Acarina 30 (2): 225–231

REDESCRIPTION OF *TYPHLODROMUS* (*ANTHOSEIUS*) *KUZNETSOVI* (DENMARK AND WELBOURN) (ACARI: PHYTOSEIIDAE) BASED ON HOLOTYPE AND NEWLY COLLECTED MATERIAL FROM TAJIKISTAN

Vladimir A. Khaustov[1*], İsmail Döker[1,2], Omid Joharchi[1], Alexander A. Khaustov[1] and Suhrob Homidov[3]

[1]X-BIO Institute, Tyumen State University, Tyumen, Russia
[2]Acarology Laboratory, Department of Plant Protection, Agricultural Faculty, Cukurova University, Adana, Turkey
[3]State Organization for Plant Protection and Chemicalization of Agriculture, Ministry of Agriculture of the Republic of Tajikistan, Dushanbe, Tajikistan
*corresponding author; e-mail: v.a.khaustov@utmn.ru

ABSTRACT: *Typhlodromus* (*Anthoseius*) *kuznetsovi* (Demnark and Welbourn) is redescribed based on the holotype female and newly collected materials from Tajikistan. After a detailed examination of the holotype female, we have concluded that several important morphological characters were incorrectly described in the original description. In this article, we redescribe and discuss these characters. Additionally, the holotype female of *T*. (*A*.) *kuznetsovi* was photographed and measured according to modern standards of phytoseiid taxonomy.

KEY WORDS: predatory mites, Typhlodrominae, Middle Asia, taxonomy, fauna

DOI: 10.21684/0132-8077-2022-30-2-225-231

INTRODUCTION

Predatory mites of the family Phytoseiidae (Acari: Mesostigmata) are well known biological control agents of phytophagous mites—mainly belonging to the families Tetranychidae, Tarsonemidae, Eriophyidae (Acari: Prostigmata)—as well as of other small soft-bodied insects such as thrips and whiteflies (McMurtry *et al*. 2013).

The subgenus *Typhlodromus* (*Anthoseius*) De Leon is the largest assemblage of species in the subfamily Typhlodrominae Wainstein, with more than 350 described species, including synonyms (Demite *et al*. 2022). *Typhlodromus* (*Anthoseius*) species are distributed worldwide, mostly occupying vascular plants. This subgenus is separated from the sister subgenus *Typhlodromus* (*Typhlodromus*) Scheuten by the presence of dorsal setae *S5*.

The phytoseiid fauna of Tajikistan is insufficiently studied and, at this point, only 10 species are known (Wainstein 1973; Kuznetsov 1984, 1994; Meshkov 1991; Demite *et al*. 2022).

During our expedition to Tajikistan in 2022, we have collected several specimens of *Typhlodromus* (*Anthoseius*) *kuznetsovi* (Denmark and Welbourn, 2002) from the species' type locality. This species was originally described under the name *Anthoseius richteri* Kuznetsov, 1984, based on two females collected from *Cydonia oblonga* Mill., in the Botanical Garden of Dushanbe, Tajikistan. Later, in their revision of the genus, Denmark and Welbourn (2002) have proposed a replacement name *Amblydromella* (*Aphanoseia*) *kuznetsovi* for *Anthoseius richteri* Kuznetsov, 1984 because of the existence of *Typhlodromus* (*Anthoseius*) *richteri* (Karg, 1970). After a detailed morphological comparison of the newly collected material with the holotype female, which is deposited in the Tyumen State University's Museum of Zoology, we have discovered that some important morphological characters were incorrectly described in the original work by Kuznetsov. These characters include: the number of dorsal solenostomes, the number of teeth on the movable digit of chelicera, the position of sternal setae *ST3*, the presence of preanal pores on ventrianal shield, and the reticulation of ventrianal shield. It should be noted that the aforementioned morphological characters are of great importance and are widely used in the species identification within the subgenus (Kolodochka 1992; Tsolakis and Ragusa 2020; Döker *et al*. 2021; Khaustov *et al*. 2021). Thus, the purpose of our study is to redescribe *Typhlodromus* (*Anthoseius*) *kuznetsovi* based on the holotype and the newly collected materials. In addition, we also describe leg segments omitted in the original description.

MATERIALS AND METHODS

Leaves of various plants were collected during our expedition to Tajikistan in May 2022. The mites were extracted directly from plant leaves using stereomicroscope Discovery V8 (Carl Zeiss, Germany) and placed in vials with 96% ethanol. For detailed morphological observations, specimens were cleared in lactic acid and mounted in Hoyer's medium (Walter and Krantz 2009). The taxonomic system of Chant and McMurtry (2007) was used for the mites of the Phytoseiidae family. Setae nomenclature for the dorsal idiosoma follows that of Lindquist and Evans (1965), as adapted for adult phytoseiids by Rowell *et al*. (1978). Setae nomenclature for the ventral idiosoma follows that of Chant and Yoshida-Shaul (1991). The nomenclature for the dorsal solenostomes and poroids follows that of Athias-Henriot (1975) and for the ventral—Johnston and Moraza (1991). The chaetotaxy of the legs follows that of Evans (1963). The peritreme length was measured from the posterior margin of the stigma to its apex. Measurements are given in micrometers (μm) and presented in square brackets for the holotype female followed by ranges for the newly collected specimens. Morphological observations, line drawings and measurements were prepared using the Axio Imager A2 compound microscope (Carl Zeiss, Germany), equipped with the differential interference contrast (DIC) and the phase contrast optical systems. Pictures were taken with Axiocam 506 color (Carl Zeiss, Germany).

All examined materials have been deposited in the collection of the Tyumen State University's Museum of Zoology, Tyumen, Russia.

SYSTEMATICS

Family Phytoseiidae Berlese, 1916

Subfamily **Typhlodrominae Wainstein, 1962**
Tribe **Typhlodromini Wainstein, 1962**
Genus ***Typhlodromus* Scheuten, 1857**
Subgenus ***Anthoseius* De Leon, 1959**

***Typhlodromus* (*Anthoseius*) *kuznetsovi* (Denmark and Welbourn, 2002)**

Anthoseius richteri Kuznetsov, 1984: 385

Amblydromella (*Aphanoseia*) *kuznetsovi* Denmark and Welbourn, 2002: 297

Female (n = 2 + holotype female) (Figs. 1–4).

Dorsum (Figs. 1A, 3A, 4B–D). Dorsal setal pattern 12A:8A (setae *r3* and *R1* off dorsal shield). Dorsal shield oval, lightly ornamented from *j1* to *J2*, and smooth on opisthosoma part, with constriction at level of *R1*. With 5 pairs of solenostomes (*gd2*, *gd4*, *gd6*, *gd8*, *gd9*) and 13 visible poroids. Muscle-marks (sigillae) visible mostly on podosoma, length of dorsal shield [332] 342–343, width (at level of *s6*) [174] 180–182, width (at level *S2*) [188] 185–190. Dorsal setae smooth, except *Z4* and *Z5* serrated. Measurements of dorsal setae as follows: *j1* [23] 22; *j3* [32] 29–30; *j4* [19] 18–19; *j5* [21] 20–21; *j6* [29] 28–29; *J2* [39] 36–37; *J5* [9] 9; *z2* [20] 19–21; *z3* [31] 27; *z4* [34] 29–30; *z5* [23] 23; *Z4* [53] 48–54; *Z5* [62] 59–62; *s4* [36] 35–36; *s6* [45] 43; *S2* [49] 46–48; *S4* [48] 48–53; *S5* [8] 8; *r3* [25] 24–27; *R1* [not visible] 30.

Peritreme [172] 187 in length, extending to level of setae *j1*.

Venter (Figs. 1B, 3B–C, 4G). Ventral setal pattern JV–4: ZV–3. Sternal shield smooth, poorly sclerotized with posterior lobe, [56] 59 in length (distance between *ST1–iv1*) and [53] 54 width (distance between setae *ST2*); with two pairs of setae (*ST1*, *ST2*) and two pairs of poroids (*iv1*, *iv2*); setae *ST3* and metasternal setae *ST4* with poroids *iv3* situated on small poorly sclerotized shields. Genital shield smooth, width (at level of setae *ST5*) [54] 59, poroids *iv5* on soft cuticle. One long slender platelet (genital sigilla) between genital and ventrianal shield. Ventral opisthosoma with two pairs of metapodal platelets, primary [33] 33–34 and accessory [9] 7–11. Ventrianal shield vase-shaped, smooth with constriction at the level of *JV3*, with four pairs of pre-anal setae (*JV1*, *JV2*, *JV3*, *ZV2*), one pair of para-anal setae *PA*, unpaired post-anal seta *PST* and a pair of small rounded pre-anal pores *gv3* posteromesad *JV2*. Length of ventrianal shield [107] 113–116, width (at the level of setae *ZV2*) [56] 58–62. Setae *ZV1*, *ZV3*, *JV4*, *JV5* and 5 pairs of poroids on soft cuticle surrounding ventrianal shield. Setae *JV5* smooth and much longer than other ventral setae, [47] 46–47 in length.

Chelicera (Figs. 1C, 3D, 4E). Fixed digit [23] 25–26 long, with three apical teeth and pilus dentilis; movable digit [22] 23 long with three small teeth.

Spermatheca (Figs. 1D, 3E, 4F). Calyx tubular [25] 25 long, with nodular atrium incorporated to basal part of calyx. Major duct wide, minor duct thin and long.

Legs (Fig. 2A–D). Length of legs (distance between base of coxae to base of pretarsi): leg I [277] 288–291; leg II [236] 243–251; leg III [228]

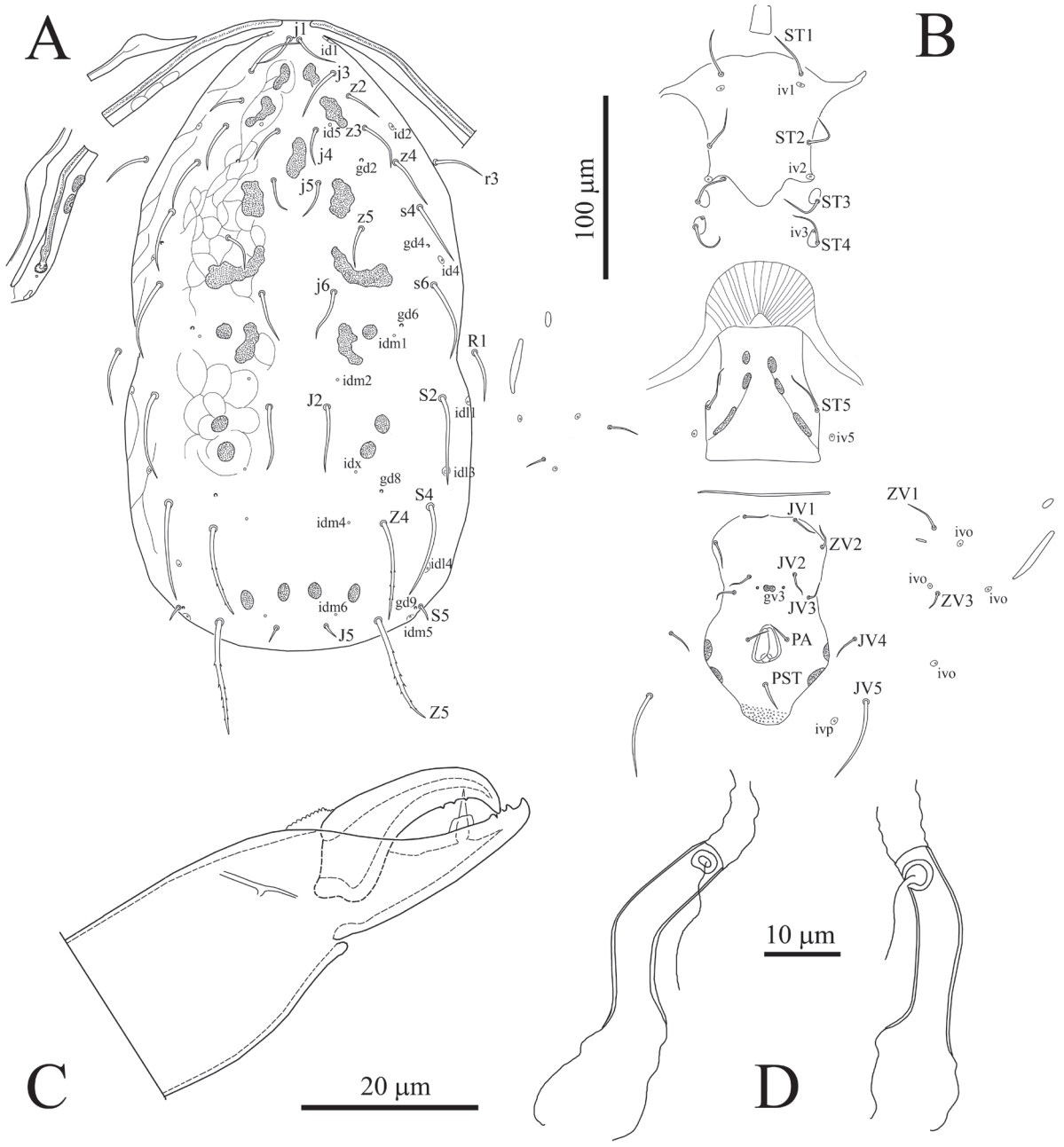

Fig. 1. *Typhlodromus* (*Anthoseius*) *kuznetsovi* (Denmark and Welbourn, 2002), female. A—dorsal idiosoma; B—ventral idiosoma; C—chelicera; D—spermathecae.

241–247; leg IV [317] 313–321. Chaetotaxy as follows: Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/1 1/2 1, femur 2 3/1 2/2 2, genu 2 2/1 2/1 2, tibia 2 2/1 2/1 2; Leg II: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 2 3/1 2/1 1, genu 2 2/0 2/1 1, tibia 1 1/1 2/1 1; leg III: coxa 0 0/1 0/1 0, trochanter 1 1/1 0/2 0, genu 1 2/1 2/0 1; tibia 1 1/1 2/1 1; Leg IV: coxa 0 0/1 0/0 0, trochanter 1 1/1 0/2, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/0 1. Chaetotaxy of tarsi II–IV is typical for Phytoseiidae with 18 setae 3 3/2 3/2 3 +*mv*, *md*. Leg IV with two pointed macrosetae on basitarsus *StIV* [36] 33–35 and telotarsus *StlIV* [35] 34–36. Other segments of legs without macrosetae.

Male: unknown.

Material examined: holotype female, slide № 42, Tajikistan, Dushanbe, Botanical Garden, on leaves of *Cydonia oblonga* Mill, 2 Sept. 1976, coll. N.N. Kuznetsov; 1 female, Tajikistan, Dushanbe, Botanical Garden, on grass, 25 May 2022, 38°36′16″N, 68°46′52″E, 869 m a.s.l., coll. V.A. Khaustov; 1 female, Varzob River Gorge, on *Juniperus*

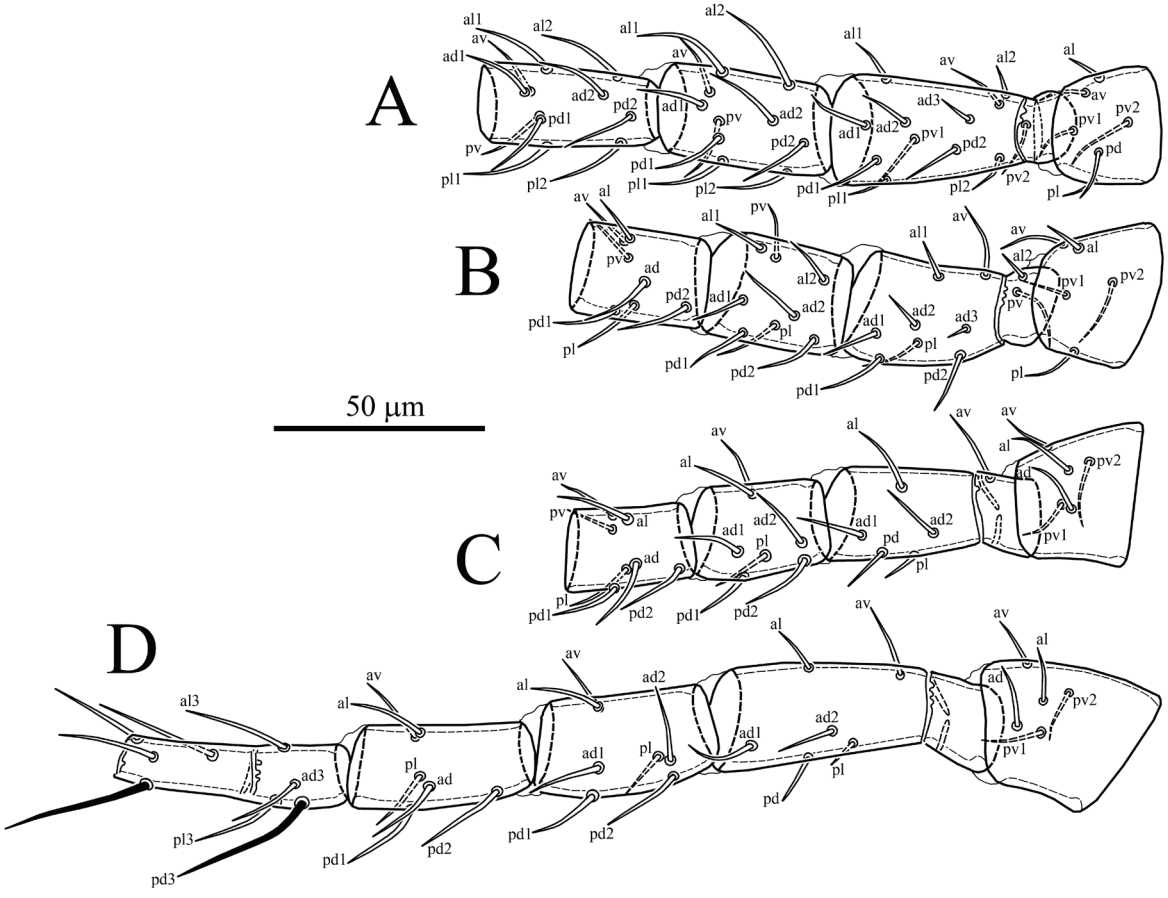

Fig. 2. *Typhlodromus* (*Anthoseius*) *kuznetsovi* (Denmark and Welbourn, 2002), female, left legs, dorsal view. A—leg I (coxa and tarsus omitted); B—leg II (coxa and tarsus omitted); C—leg III (coxa and tarsus omitted); D—leg IV (coxa and apical part of tarsus omitted).

sp., 26 May 2022, 38°49′56″N, 68°52′40″E, 1,520 m a.s.l., coll. V.A. Khaustov.

Remarks. *Typhlodromus* (*Anthoseius*) *kuznetsovi* has a limited distribution and, until now, has been known only based on its original description from Tajikistan. The specimens of *Typhlodromus* (*Anthoseius*) *kuznetsovi*, collected during our expedition to Tajikistan, were compared to the holotype female. After a detailed examination, we have observed some morphological differences between the original description and the holotype female. Contrary to the original description, solenostomes *gd4* are present in the holotype female and in the newly collected materials. In addition, Kuznetsov (1984) has mentioned: a movable digit of chelicera without teeth (vs. with 3 small teeth in the holotype female and in the newly collected material); setae *ST3* on sternal shields (vs. *ST3* on metasternal shield in the holotype female and in the newly collected material); ventrianal shield without preanal pores *gv3* and reticulated anteriorly (vs. ventrianal shield with small rounded preanal pores and smooth in the holotype female and in the newly collected material).

All morphological characters mentioned above are of great importance due to them being widely used in delimiting species within the Phytoseiidae family. For instance, several studies have demonstrated the taxonomic utility of a single pair of solenostomes when distinguishing between two morphologically identical species (Kolodochka 2018; Khaustov *et al*., 2022). Thus, to avoid taxonomic confusions, such characters should be correctly illustrated and described.

ACKNOWLEDGEMENTS

This study was supported by a grant from the Russian Science Foundation (project № 20-64-47015).

REFERENCES

Athias-Henriot, C. 1975. Nouvelles notes sur les Amblyseiini. II. Le relevé organotaxique de la face

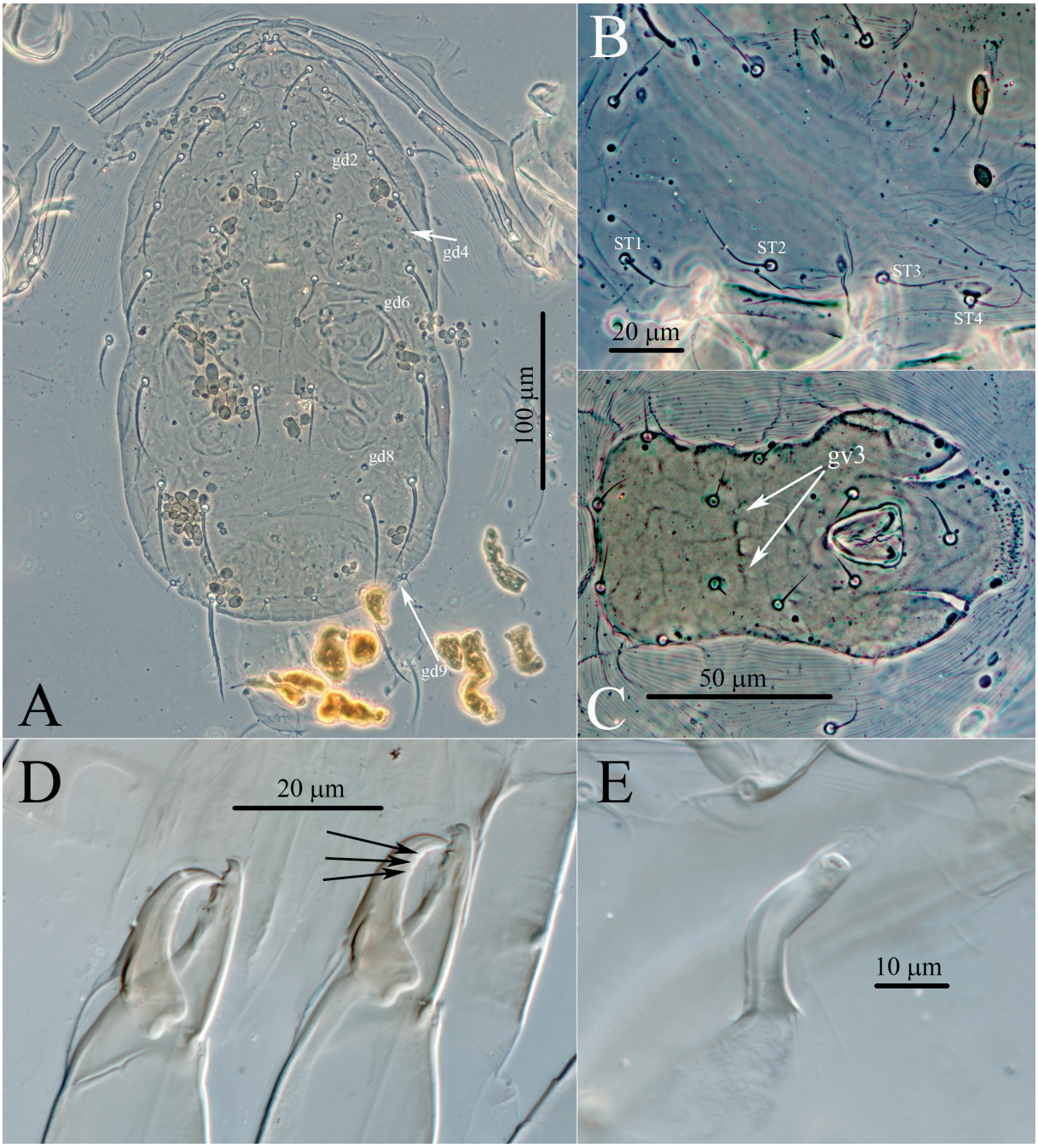

Fig. 3. Micrographs of *Typhlodromus* (*Anthoseius*) *kuznetsovi* (Denmark and Welbourn, 2002), female. A—dorsal idiosoma; B—sternal shield area; C—ventrianal shield; D—chelicerae; E—spermatheca.

dorsale adulte (Gamasides protoadéniques, Phytoseiidae). *Acarologia*, 17(1): 20–29.

Chant, D.A. and McMurtry, J.A. 2007. *Illustrated Keys and Diagnoses for the Genera and Subgenera of the Phytoseiidae of the World (Acari: Mesostigmata)*. Indira Publishing House, West Bloomfield, 219 pp.

Chant, D.A. and Yoshida-Shaul, E. 1991. Adult ventral setal patterns in the family Phytoseiidae (Acari: Gamasina). *International Journal of Acarology*, 17(3): 187–199.

Demite, P.R., Moraes, G.J. de, McMurtry, J.A., Denmark, H.A. and Castilho, R.C. 2022. *Phytoseiidae Database*. Date of access: 5 Nov. 2022. http://www.lea.esalq.usp.br/phytoseiidae/

Denmark, H.A. and Welbourn, W.C. 2002. Revision of the genera *Amblydromella* Muma and *Anthoseius* De Leon (Acari: Phytoseiidae). *International Journal of Acarology*, 28(4): 291–316.

Döker, I., Khaustov, V.A. and Joharchi, O. 2021. A new species of *Typhlodromus* (*Anthoseius*) De Leon and

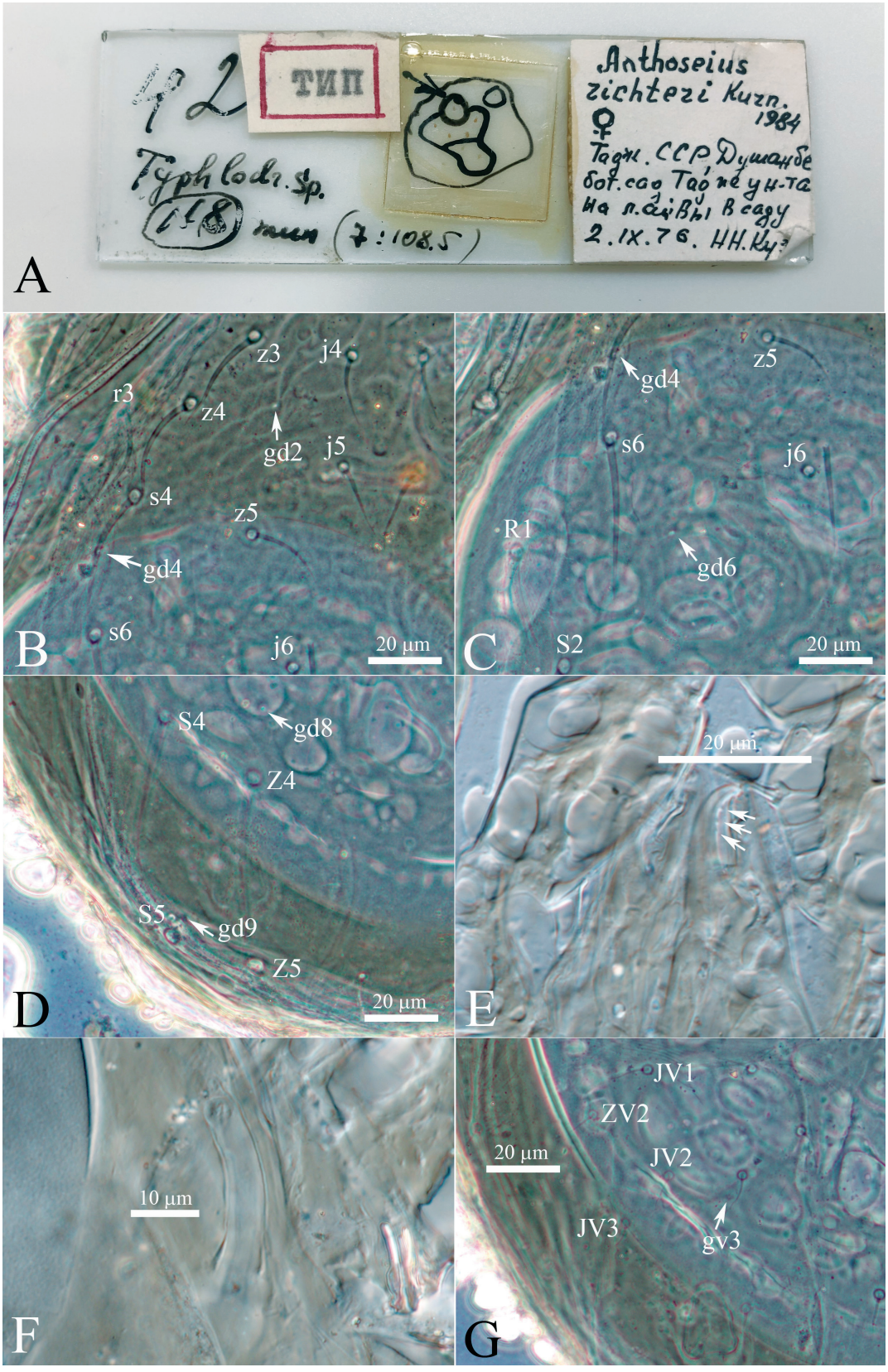

Fig. 4. Micrographs of the holotype female of *Typhlodromus* (*Anthoseius*) *kuznetsovi* (Denmark and Welbourn, 2002). A—slide with holotype female (indicated by arrow); B—part of dorsal shield with indicated by arrow dorsal solenostomes *gd2* and *gd4*; C—part of dorsal shield with indicated by arrow dorsal solenostomes *gd4* and *gd6*; D—part of dorsal shield with dorsal solenostomes *gd8* and *gd9* (indicated by arrow); E—chelicerae (teeth indicated by arrow); F—spermatheca; G—ventrianal shield (pre-anal pores indicated by arrow).

redescription of *T.* (*A.*) *montanus* Chant & Yoshida-Shaul from Russia. *Zootaxa*, 4951(2): 372–380.

Evans, G.O. 1963. Observations on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigrnata). *Bulletin of the British Museum (Natural History) Zoology*, 10: 275–303.

Johnston, D.E. and Moraza, M.L. 1991. The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina). In: F. Dusbábek and V. Bukva (Eds.). *Modern Acarology.* Vol. 2. Academia, Prague, pp. 349–356.

Karg, W. 1970. Neue Arten der Raubmilbenfamilie Phytoseiidae Berlese, 1916 (Acarina: Parasitiformes). *Deutsche Entomogische Zeitschrift*, 17: 289–301.

Khaustov, V.A., Döker, I. and Joharchi, O. 2021. A new species of *Typhlodromus* (*Anthoseius*) De Leon (Acari: Mesostigmata: Phytoseiidae) from Sakhalin island, Russia. *Acarina*, 29(2): 257–265.

Khaustov, V.A., Döker, I., Joharchi, O., Kazakov, D.V., Khaustov, A.A., Moradi, M., Fang, X.-D. and Klimov, P. 2022. A new, broadly distributed species of predacious mites, *Neoseiulus neoagrestis* sp. nov., (Acari: Phytoseiidae) discovered through GenBank data mining and extensive morphological analyses. *Systematic and Applied Acarology*, 27(10): 2038–2061.

Kolodochka, L.A. 2002. A new species of the genus *Typhlodromus* (Parasitiformes: Phytoseiidae) from Ukraniane Carpathians. *Vestnik Zoologii*, 36(6): 81–84.

Kolodochka, L.A. 2018. Two new species of the genus *Neoseiulus* (Parasitiformes, Phytoseiidae) with redescriptions of *N. bicaudus* and *N. micmac* based on holotypes. *Vestnik Zoologii*, 52(4): 295–306.

Kuznetsov, N.N. 1984. [New species of predacious mites of the family Phytoseiidae (Parasitiformes) in the USSR]. *Entomologicheskoe Obozrenie*, 63(2): 384–397. [In Russian]

Kuznetsov, N.N. 1994. [Two new phytoseiid mite species (Parasitiformes, Phytoseiidae) from Armenia and Tadjikistan]. *Vestnik Zoologii*, 2: 78–81. [In Russian]

Lindquist, E.E. and Evans, G.O. 1965. Taxonomic concepts in the Ascidae with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). *Memoirs of the Entomological Society of Canada*, 47: 1–64.

McMurtry, J.A., Moraes, G.J. de, Sourassou, N.F. 2013. Revision of the lifestyles of phytoseiid mites (Acari: Phytoseiidae) and implications for biological control strategies. *Systematic and Applied Acarology*, 18(4): 297.

Meshkov, Yu.I. 1991. [*Euseius amissibilis* sp.n. (Parasitiformes, Phytoseiidae), a new species of mite from Tadjikistan]. *Zoologicheskii Zhurnal*, 70(11): 138–140. [In Russian]

Rowell, H.J., Chant, D.A. and Hansell, R.I.C. 1978. The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae (Acarina: Mesostigmata). *The Canadian Entomologist*, 110(8): 859–876.

Tsolakis, H. and Ragusa, S. 2020. New records of phytoseiid mites from Italy, with description of a new species and a redescription of other two (Parasitiformes, Phytoseiidae). *Acarologia*, 60(4): 735–752.

Wainstein, B.A. 1973. [New genus and species of Phytoseiidae (Parasitiformes)]. *Zoologicheskii Zhurnal*, 52(6): 953–955. [In Russian]

Walter, D.E. and Krantz, G.W. 2009. Collecting, rearing and preparing specimens. In: G.W. Krantz and D.E. Walter (Eds.). *A Manual of Acarology*. 3rd Edition. Texas Tech University Press, Lubbock, Texas, pp. 83–95.