these lacunae smaller and clearly pronounced in posterior part; length 260–270, greatest width at level of humeral shields 185–200. Lateral sclerotized bands close to lateral margins of hysteronotal shield, their anterior ends extending almost to level of setae *c2*, posterior ends fused with opisthosomal part of hysteronotal shield. Hysteronotal gland openings *gl* on hysteronotal shield near lateral margins. Cupules *ia* on humeral shield near setae *c2*, cupules *im* on lateral sclerotized bands, slightly anterior to level of openings *gl*. Opisthosomal lobes short, twice as wide at base than long, posterior margin widely rounded. Terminal cleft small, semicircular, 15–18 long. Supranal concavity open posteriorly. Posterior margin of opisthosomal lobes with setae *h2* and *h*3 represented by macrosetae, setae *ps1* and *ps2* lanceolate, setae *f2* short filiform, and setae *h1* minute filiform. Setae *ps1* and *ps2* 13–16 and 18–22 long, respectively. Setae *h1* situated mesal to bases of setae *ps1*. Setae *f2* slightly anterior to bases of setae *ps2*. Distances between dorsal setae: *c2:d2* 135–145, *d2:e2* 75–88,

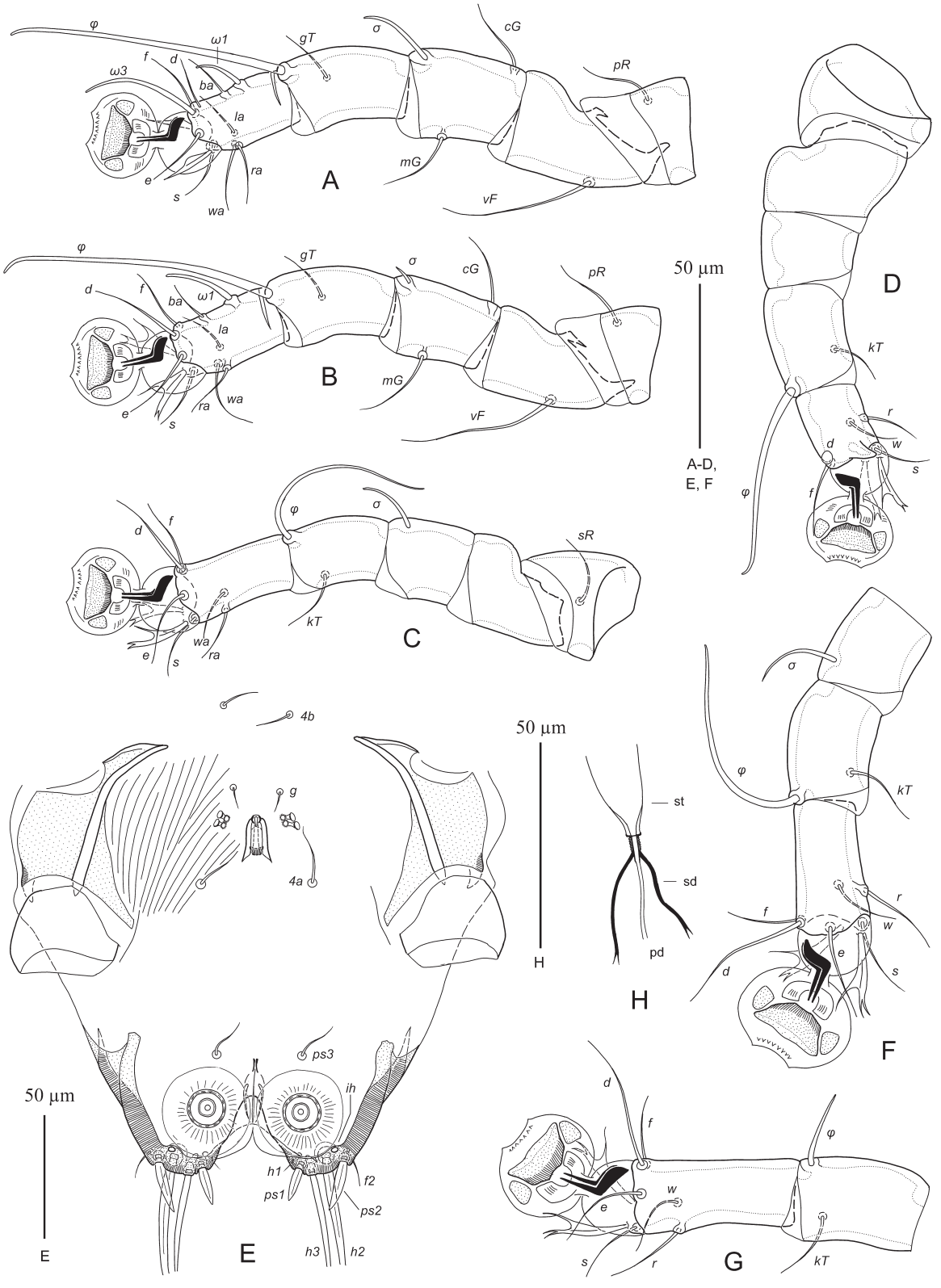

Fig. 10. *Geranolichus gruis* (Trouessart, 1884), details. A–D— legs I–IV of male, respectively E—ventral view of male opisthosoma; F—genu, tibia and tarsus III of female, G—tibia and tarsus IV of female, H—spermatheca. Abbreviations: pd—primary spermaduct, sd—secondary spermaduct, sp—spermatheca.

d2:gl 35–42, *e2:h3* 40–48, *d1:d2* 50–70, *e1:e2* 22–35, *h2:h2* 58–65, *h3:h3* 45–50, *ps1:ps1* 38–40.

Epimerites I fused in a Y, stem about ⅓ the total length of epimerites. Epimerites I, II without extensively sclerotized areas. Epimerites IV with triangular sclerotized areas flanking bases of trochanters IV. Genital apparatus between levels of trochanters III and IV. Genital arch 17–20 × 11–13, aedeagus barely protruding from genital arch. Genital papillae connected at bases, situated at level of anterior part of genital arch. Setae *4b* slightly posterior to level of setae *3a*. Setae *g* anterior to level of genital arch apex. Setae *4a* posterior to level of genital arch tips. Cupules *ih* large ovate, situated anterolateral to bases of setae *h2*. Ventral margins of hysteronotal shield form adanal apodemes flanking anal area laterally. Adanal suckers 16–18 in diameter, corolla without denticles, surrounding membrane with sparse fine striae. Distances between ventral setae: *4b:g* 30–34, *g:4a* 35–40, *4a:ps3* 70–78, *ps3:h3* 40–45, *ps3:ps3* 35–43.

Ambulacral discs of all legs with slightly concave distal margin. Legs I, II without apophyses and enlargements. Legs IV shorter and thicker than legs III, with tarsus extending beyond apices of opisthosomal lobes. Tarsus IV with subapical spine-like process, seta *d* button-like, seta *e* absent. Lengths of tarsi: I 30–33, II 33–35, III 33–35, IV 21–23. Lengths of solenidia: ω1I 12–15, ω1II 18–20, σI 18–22, σII 5–6, σIII 15–18, φIV 53–58.

Female (range for 10 specimens) (Figs. 8, 9C, 10F–H). Odiosoma ovate, length × width, 475–530 × 270–300; length of hysterosoma 350–380. Gnathosoma trapezoidal, 50–57 × 73–78. Prodorsal shield shaped as in the male, length along midline 95–110, width at posterior margin 145–160. Setae *vi* filiform, 40–50 long. Distance between scapular setae *se* 95–105. Setae *si* thin spiculiform, 20–25 long, separated by 58–68. Scapular shields small. Humeral shields fused ventrally with epimerites III. Setae *c2* small spiculiform, 23–25 long, situated in anterior end of humeral shields. Subhumeral setae *c3* thick spiculiform, 25–30 long. Hysteronotal shield: covering almost entire surface of dorsal hysterosoma, anterior margin straight, lateral margins slightly convex at level of humeral shield and trochanters III, anterior ⅔ with small circular lacunae, lacunae in central area noticeably smaller and clearly pronounced; length 335–360, greatest width 205–235. Lateral sclerotized bands close to lateral margins of hysteronotal shield, their anterior ends extending to humeral shield, posterior ends fused with opisthosomal part of hysteronotal shield. Hysteronotal gland openings *gl* on hysteronotal shield near lateral margins. Cupules *ia* on humeral shield posterior to setae *c2*, cupules *im* on lateral sclerotized bands, slightly posterior to level of setae *d2*. Setae *e1* and *h1* short, spiculiform, about 10 long, arranged in a rectangle (rarely trapezoid) in rear quarter of opisthosoma. Setae *e2* situated posterolateral to setae *h1* and closer to midline than lateral setae *f2*. Opisthosoma widely rounded posteriorly, with smoothed median extension. Supranal concavity small, roughly ovate. Distances between dorsal setae: *c2:d2* 60–175, *d2:e2* 130–160, *d2:gl* 45–50, *e2:h3* 28–42, *d1:d2* 60–70, *e1:e2* 38–60, *h1:h3* 50–60, *e1:h1* 25–32, *e1:e1* 33–36, *h1:h1* 32–50, *h2:h2* 48–52, *h3:h3* 24–26.

Epimerites I fused in a Y, with stem about 1/4 the total length of epimerites. Epimerites of all coxa without sclerotized areas. Epimerites IVa thin, barely distinct. Epigynum poorly sclerotized, represented by bow-shaped fold covering anterior end of oviporus, 10–15 × 35–45. Setae *g* posterior to level of setae *3a*. Copulatory opening terminal. Head of spermatheca as in Fig. 10H; length of secondary spermaducts 20–22 long. Distances between ventral setae: *4b:3a* 25–35, *3a:g* 20–32, *g:4a* 30–40.

Legs I, II as in the male. Legs IV with ambulacral discs extending beyond posterior margin of opisthosoma. Lengths of tarsi: I 38–40, II 40–43, III 38–43, IV 48–50. Lengths of solenidia: ω1I 13–16, ω1II 19–21, σI 26–28, σII 4–5, σIII 18–24, φIII 65–68, φIV 25–28.

Remark. *Geranolichus gruis* differs from the second species of the genus, *G. canadensis,* in having the following features. In males of *G. gruis*, the anterolateral projections of the prodorsal shield short and rounded, not extending to lateral margins of propodosoma; cupules *im* are closer to the level of gland openings *gl* than to setae *d2*; the terminal cleft is distinct and extends to or beyond the level of setae *h2*; and setae *h1* are situated mesal to bases of setae *ps1*. In females of *G. gruis*, the hysteronotal gland openings *gl* are closer to the level of setae *d2* than to that of setae *e1*, and solenidion σIII is about ⅔ the length of genu III. In males of *G. canadensis*, the anterolateral projections extend to the lateral margins of propodosoma; cupules *im* are closer to the level of setae *d2* than to that of gland openings *gl*; the terminal cleft is small,

bluntly-angular; and setae *h1* are anterior to the bases of setae *ps1*. In females of *G. canadensis*, gland openings *gl* are closer to the level of setae *e1* than to that of setae *d2*, and solenidion σIII is shorter than the half-length of genu III.

Superfamily **Analgoidea Trouessart and Mégnin, 1984**

Family **Analgidae Trouessart and Mégnin, 1984**

Subfamily **Megniniinae Gaud and Atyeo, 1982**

Genus ***Megniniella* Gaud, 1958**

Type species: *Dermaleichus gallinulae* Buchholz, 1869, by subsequent designation (Gaud and Mouchet 1959a).

The genus *Megniniella* is restricted to Gruiformes and for a long time has included only the species known from rails (Rallidae), the largest family of gruiforms (Gaud 1958, 1968; Gaud and Mouchet 1959a; Mironov and Galloway 2002). Mironov and Malovichko (2023) have recently described *Megniniella gruophila* Mironov and Malovichko, 2023 from the Common Crane and provided an updated world checklist of this genus with ten valid species.

Remark. It is highly possible that *Megninia fornicata* Trouessart, 1899, described from the Limpkin, *Aramus guarauna* (Linnaeus) (Gruiformes: Aramidae) in South America (Trouessart 1899), also belongs to the genus *Megniiella*. This question can be solved after the investigation of the type specimens or some newly recollected material from this host.

***Megniniella gruophila* Mironov and Malovichko, 2023**

(Fig. 11)

Megniniella gruophila Mironov and Malovichko, 2023: 1556, Figs. 1–4.

Material examined. Male holotype (ZISP 22 250), 21 male and 14 female paratypes (22 251–22 275, 22 359–22 368) from *Grus grus* (Linnaeus, 1758) (Gruiformes: Gruidae), Russia, Stavropolsky Krai, Turkmen District, near Poperechnyi, 45°25′ 22″N 43°15′28″E, 10 November 2022, coll. L.V. Malovichko.

Megniniella gruophila associated with the Common Crane is the only species of the genus *Megniniella* known thus far from the family of cranes (Gruidae). This finding gives reason to expect that more *Megniniella* species could be collected from other representatives of this host family.

Family **Alloptidae Gaud, 1957**

Subfamily **Alloptinae Gaud, 1957**

Genus ***Brephosceles* Hull, 1934**

Type species: *Pterolichus forficiger* Mégnin and Trouessart, 1884, by original designation.

The genus *Brephosceles* currently includes 52 species associated with the aquatic birds of the orders Anseriformes, Charadriiformes, Gaviiformes, Gruiformes, and Procellariiformes (Hull 1934; Dubinin 1951, 1952; Gaud 1953, 1957, 1968; Peterson and Atyeo 1968; Atyeo and Peterson 1970; Peterson 1971; Vasyukova and Mironov 1986, 1991; Mironov *et al*. 2022).

In the world taxonomic revision of this genus, Peterson (1971) provided unified (re)descriptions and a key to the species known at the time, arranging them in six species groups. Phylogenetic analysis of the family Alloptidae, based on morphological characters (Mironov 2007), supported the monophyly of the clade, incorporating all *Brephosceles* species groups recognized by Peterson (1971). However, the above analysis also showed that this genus is apparently paraphyletic, because this clade also incorporates several closely related but derived genera, including *Alloptoides* Gaud, 1961, *Dichobrephosceles* Peterson and Atyeo, 1968, *Homeobrephosceles* Peterson and Atyeo, 1968 and *Onychalloptes* Peterson and Atyeo, 1968.

Two formerly known species belonging to the *geranoxenus* species group were previously known from cranes: *Brephosceles geranoxenus* Peterson, 1968 from *Balearics regulorum* in Zambia (Nyassaland and Northern Rhodesia) and *Br. petersoni* Atyeo and Windingstad, 1979 from *Antigone canadensis tabida* in Wisconsin, the USA (Gaud 1968; Atyeo and Windingstad 1979).

***Brephosceles* sp.**

(Fig. 12)

Material examined. 1 female and 2 tritonymphs from *Grus grus* (Linnaeus, 1758) (Gruiformes: Gruidae), Russia, Stavropolsky Krai, Turkmen District, near Poperechnyi, 45°25′22″N 43°15′28″E, 10 November 2022, coll. L.V. Malovichko.

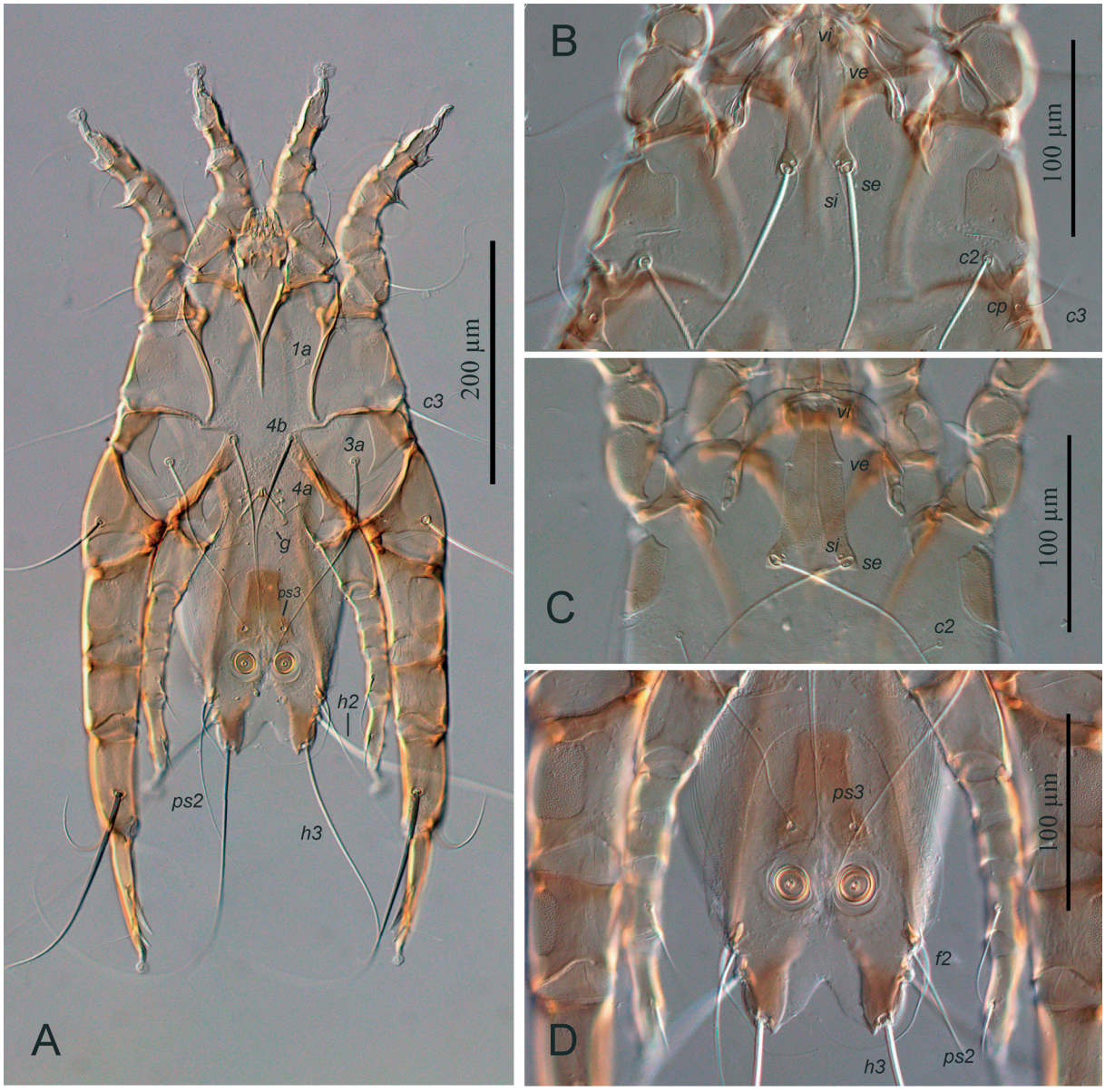

Fig. 11. *Megniniella gruophila* Mironov and Malovichko, 2023. A—ventral view of male, B—dorsal view of male prodorsum, C—dorsal view of female prodorsum, D—ventral view of male opisthosoma.

Only one female and one tritonymph of the genus *Brephosceles* have been collected from the Common Crane specimens using a washing technique. This mite belongs to the *geranoxenus* species group and apparently represents an undescribed species, but its description, based only on a single female, seems invalid at this time.

Remark. These specimens could potentially be *Brephosceles discurus* (Trouessart, 1885) described from *Grus grus*, whose identity is not sufficiently clear. Trouessart (1885: 74) described this mite as a subspecies *Pterodectes* (*Pterocolus*) *flagellifer discurus,* providing only a few male characteristics. Since the species *P.* (*Pt.*) *flagellifer* Trouessart, 1885 associated with the Common Sandpiper *Actitis hypoleucos* (Linnaeus) appeared a junior synonym and was synonymized with *Dermaleichus actitidis* Canestrini, 1878 from the same host, the subspecies *discurus* was given the subspecies name *Pterodectes actitidis discura* (Trouessart, 1885) (Canestrini and Kramer 1899; Radford 1953, 1958). In the preliminary revision of the genus *Brephosceles* and related genera, Peterson and Atyeo (1968) treated this subspecies as a full species *Brephosceles discurus* (Trouessart, 1885), while the

Fig. 12. Female of *Brephosceles* sp. from *Grus grus*. A—dorsal view; B—ventral view.

nominal subspecies *Dermaleichus actitidis* was placed in a separate genus *Dichobrephosceles* Peterson and Atyeo, 1968. However, Peterson (1971) did not subsequently consider *B. discurus* in the world revision of the genus *Brephosceles*, and did not even mention it in his work. It is possible that Peterson could not relate this mite to any of the recognized species groups of the genus, because the original description by Trouessart (1885) was quite scanty. The type specimens of this mite are probably lost, because this species is not mentioned in a hand-written catalog of the Trouessart's collection, generated by the late Prof. Jean Gaud in the 1980s.

ACKNOWLEDGEMENTS

The author thanks Aleksandr V. Matyukhin (A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia) for the delivery of crane specimens to the Zoological Institute RAS. This study was supported by the Ministry of Science and Higher Education of the Russian Federation (project № 125013001089-0).

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