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THE PREDATORY MITES (PHYTOSEIIDAE, PARASITIFORMES) IN THE FAUNA OF UKRAINE: GENERA *PARAGIGAGNATUS*, *CARINOSEIUS*, *KAMPIMODROMUS*, *EHARIUS*, *TYPHLODROMIPS*, AND *EUSEIUS*

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The Predatory Mites (Phytoseiidae, Parasitiformes) in the Fauna of Ukraine: of the Genera *Paragigagnatus*, *Carinoseius*, *Kampimodromus*, *Eharius*, *Typhlodromips*, and *Euseius*. Kolodochka, L. A. — Phytoseiid mites (Phytoseiidae, Parasitiformes) are well known as effective predators that are successfully used for biological control of plant pests. Despite significant progress in finding and using effective species of these mites in the practice of plant protection, in general, the amount of knowledge about this important group of small arthropods remains insufficient. This article continues previous publications about research results, some of which were published earlier (Kolodochka, 2022; 2023). The article summarises the results of the study of the species composition of phytoseiid mites of six genera conducted in Ukraine over the past decades, namely, *Paragigagnatus* Amitai & Grinberg, *Carinoseius* Wainstein, *Kampimodromus* Nesbitt, *Eharius* Tuttle & Muma, *Typhlodromips* De Leon, *Euseius* Wainstein. It provides the main elements of the characteristics of these taxa: detailed species redescriptions are accompanied by species identifiers, drawings, morphological data and measurements, diagnoses, places of storage of types, data on the distribution of species in the world and Ukraine, places of residence, estimation of abundance etc.
Key words: phytoseiid mites, taxonomy, identification, diagnosis, distribution.

Introduction

Predatory mites of the family Phytoseiidae (Acarina, Parfsitiformes) deserve a worthy place among the beneficial arthropods that are able to control the number of herbivorous pests and are useful from an economic point of view. These natural enemies of phytophagous mites and small insects can, under certain conditions, reliably protect plants from herbivorous pests that cause serious damage to agricultural production. At the same time, knowledge of these beneficial predators is still poor, for example in Europe. Recently, the situation has begun to change, as evidenced by the recent monograph on phytoseiids of Greece (Papadoulis et al., 2009) and the publication of an article on mites of the genera *Graminaseius* and *Transeius* in the fauna of Ukraine (Kolodochka, 2022, 2023). The results of the development of research in this direction are presented in the present article, which complements and details the results of the further study of the species composition of mites on various plants in the natural and anthropogenic landscapes of Ukraine based on the material of long-term collections. Detailed redescriptions of the identified species are accompanied by keys, line drawings, descriptions of morphological characteristics and measurement data, diagnostics, list of habitat types, estimation of abundance and frequency of occurrence, information on distribution in the world and in Ukraine.

Material and methods

The study was carried out on the collection material from different natural zones of Ukraine on terrestrial vegetation of various types. Mites were collected using standard methods described in the previous article (Kolodochka, 2022). The collected material was fixed with 70 % alcohol and preserved for a short time. Mites were mounted on glass slides in Hoyer's liquid. Then the slides were dried in a thermostat at 60° C for 2–3 weeks. Slides were examined with a microscope MBI-3 (LOMO) with the phase-contrast objectives KF-4 with 10–90× magnification and camera lucida PA-6 (LOMO), 1.5× for drawing and measurements. The type specimens of the species are deposited in the collection of the I. I. Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kyiv (SIZK). Where necessary, slides of species from the collection of B. A. Wainshtein, deposited in the Department of Acarology of the Institute of Zoology (SIZK), were used for comparison. One species was redescribed on the basis of non-type specimens from Ukraine after comparison with the type deposited in the Naturalis Biodiversity Center (Nationaal Natuurhistorisch Museum; formerly Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands (RMNH). In one case where the type material was missing, illustrations and descriptions of the species in publications by other authors were used for identification. Measurements are given in micrometres (μm). The terminology of idiosomal setae follows Wainstein (1973 a) with minor modifications or is adopted from Wainstein (1973 b) and Kolodochka (1990) for the description of the reproductive system of phytoseiids. All drawings in this paper are original. The genera are accepted here as understood by Chant & McMurtry (2007) and Denmark & Evans (2019) with some corrections.

The phytoseiid genera considered in this article belong to different tribes of phytoseiid mites, which can be distinguished by a number of morphological characters using the key (table 1).

Mites of the genera *Paragigagnatus* Amitai & Grinberg, *Carinoseius* Wainstein, *Kampimodromus* Nesbitt, *Eharius* Tuttle & Muma, *Typhlodromips* De Leon, *Euseius* Wainstein considered here belong to four tribes of the subfamily Amblyseiinae (Phytoseiidae: Parasitiformes, Mesostigmata). As the topography of the setae on the body of mites is specific in each of the tribes, the genera profiles are given here separately.

Subfamily Amblyseiinae
Tribe Neoseiulini

Genus *Paragigagnathus* Amitai & Grinberg, 1971

Paragigagnathus Amitai & Grinberg, 1971: 327.
Type species: *Paragigagnathus tamaricis* Amitai & Grinberg, 1971: 327.
Pamiroseius Wainstein, 1973: 954; Kolodochka, 1989: 221.
Type species: *Pamiroseius strunkhovae* Wainstein, 1973 b: 954.
Afrogigagnathus Yousef, 1974: 381.
Type species: *Afrogigagnathus tawfiki* Yousef, 1974: 381 (= *P. tamaricis* Amitai & Grinberg, 1971: 327).
Phytocerus Amitai & Swirski, 1978: 124.
Type species: *Phytocerus desertorum* Amitai & Swirski, 1978: 124.

Ansaria Chaudhri, Akbar & Rasool, 1979: 63.
Type species: *Ansaria amantis* Chaudhri, Akbar & Rasool, 1979: 63.
Paragigagnathus: Kolodochka, 1995 b: 3, 1996: 3, 2006: 82.

Genus profile. Dorsal shield of female with 17 pairs of setae, strongly sclerotised, covered with tuberculate sculpture: AD1, AD2, AD3, AD4; PD2, PD4; AM1, AM2; AL1, AL3, AL; PL1, PL2, PL3; PM1, PM3, PM4 — on the dorsal shield; AS, PS (both on interscutal membrane). Solenostomes 7 pairs (*it, iv, id, isc, il, is, ic*), they are often masked by the relief of the shield surface. The posterior half of the shield wider than the anterior one, the posterior-lateral margins are often bent towards the ventral side of the opisthosoma. Dorsal setae thickened, short or some elongate, more or less equal in length, blunt or sharp at ends, and often situated on tubercles. Setae AS and PS are located on the membrane off the shield. Setae PM3 shifted noticeably caudal to level of setae PD4. The peritreme are long, reaching the base of theca AD1. Sternal shield with 3 pairs of setae. The genital shield is narrow. Ventrianal shield elongate, with distinct constriction in anterior third. Pair of PrA1 seta is located on the ventrianal shield but in some species it sit on membraine before shield. Also the most species have a distinctly elongated gnathosoma which connected with the idiosoma by a rare for mites of the family formation — a long thin-walled and elastic tubular "sleeve", or gnathobrachium (fig. 1, *12*), which can be lengthen and shorten. Medium-size chelicera has little small teeth on both fingers. The basitarsus of the leg IV with short macroseta.

Diagnosis. The dorsal setal pattern of *Paragigagnathus* is generally similar to that of other genera of the tribe Amblyseiini, but it has features of the structure of dorsal shield and topography of the setae on the caudal part of the dorsal shield that are characteristic only for species of this genus. Namely, a peculiar combination of a partially tuberculate dorsal shield with a narrow ventrianal shield. Beside that mites of the genus Paragigagnathus differ from anothers genera with strong, well-sclerotised dorsal setae. They are thickened and often located on tubercles, setae PM4 are shifted caudally from the level of setae PD4, and posterior-lateral margins of dorsal shield are often bent onto the ventral side of the opisthosoma. Wherein the ventrianal shield elongated, in anterior part with constriction.

The scope and distribution of the genus. Twelve nominal species are known in the world fauna (Demite et al., 2022), one species in the fauna of Ukraine.

Paragigagnathus insuetus (Livschitz & Kuznetzov, 1972) (fig. 1)

Amblyseius insuetus Livschitz & Kuznetzov, 1972: 27.
Pamiroseius insuetus: Beglarov, 1981 a: 30; Kolodochka, 1982: 9 (partly), 1989 a: 227.
Paragigagnathus insuetus, Kolodochka, 1996: 6; Chant & McMurtry, 2007: 33; Papadoulis et al., 2009: 76.

Material. **Type.** Lectotype ♀: #3690, Ukraine, Crimea, Yalta, The State Nikita botanical garden, on *Tamarix* sp., 08.07.1968 (Vasilieva); paralectotypes 10 ♀, 10 ♂, in the same slide with the lectotype in collection of B. A. Wainstein (SIZK).

Non-type. Crimea: 166 specimens (148 ♀, 18 ♂) (SIZK).

Redescription. Female. Dorsal shield (fig. 1, *1*) well sclerotised, tuberculate sculpture better expressed in its central part, sharply tapering frontally; 5 pairs of well-marked solenostomes (*it*, *iv*, *il*, *is*, *ic*; *id* and *isc* are absent). Dorsal setae short, thick, curved, blunt-pointed, smooth, except for coarsely serrated and pointed PD4 (fig. 2, *11*), PM3 with 1–2 serrations (fig. 2, *10)*. Setae PL1–PL3, PM3 approximately equal in length. Peritremes reaching nearly the thecae of setae AD1. The base of the gnathosoma (gnathobase), pedi-

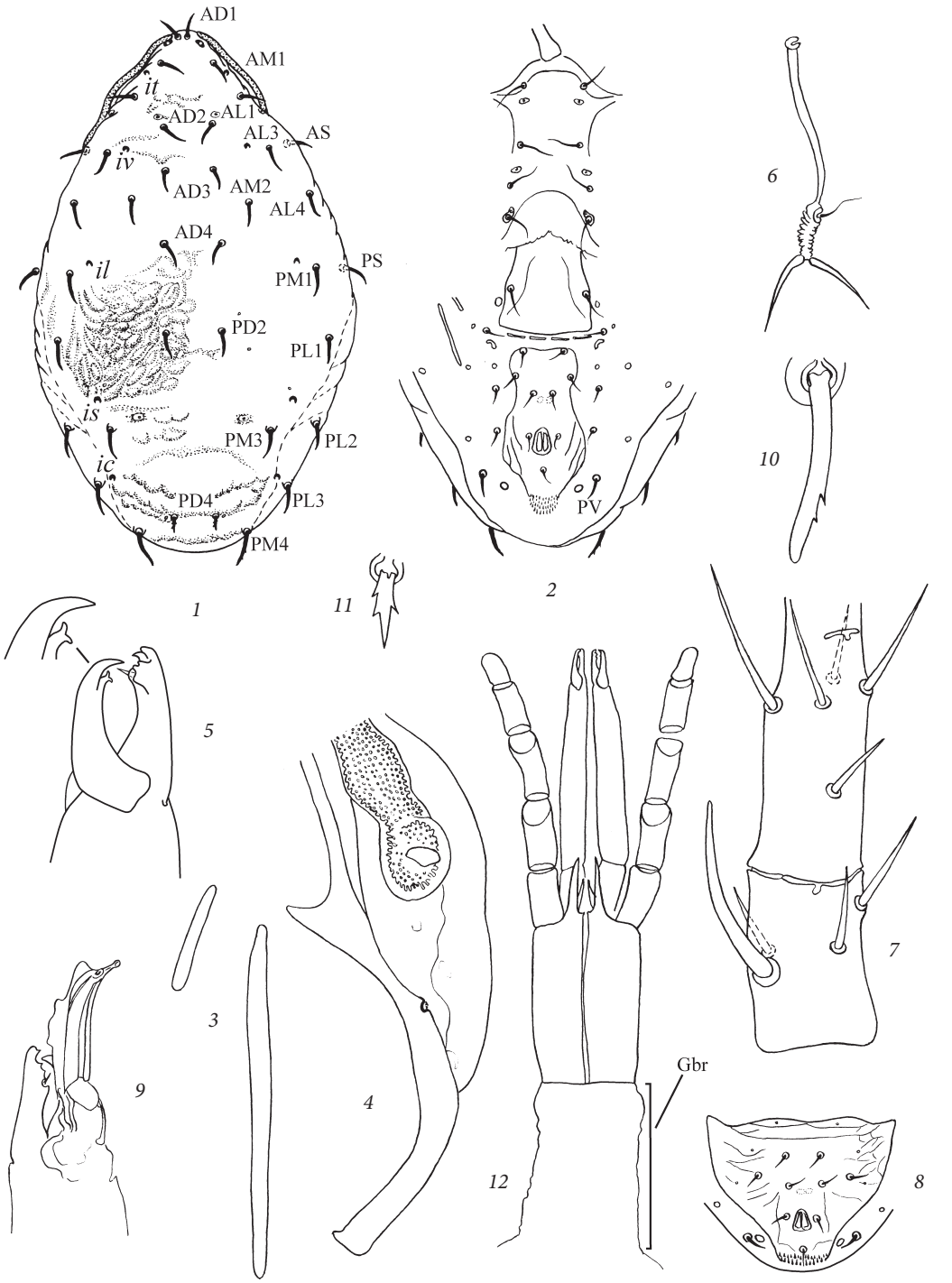

Fig. 1. *Paragigagnathus insuetus* (Livschitz & Kuznetzov, 1972) ♀ (*1–7*), ♂ (*8, 9*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — posterior part of peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — chelicerae with spermatodactil; *10* — seta PM4; *11* — seta PD4; *12* — гнатосома (seta no shown), Gb — gnathobrachium.

palps and chelicerae are strongly elongated. The gnathobase is connected to the idiosoma by the gnathobrachium (fig. 2, *12*). The sternal shield is very weakly sclerotised, its edges are indistinguishable even with the use of a phase-contrast attachment. Because of this, it is very difficult to determinate the real location of the pores St2 (on the shield or outside it) and St3 (on the outgrowths of the shield, or on individual scutes, or on the membrane). The setae of MSt are located on separate, poorly distinguishable scutes. Sandal-shaped ventrianal shield well sclerotised, narrower than genital shield, sharply narrowing caudally; anal pores missing. Metapodal scutes are linear (fig. 1, *3*). The posterior part of the peritremal shield is narrow, curved, with a rounded end (fig. 1, *4*). Chelicera (fig. 1, *5*) relatively small, Df with 1 pointed and 3 blunt teeth, Dm with 1 peculiarly forked tooth. The distal end of Df has a notch into which the end of Dm enters when the chelicera closes. A forked tooth on Dm, when the fingers of the chelicerae are closed, rests on the middle, highest, tubercle on a wide triple tooth on Df. In this case, a reliable tong-like grip is formed with simultaneous crushing of pollen grains or small mites.

Spermatheca with cup-shaped funnel, atrium located on a thickened, roughly folded neck (fig. 1, *6*). Leg IV 1 has a short, thickened, blunt, curved macrochaete (fig. 1, *7*).

Measurements. Lds 348, Wds 210; Lvas 110, Wvas 54; Ltar 79; setae length: AD1 14; AD2 16; AD3 14; AD4 16; PD2 16; PD4 11; AM1 16; AM2 15; AL1 18; AL3 17; AL4 18; PL1 19; PL2 19; PL3 20; PM1 17; PM3 20; PM4 23; PS 15; AS 17; PV 14; MCh IV 22.

Male. Preanal setae 3 pairs, anal pores missing, approximately in their place, caudal to setae PrA2, 2 rounded pale contiguous spots are placed (fig. 1, *8*). The spermatodactyl is curved with a thin end (fig. 1, *9*). Lds 265.

Diagnosis. The unusual connection of the gnathosome with the idiosome makes this species easily recognizable among other representatives of the Ukrainian fauna family.

Distribution, habitat, occurrence. Europe (Greece, Ukraine), Western Asia (Iran, Saudi Arabia, Turkey), Central Asia (Kyrgyzstan, Turkmenistan). In Ukraine: only in Crimea, and only on the comber *Tamarix* sp.; frequent.

Tribe Kampimodromini Kolodochka
Kolodochka, 1998: 59.

Subtribe Typhloseielina Chant & McMurtry

Carinoseius Wainstein, 1980
Carinoseius Wainstein 1980: 149; Kolodochka 2006: 110.
Type species: *Carinoseius perforatus* Wainstein, 1980: 149.

Genus profile. Dorsal shield weakly sclerotised, smooth, with 5 pairs of solenostomes (*it, iv, il, is, ic*; absent *id, isc*). 18 pairs setae on dorsal shield: AD1, AD2, AD3, AD4; PD2, PD3, PD4; AM1, AM2; AL1, AL3, AL4; PL1, PL3; PM1, PM2, PM3, PM4 — on the dorsal shield; AS; PS (both on interscutal membrane). Setae of dorsal shield medium-sized, pointed, with 1–3 serrations; AD1 and PD4 may be smooth or serrated. PM2 and PD3 setae are available. Setae AM3 and PL2 absent. Crater-shaped solenostoms penetrate deep into the idiosoma; solenostomes *iv* the largest; *il, is, ic* smaller and *it* minimal. All ventral setae short, smooth, sharp, and thin, except for weakly serrated PV, which are longer than others. The boundaries of the sternal shield and the location of setae ST1–ST3 and Mst in this zone are difficult to study even with the help of immersion and a phase-contrast device because of the very thin and highly transparent shields. Ventrianal shield with one pair of preanal setae PrA2; no anal pores. Setae V3 missing on interscutal membrane surrounding

the shield. Peritremes short and wide, reaching only level of setae AS. Metapodal scutes narrow. The posterior part of the peritremal shield is caudally narrowed and rounded at the end or sharp. There are 2–3 teeth on Df of the chelicerae, and 1 small on Dm. The infundibulum of spermatheca is saucer-shaped with a small atrium, the neck is not pronounced. Legs without macrochaetes.

Two nominal species are known in the world fauna (Demite et al., 2022), one of them in Ukraine.

Carinoseius improvisus (Kolodochka, Bondarev & Gwiazdowicz, 2015), **comb. n.** (fig. 2)

Typhloseiella improvisa Kolodochka, Bondarev & Gwiazdowicz, 2015: 843.

Material. **Type.** Holotype ♀ (marked #1): #C–533/323, Ukraine, Luhansk Region, Sverdlovsk [currently Dovzhansk] District, env. vil. Provallia, branch of the Luhansk Natural Reserve, flood plain of River Verkhnie Provallia, glandular globe thistle *Echinops spherocephalus* (N 48° 08′, E 39° 49′), microslide of sample, 10.06 2012 (Bondarev); paratypes ♀ (marked #2), in the same slide, location and date as holotype; paratypes 2 ♀, #6211, ibid., glandular globe-thistle (N 48° 09′, E 39° 50′), ibid., 11.07 2012 (Kolodochka); paratypes 2 ♀, #6224, Donetskaya oblast, Shakhtinsky District, 8 km East of Khartsizk, the Regional Landscape Park "Zujevsky", metgrass steppe, miscellaneous herbs part, hoary alyssum *Berteroa incana* DC (N 48° 03′, E 38° 16′), 12.07 2012 (Kolodochka) (SIZK).

Redescription. Female. Dorsal shield (fig. 2, *1*) weakly sclerotised, smooth, with 5 pairs of solenostomes (*it, iv, il, is, ic*; absent *id, isc*). Setae of dorsal shield medium-sized, pointed, many of them with 1–2, rarely with 3 serrations, except for smooth AD1 and PD2. Setae PM2 and PD3 are available. Setae AM3 and PL2 absent. Crater-shaped solenostoms penetrate deep into the idiosoma (fig. 1, *1,12*); solenostomes *iv* the largest (fig. 1, *8*); *il, is, ic* smaller (fig. 1, *9–11*), and *it* minimal. Some individuals have a transverse fold on the dorsal shield between a pair of solenostomes *iv* and/or a pair of *il* (both folds in the holotype), which is an artifact that occurs during the preparation. All ventral setae short, smooth, sharp, and thin, except for weakly serrated PV, which are longer than others. The boundaries of the sternal shield and the location of setae ST1–ST3 and Mst in this zone are difficult to study even with the help of immersion and a phase-contrast device because of the very thin and highly transparent shields. Ventrianal shield (fig. 2, *2*) with one pair of preanal setae PrA2; anal pores absent. Setae V3 missing on interscutal membrane surrounding the shield. Peritremes short and wide, reaching only level of setae AS (fig. 2, *7*). Metapodal scutes narrow, anterior smaller than posterior (fig. 2, *3*). The posterior part of the peritremal shield is caudally narrowed and rounded at the end (fig. 2, *4*). There are 2 teeth on Df of the chelicerae, and 1 small on Dm (fig. 2, *5*). The spermatheca is saucer-shaped with a small atrium, the neck is not pronounced (fig. 2, *6*). Legs without macrochaetes.

Measurements. Lds 312, Wds 160; Lvas 79, Wvas 56; Ltar IV 88; setae length: AD1 23; AD2 35; AD3 34, AD4 36; PD2 40; PD3 36; PD4 12; AL1 40; AL3 43; AL4 45; AM1 39; AM2 34; PL1 40; PL3 37; PM1 40; PM2 40; PM3 45; PM4 47; AS 44; PS 41; PV 34.

Male unknown.

Diagnosis. Mites of this rare representative of the genus are easily recognizable by the main feature of the genus, the presence of 7 pairs of dorsocentral setae in a row (4 AD + 3PD), while all other genera of mites of the Ukrainian fauna have 6 pairs of setae in this row (PD3 is absent).

Distribution, habitat, occurrence: Europe (Ukraine). In Ukraine: steppe zone, grasses; rare.

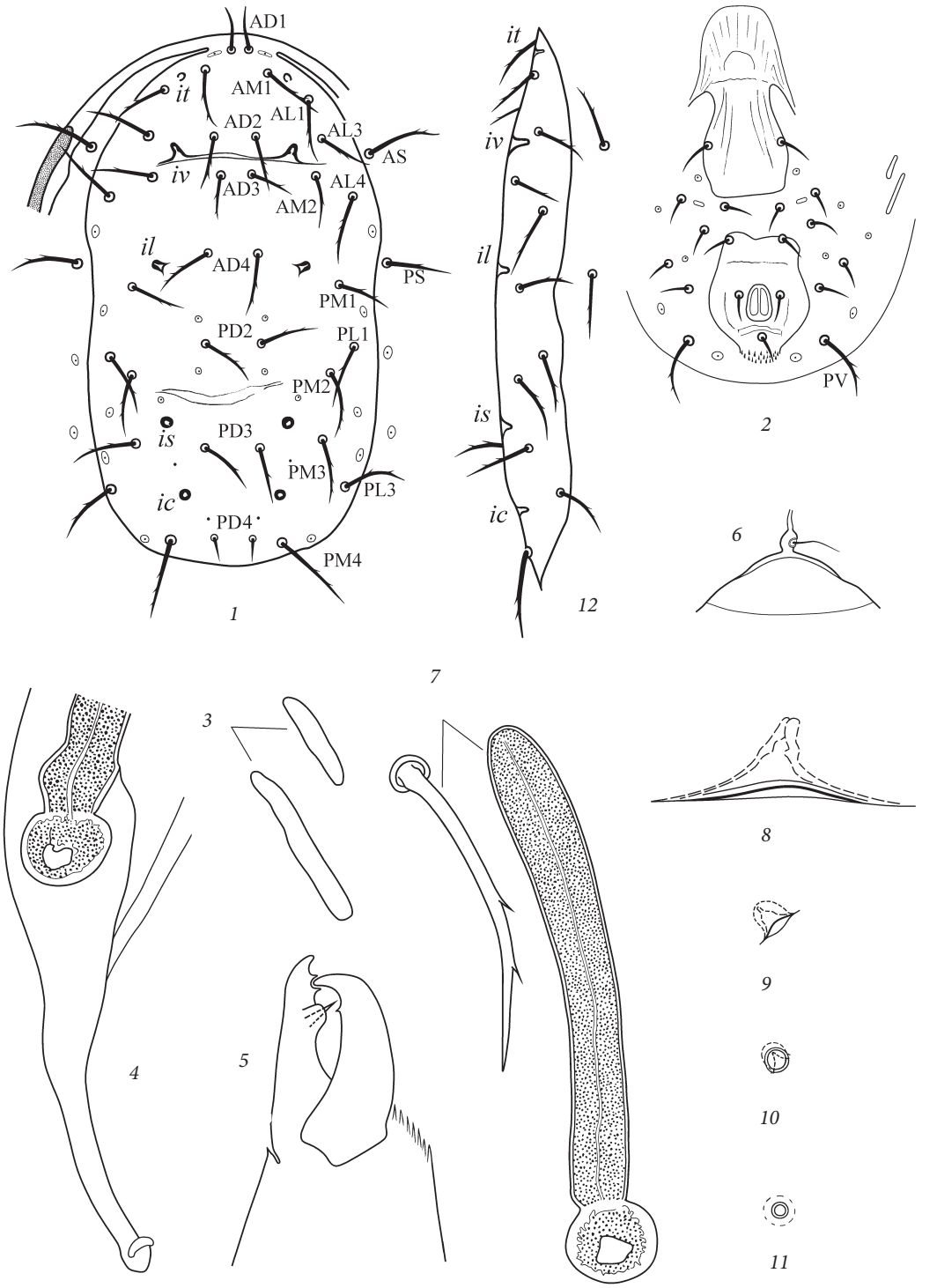

Fig. 2. *Carinoseius improvisus* (Kolodochka, Bondarev, & Gwiazdowicz, 2015), **comb. n.** ♀ (*1–11*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — posterior part of peritremal schield; *5* — chelicera; *6* — spermatheca; *7* — seta AS and peritreme; 8 — solenostome *iv*; *9* — solenostome *il*; *10* — solenostome *is*; *11* — solenostome *ic*.

Notes. 1. The discovery and description of the species *Typhloseiella improvisa* Kolodochka, Bondarev, & Gwiazdowicz, 2015 provided the basis for restoring the validity of the independent genus *Carinoseius* Wainstein, 1980 as well with the type species *Carinoseius perforantus* Wainstein, 1980 (unknown in fauna of Ukraine) and introducing *C. improvisus* into it, simultaneously excluding both species from the composition genus *Typhloseiella* (Athias-Henriot, 1958), which again became monotypic.

2. The transverse fold on the dorsal shield of mites of this species occurs during preparation because the dorsal shield is more convex than in other species and is elastic due to very weak sclerotization, and is an artefact that differs in location and configuration.

Subtribe Kampimodromina Chant & McMurtry

Genus *Kampimodromus* Nesbitt, 1951
Kampimodromus Nesbitt, 1951: 53; Kolodochka 1978: 44; 2006: 88; Beglyarov, 1981 b: 8; Chant & McMurtry 2007: 36; Papadoulis et al. 2009: 37.
Type species: *Typhlodromus aberrans* Oudemans, 1930c: 48.
Paradromus Muma, 1961: 286.
Amblyseius (*Kampimodromus*): Pritchard & Baker, 1962: 294.
Amblyseius (*Kampimodromus*) section *Kampimodromus*: Wainstein 1962, 14.
aberrans group: Chant, 1959: 101.

Genus profile. Dorsal shield of female with 16 pairs of setae and up to 5 pairs of solenostomes (*it, iv, il, is, ic*). Dorsum bears16 pairs of setae: AD1, AD2, AD3, AD4; PD2, PD4; AM1, AM2; AL1, AL3, AL4; PL1, PL3, PM1, PM3, PM4 — on the dorsal shield; AS, PS (both on interscutal membrane). The degree of sclerotization of the dorsal shield of different species varies from weak to moderate. The sculpture is often tuberculate, sometimes combined (folded-reticulate-scaly with elements of parallel striation). Setae of dorsal shield smooth or serrate, may vary in length; however, longest setae are not scab-shaped. Setae AD1 are placed very close to each other. Perithremes shortened (reaching level of theca setae AL1 or slightly extending frontally behind it) or short (reaching only level of theca setae AS). Sternal shield square, often notched along posterior margin. Ventrianal shield elongated, with lateral emarginations, bearing 3 pairs of preanal setae. The anal pores are small, sometimes poorly visible. There are 4 pairs of setae around the ventral shield. Macrosetae only on basitarsus of leg IV or absent. Chelicerae on Df with 2–4 teeth, on Dm 0–1 tooth.

The genus *Kampimodromus* contains 17 nominal species (Chant & McMurtry, 2007), but according to Demite et al. (2023), the World Fauna contains 14 species of which 3 were recorded in Ukraine.

Kampimodromus aberrans (Oudemans, 1930 a) (fig. 3)

Typhlodromus aberrans Oudemans, 1930 a: 48; Nesbitt, 1951: 20.
Typhlodromus elongatus Oudemans, 1930 b: 50.
Typhlodromus vitis Oudemans, 1930 c: 98.
Kampimodromus elongatus: Nesbitt, 1951: 53.
Kampimodromus aberrans: Chant, 1955: 496.
Amblyseius aberrans: Karg, 1971: 213.
Kampimodromus aberrans: Kolodochka, 1978: 44; Karg, 1993: 178; Chant & McMurtry, 2007: 37; Cargnus et al., 2012: 583; Cargnus & Zandigiacomo, 2014: 207; Döker et al., 2017: 361; Denmark & Evans, 2019: 217.

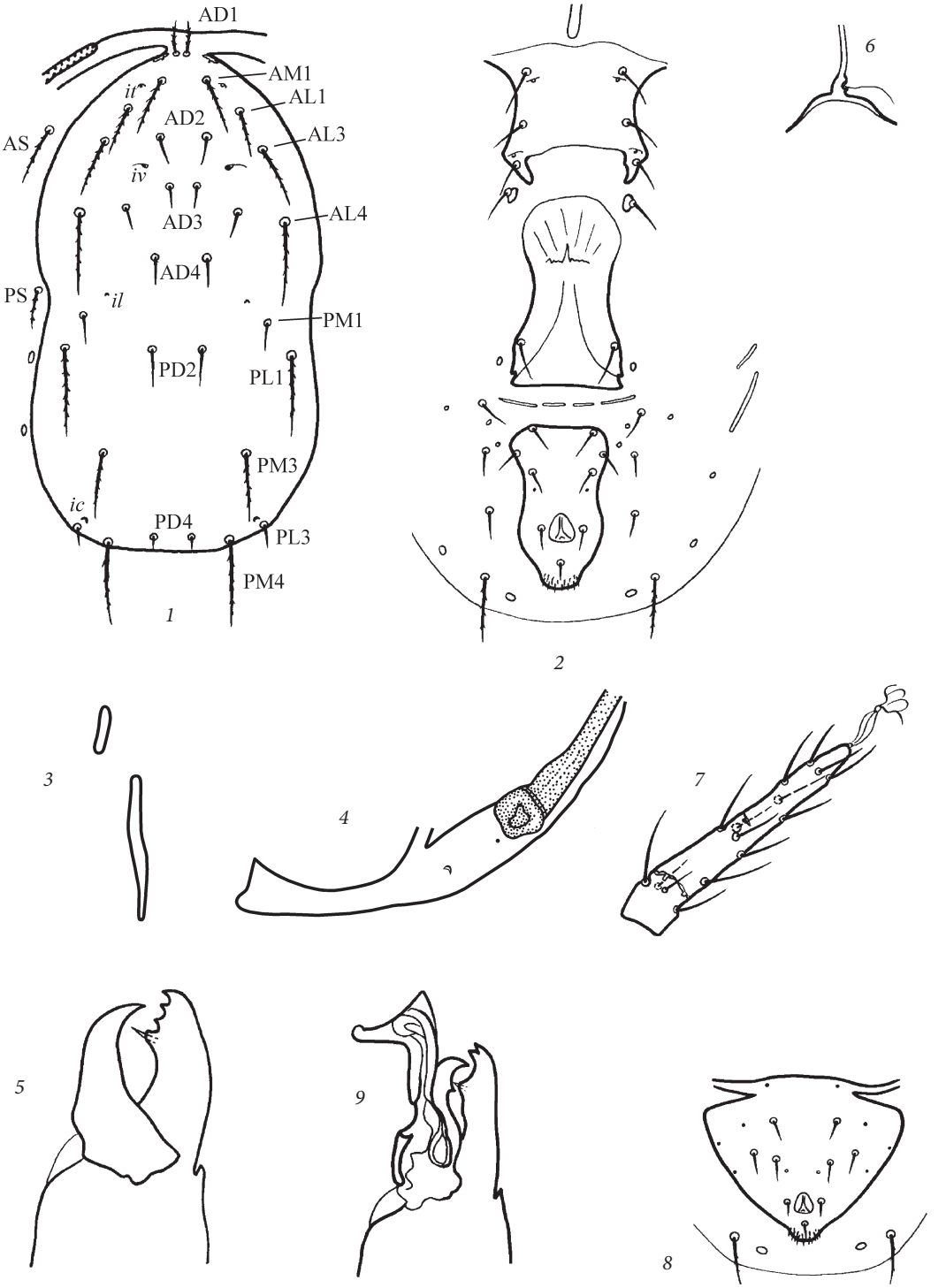

Fig. 3. *Kampimodromus aberrans* (Oudemans, 1930 a) ♀ (*1–7*), ♂ (*8, 9*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — posterior part of peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — chelicerae with spermatodactil.

Material. **Type.** Holotype ♀ *Typhlodromus aberrans*: The Netherlands, Arnhem, on *Tilia platiphillos*, #376 [collection date unknown] (RMNH).

Non-type. 5078 specimens (3941 ♀, 1137 ♂) — throughout Ukraine.

Redescription. Female. Dorsal shield (fig. 3, *1*) weakly sclerotised, elongate-oval, with lateral notches, covered with reticulate-scaly sculpture with slight folding; 4 pairs of small solenostomes (*it, iv, il, ic; id, isc, ic* are absent). Setae AD1, AM1, AL1, AL3, AL4, PL1, PM3, PM4, AS, PS serrated, elongated, others smooth and much shorter. Setae AD3 as long as distance between their thecae. Setae AM1 and AL1 extend beyond the thecae of subsequent setae. Peritremes reach the level of thecae setae AL1. Sternal shield with deep notch along posterior margin. Ventrianal shield (fig. 3, *2*) elongate, narrow, with distinct lateral emarginations, its anterior part wider than posterior, preanal setae arranged in two almost longitudinal rows; anal pores small, widely spaced, poorly distinguishable. Setae PV serrated. Metapodal scutes linear, posterior S-shaped, 3 times as long as anterior (fig. 3, *3*). Posterior part of peritremal shield slightly curved (fig. 3, *4*). Chelicera with 2 teeth on Df, Dm with 1 tooth (fig. 3, *5*). Spermatheca is small, the funnel is saucer-shaped; atrium of moderate size, sessile (fig. 3, *6*). There are no macrochaetes on the legs (fig. 3, *7*).

Measurements. Lds 305, Wds 150; Lvas 95, Wvas 75, Lian 25; Ltar 92; setae length: AD1 19; AD2 18; AD3 15; AD4 16; PD2 22; PD4 8; AM1 39; AM2 14; AL1 33; AL3 45; AL4 58; PL1 56; PL3 14; PM1 19; PM3 53; PM4 58; AS 45; PS 28; PV 30.

Male. Ventrianal shield with 3 pairs of preanal setae, anal pores small (fig. 3, *8*); spermatodactyl massive, beak-shaped (fig. 3, *9*). Lds 240.

Diagnosis. There is considerable variation in the indicators of metric characters in different populations of *K. aberrans*, which is widespread in countries with a temperate climate (Chant, 1955). This reduces the diagnostic power of metric characters in describing species differences, especially when comparing closely related species. Therefore, metric characters have not been used here to describe differences between *K. aberrans* and other species of the genus. In addition to the characters indicated in the key for species of the genus (see above), *K. aberrans* has other morphological characters that are absent in *Kampimodromus* species known in Ukraine, namely, macrochaetae on the legs do not differ from ordinary setae, anal pores are small and widely spaced, the other shape and structure of the relatively more massive male spermatodactyl is different.

Distribution, habitat, occurrence. The species is widespread in Europe, the Middle East, and the Caucasus. In Ukraine: in natural and cultivated plantations in all natural zones. Prefers woody and shrubby plants of Rosaceae, which are often numerous; common in abandoned fruit orchards, found in industrial vineyards, garden plots, occasionally on herbaceous annuals and perennials of other families; mass.

Notes. 1. Description, morphometry, and illustrations are based on non-type specimens from Kyiv.

2. The author's own observations confirm evidence from various sources of nondiscrete (monotonic) variability in length of dorsal setae that often observed in mites of various populations of *K. aberrans*. It was also established that serration of dorsal setae depends on their own length and thickness (shorter setae usually are smoother).

Kampimodromus corylosus Kolodochka, 2003 (fig. 4)

Kolodochka, 2003: 51; Cargnus et al., 2012: 583, 2014: 207; Döker et al., 2017: 361.

Fig. 4. *Kampimodromus corylosus* Kolodochka 2003 ♀ (*1–7*), ♂ (*8, 9*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — posterior part of peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — chelicerae with spermatodactil.

Material. **Type.** Holotype ♀ (marked #1): #1541; Ukraine, Kyiv, Teremki, oak forest underwood, *Corylus avellana*, 15.07.1975 (Kolodochka) (SIZK); paratypes 34 ♀, 7♂, ibid. (#1541b, #1541r) together with the holotype (Kolodochka) (SIZK).

Non-type. 206 specimens (176 ♀, 30 ♂): Crimea, Donetsk, Zhytomyr, Transcarpathian, Kyiv, Mykolaiv, Sumy, Ternopil, Kharkiv, Chernihiv Regions.

Redescription. Female. Dorsal shield (fig. 4, *1*) weakly sclerotised, bearing 5 pairs of solenostomes (*it, iv, il, is, ic; id* and *isc* absent). Setae ADl, AM1, AL1, AL3, AL4, PL1, PM3, PM4, AS, PS elongated and serrated, the rest short and smooth (some may have single serrations). Setae AD3 as long as distance between their thecae. Setae PD4, PL3 and macrochaetes IV smooth or with 1–2 serrations. Seta AM1 extending beyond theca AL1. The length of AL1 and the distance to the theca of AL2 is equal. Narrow and smooth ventrianal shield elongate with lateral emarginations (fig. 4, *2*); anal pores distinct, rounded, shifted towards each other. Seta PV elongated and serrate. Peritremes reach mid-distance between setae AM1 and AL1. Metapodal scutes linear, posterior not less than 2.3 times as long as anterior scute (fig. 4, *3*). The peritremal shield is caudally expanded, ending as a coracoid in shape (fig. 4, *4*). Df of chelicera with 3 small teeth, Dm without teeth (fig. 4, *5*). Funnel of spermatheca saucer-shaped, atrium on poorly noticeable, very short neck, from different angles looking to be sessile (fig. 4, *6*). Basitarsus of leg IV with short and sharp macrochaete, smooth or with 1–2 serrations (fig. 4, *7*).

Measurements. Lds 300, Wds 160, Lvas 90, Wvas 48, Lian 15, Ltar 80; setae length: AD1 22, AD2, 14; AD3 14; AD4 16, PD2 23, PD4 7, AM1 29, AM2 15, AL1 25; AL2 34, AL4 41, PL1 43, PL3 18, PM1 21, PM3 39, PM4 48, AS 35, PS 25; PV 29; MChlV: ta 22.

Male. Preanal setae 3 pairs (fig. 4, *8*); anal pores distinct, rounded, shifted towards each other. Spermatodactyl (fig. 4, *9*) L-shaped, branch elongated, thin, curved, with a sharply bent tip. Lds 240.

Diagnosis. *Kampimodromus corylosus* is very similar to *K. aberrans*, differing by the presence of five rather than four pairs of dorsal solenostomes (solenostome *is* present), closely spaced anal pores, a different shape of the ventrianal shield, a greater number of teeth on Df, as well as the shape, structure, and larger size spermatodactyl of male. *Kampimodromus karadaghensis* Kolodochka, from the Crimea, also has 5 pairs of dorsal solenostomes, but its dorsal setae AL4, PL1, PM1 and the setae of the AD and PD rows are distinctly longer than those of *K. corylosus*, especially PD2, which almost reach the *is* solenostome, and the male spermatodactyl has a different proportion of parts (see the diagnosis of *K. karadaghensis* below).

Distribution, habitat, occurrence. Europe: Hungary, Moldova, Croatia, Ukraine. In Ukraine: the Wood-and-Steppe Zone and the bordering parts of the Polissia and the Steppe, the mountainous Crimea, the Carpathians and Transcarpathia. *Kampimodromus corylosus* is restricted to hazel, occasionally on other species of trees, shrubs, and herbs.

Note. 1. Description, illustrations, and measurements are based on holotype.

2. *Kampimodromus corylosus* shows a strong association with the hazel or bear nut. Rare exceptions do not mask this connection; the range of this species coincides with the range of hazel. In Ukraine, *K. aberrans* and *K. corylosus* do not occur together on the same plant, at least according to the author's materials. Therefore, any information in early publications regarding the findings of *K. aberrans* on hazelnuts should be attributed to *K. corylosus*. It is highly probable that the reports of other researchers about the finds of mites of

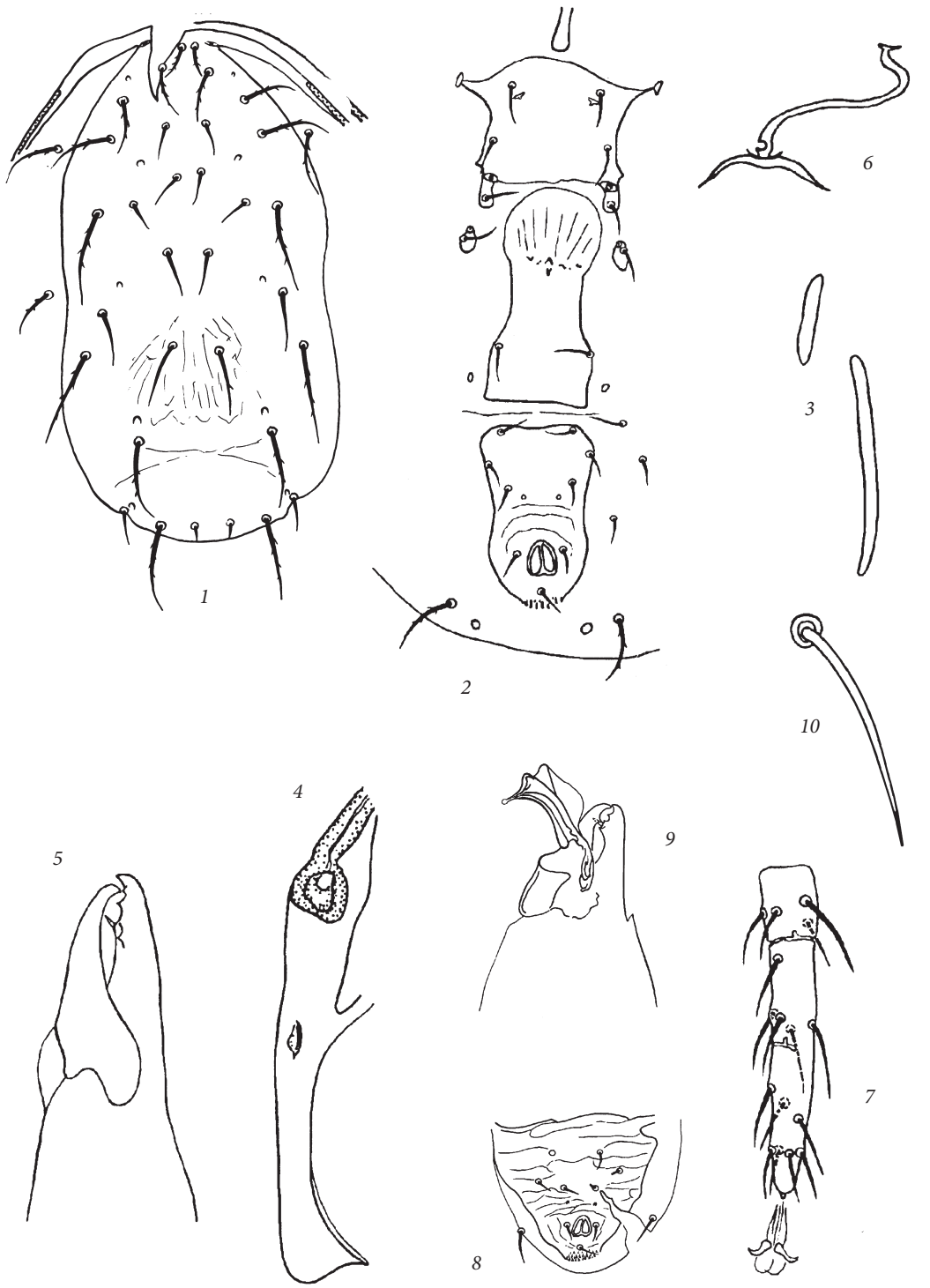

Fig. 5. *Kampimodromus karadaghensis* Kolodochka 2005 ♀ (*1–7, 11*), ♂ (*8, 9*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — posterior part of peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — chelicerae with spermatodactil; *10* — macroseta on tarsus of leg IV.

the genus *Kampimodromus* on hazelnuts can also be assigned to *K. corylosus*, at least such specimens need re-identification.

Kampimodromus karadaghensis Kolodochka, 2005 (fig. 5)

Kampimodromus karadaghensis Kolodochka, 2005: 23; Chant & McMurtry, 2007: 37; Döker et al., 2017: 361.

Material. **Type.** Holotype ♀: #1293, Ukraine, South-Eastern Crimea, Karadag Nature Reserve, *Crataegus* sp., 05.06 1975 (Kolodochka); paratypes (same locality as holotype): 6 ♀, #1331, *Prunus stepposa*, 07.06 1975; 5 ♀, 1 ♂, #1369, *Quercus pubescens*, 10.06 1975 (SIZK).

Non-type. 13 specimens (12 ♀, 1 ♂), Crimea.

Redescription. Female. Dorsal shield (fig. 5, *1*) weakly sclerotised, smooth (except for slight striation in area of setae D5), with 5 pairs of solenostomes (*it, iv, il, is, ic*; *id* and *isc* absent). Setae ADl, AM1, AL1, AL3, AL4, PLl, PM3, PM4, AS, PS serrated, others smooth; in females, one of the usually smooth setae of AD2–AD4, PD2, PD2, and PL3 pairs sometimes has 1–2 serrations. Setae AL4 and PL1 longer than other dorsal setae. Setae AD3 longer than distance between their own thecae. Seta AM1 slightly projecting beyond theca AL1. Seta AL1 projecting beyond theca AL2. Ventrianal shield (fig. 5, *2*) narrow, vase-shaped, smooth, finely striated in the circumanal region; anal pores distinct, rounded, shifted towards each other. Seta PV slightly serrate; other ventrianal setae smooth, sharp, thin. The peritremes are narrow (about 2.5 μ), reaching the level of setae AM1. Metapodal scutes narrow, posterior not less than 2.0 times as long as anterior scute (fig. 5, *3*). The posterior part of the peritremal shield is narrow, almost straight, widening towards the beak-shaped end (fig. 5, *4*). Chelicera with 4 small teeth on Df, Dm without teeth (fig. 5, *5*). The spermatheca is small, with a saucer-shaped funnel; atrium small, sessile, as if pressed into the base of the funnel (fig. 5, *6*). Leg IV with sharp, smooth macrochaete on basitarsus (fig. 5, *7*, *10*). In one of 11 paratype females, macrochaete with notch on one leg.

Measurements. Lds 293, Wds 146; Lvas 92, Wvas max 57, Lian 18; Ltar IV 84; setae length: ADl 19; AD2 21, AD3 22; AD4 27; PD1 33–37; PD4 6; AM1 30; AM2 16; AL1 31; AL2 39; AL450; PL1 49–59; PL3 20–23; PM1 34–37; PM3 41–45; PM4 51; AS 37; PS 27; PV 35; MCh tar LV 26.

Male. Ventrianal shield (fig. 5, *8*) with 3 pairs of preanal setae; anal pores distinct, rounded, shifted towards each other. The spermatodactyl is beak-shaped, the process is short, club-shaped at the end (fig. 5, *9*). Lds 275.

Diagnosis. Similar to the widespread species *K. aberrans*, but easily distinguished from it by the presence of five pairs of dorsal solenostomes (there is a pair of *is*), rather than four pairs, and distinctly longer dorsal setae AD3–AD4, PD2. AL4, PL1, PL3, PM1, PM3, PV in females, the male spermatodactyl is smaller and has different proportions of structural details. For differences between *K. karadaghensis* and *K. corylosus*, which also has 5 pairs of dorsal solenostomes, see the essay on the latter.

Distribution, habitat, occurrence. Europe (Ukraine). In Ukraine: known only from the type locality, on trees and shrubs; rare.

Note. Description, illustrations and morphometry are based on type specimens.

Genus *Eharius* Tuttle & Muma

Eharius Tuttle & Muma, 1973: 14.
Type species: *Amblyseius chergui* Athias-Henriot, 1960.
Zavicus Arutunjan, 1973: 115.
Type species: *Amblyseius marzhaniani* Arutunjan, 1969: 42.

Kampimodromus: Kolodochka, 1979 a: 8.
Eharius: Kolodochka, 1995 a: 81, 2006: 95; Chant & McMurtry, 2007: 39; Papadoulis et al., 2009: 37.

Genus profile. Dorsal shield of female with 16 pairs of setae and up to 4 pairs of solenostomes (*iv, id, il, ic*) and with AD1, AD2, AD3, AD4; PD2, PD4; AM1, AM2; AL1, AL3, AL4; PL1, PL3; PM1, PM3, PM4 — on the dorsal shield; AS, PS (both on interscutal membrane). Dorsal shield weakly or considerably sclerotised. The sculpture of the dorsal shield is represented by longitudinally parallel striation with anastomoses (sometimes convex, which creates a distinct folding) in combination with smooth, reticulate or scaly areas in the posterior half of the shield. Dorsal setae fine, sometimes hairy, smooth (PM3 thicker than others, often serrate). Peritremes short, not reaching the level of setae AL1, often much shorter. Ventral part of opisthosoma with 6–7 pairs of setae (MV1 absent) and one unpaired (postanal) seta: PrA1, PrA2, V2, PaA, PsA (unpaired) on ventrianal shield. There are only 3 (V1, MV2, PV) or 2 (V1, PV) pairs of setae on the membrane around the ventrianal shield. One or both setae PrA1 and V2 may be located outside the ventrianal shield as a result of reduction of its anterior part. Anal pores are present. The legs are short, their segments are thickened and wide. There are no macrochaetes on the legs, but the distal parts of the tarsi may have thickened setae. The constituent parts of the gnathosoma are either of normal proportions for the family, or the gnathobase and chelicerae are elongated, while the pedipalps remain relatively short.

Some species of the genus *Eharius* have a special organ, the gnathobrachium, which is very rare in this family. A similar structure is developed in mites of the genus *Paragigagnathus* (see above note to the species description of *P. insuetus*) and the monotypic genus *Gigagnathus* Chant, 1965 with type species *G. extendus* Chant, 1965: 168 (Metaseiulini, Typhlodrominae) known only from Bermuda (Chant & McMurtry, 2007). Simultaneously with the presence of the gnatobrachium, the segments of the chelicerae are elongated. Gnathobrachium is present in five of known species *Eharius*, but absent only in *E. kuznetzovi*. Interestingly, the pedipalps did not undergo elongation and remained relatively short. Probably, the explanation for this phenomenon should be sought in the feeding behavior of mites, as in the case of the previously considered genus *Paragigagnathus*.

Diagnosis. The characteristic linear sculpture of the dorsal shield is a common character of the mites of this genus. The genus *Eharius* is clearly subdivided into two subgenera based on the structure and proportions of the gnathosoma, as shown by Kolodochka (1979). Chant & McMurtry, 2003 proposed to consider them as two species groups based on the presence/absence of seta MV2: the *kuznetzovi* species group with MV2 and the *kostini* species group without MV2.

Two species of the two subgenera are known in Ukraine (Kolodochka, 1995).

Notes. 1. Findings of mites of this genus are more often associated with members of the family Lamiaceae. Athias-Henriot (1960) suggested hossible phytophagy of the species *E. chergui* without specifying the food specialisation (sap? pollen? — *L. K.*). Judging from the frequent abundance of mites of this species on the plant they inhabit in the absence of herbivorous mites on the plant, such an assumption may have a very real basis.

2. The vast majority of phytoseiids have a gnathosome fixedly attached to the body. The presence of gnathobrachium, which is rare in the family, gives mobility to the gnathosome. It is capable of facultative elongation due to straightening of walls in case, for example, if the total length of chelicerae and gnathobase is insufficient for capturing food. This morphological feature serves as an easily reconised character for grouping

forms on the basis of external similarity. However, this trait is under targeted functional pressure to improve food grasping and is therefore subject of homoplasy (convergent or parallel) and thus has a low phylogenetic signal. In this case, the traits free from the influence of functional load are needed. Chetological analysis is the most suitable as a source of such traits, which allows us to use setal topography as an external manifestation of genome features.

In the considered case, species of genus *Eharius* show a peculiarity not frequently met in other taxa of phytoseiids, namely, absence of some pairs of opisthoventral seta MV. Two species of subgenus *Eharius* (*Zavicus*) lack pair MV1, five species of subgenus *Eharius* (*Eharius*) lack two pairs of opisthoventral setae (MV1 and MV2).

Since the mites of the family Phytoseiidae are characterized by hypotrichia (Chant, 1993), the degree of evolutionary advancement of the nominative subgenus in relation to the subgenus *Eharius* (*Zavicus*) is obvious, as well as a distinct hiatus in the opisthoventral chaetome between these taxa, demonstrating genetic differences and supported by differences in the structure of the gnathosome, which bear the imprint of functionality (presence or absence of gnathobrachium). On this basis, I consider it expedient to keep two subgenera, nominative and *Eharius* (*Zavicus*), within the genus *Eharius* Tuttle & Muma.

Subgenus *Eharius* Tuttle & Muma
Eharius (s. str.): Kolodochka 1995 a: 82.
Type species: *Amblyseius chergui* Athias-Henriot 1960.

Eharius (Eharius) kostini (Kolodochka, 1979) (fig. 6)

Kampimodromus kostini Ko1odochka, 1979 a: 8; Begljarov, 1981: 8; Karg, 1993: 178.
Eharius (Eharius) kostini: Kolodochka, 1995 a: 86; Chant & McMurtry, 2006: 98, 2007: 39.

Material. **Type.** Holotype ♀: #1793 b, Ukraine: Crimea, Razdolnensky, northwestern part of the Crimean Peninsula, seaside steppe, *Marrubium vulgare*, 29.05.1976 (Kolodochka) (SIZK); paratype: 1 ♂, same slide and locality.

Non-type. 275 specimens (180 ♀, 95 ♂) — Crimea and Mykolayiv Region.

Redescription. Female. Dorsal shield (fig. 6, *1*) well sclerotised, ovoid, with small lateral emarginations, with convex sculpture, longitudinal folding is pronounced on the sides of the shield; 2 pairs of solenostomes (*iv* deep crater-shaped, *ic* good visible) (fig. 6, *10*). Dorsal setae short, thin, flexible, smooth with exception PM3, which are longer than the rest, thickened and slightly serrated, often pointed, occasionally ending with a tiny club. Setae AM1 extend beyond bases of setae AL1. Other setae of dorsal shield much shorter than distance from their thecae to thecae of subsequent setae. Peritremes short, not reaching level of seta AS (fig. 6, *5*). The ventrianal and genital shields are well sclerotised, the sternal shield is much weaker. Setae MSt located on separate scutes, sometimes merging with sternal shield with narrow bridge. Genital shield narrow, long; genital valve wider than posterior part of shield proper. Opistoventral setae of pairs MV1 and MV2 are absent. Ventrianal shield (fig. 6, *2*) pear-shaped, wider in posterior half than genital shield, covered with distinct striation; anal pores small, widely spaced. There are specimens with additional setae on the shield (fig. 6, *11*) or with an anomalous arrangement of preanal setae V2 displaced on the membrane (fig. 6, *12*, *13*). Metapodal scutes narrow, elongated, curved anteriorly, smaller than posterior ones (fig. 6, *3*). Posterior end of peritremal shield crescent-shaped, peritremes short, not reaching level of setae AS (fig. 6, *4*).

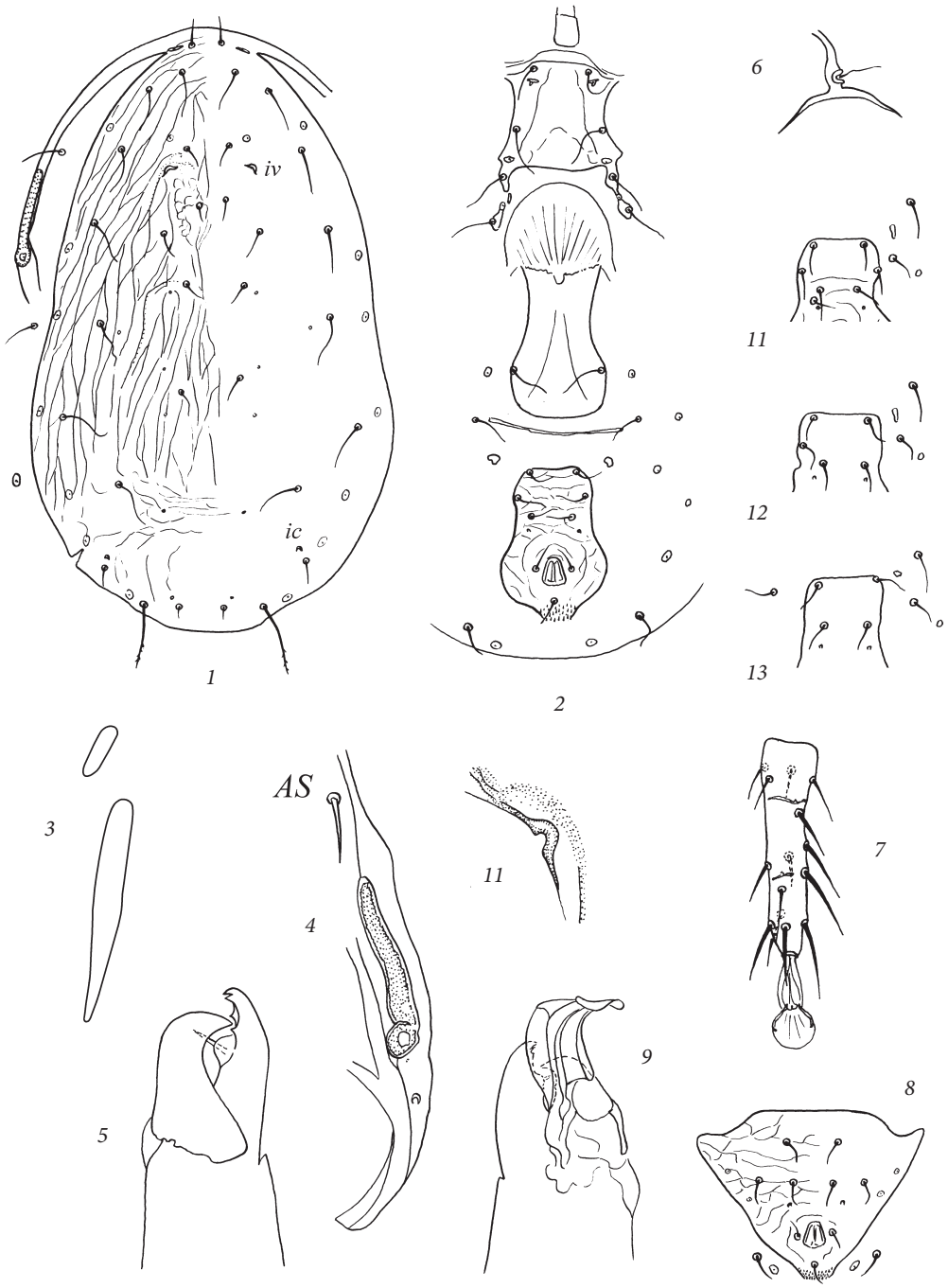

Fig. 6. *Eharius (Eharius) kostini* (Kolodochka) ♀ (*1–7, 11*), ♂ (*8, 9*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — seta AS, peritreme with peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — chelicerae with spermatodactil; *10* — solenostome *iv*; *11–13* — samples of aberrations in the placement of preanal setae.

Gnathobase noticeably elongated. The ratio of its length, measured from the base to the end of the cornicula, to the width of the base is 1.75:1. For example, in species of a close genus, *Kampimodromus aberrans*, this ratio is 1:1. The second basal segment of the chelicerae is strongly elongated.

Measurements. Lds 344, Wds 189, Lvas 85; Wvas 60; Lian 31, Ltar IV 58; длина щетинок: AD1 12; AD2 12; AD3 12; AD4 12; PD2 15; PD4 5; AM1 25; AM2 12; AL1 25, AL3 27; AL4 26; PL1 23; PL3 10; PM1 22; PM3 22; PM4 37; AS 25; PS 16; PV 17.

Male. Ventrianal shield with reticulate sculpture; preanal setae 3 pairs; anal pores small, round (fig. 6, *8*). Spermatodactyl is massive, curved (fig. 6, *9*). Lds 270.

Diagnosis. In addition to the characters indicated in the key, *E. (E.) kostini* is characterized by the following features: the presence of thickened and longest, slightly serrate, often pointed or occasionally ending in a tiny club setae PM4 on the dorsal shield; ventrianal shield wider in it posterior half than genital shield; seta AL1 is shifted laterally with respect to the common arc of setae of row AL.

Distribution, habitat, occurrence. Europe (Ukraine), Central Asia (Kyrgyzstan). In Ukraine: steppe Crimea, grasses (one chance finding of a female on a coniferous shrub *Biota orientalis* in a decorative planting); reaches a high abundance on *Marrubium vulgare*, with which it is closely related; frequent.

Notes. 1. Description, illustrations and morphometry are based on the holotype.

2. Concentrated in the inflorescences of the host plant. Judging by the structure of the chelicera as a whole and by the position of the teeth in particular, the probability of pollenophagy in *E. kostini* is very high (see also the note in the essay by *E. kuznetzovi*).

Subgenus *Zavicus* Arutunjan

Zavicus Arutunjan, 1973: 115.
Type species: *Amblyseius marzhaniani,* Arutunjan, 1969: 42.
Eharius (*Zavicus*): Kolodochka, 1995: 92.

Eharius (Zavicus) kuznetzovi (Kolodochka, 1979) (fig. 7)

Kampimodromus kuznetzovi: Kolodochka, 1979 a: 10; Beglyarov, 1981 b; 8; Karg, 1993: 178.
Eharius (*Zavicus*) *kuznetzovi*: Kolodochka, 1995 a: 92, 2006: 99.
Eharius kuznetzovi: Chant & McMurtry, 2007: 39; Papadoulis et al., 2009: 37.

Type. Holotype ♀ (marked #1): #2025, Ukraine, Crimea, Main ridge of the Crimean Mountains, 1400 m a. s. l., Nikitskaya Yayla, ur. Krasnyi Kamin, *Stachys cretica*, 13.06 1976; paratype 1 ♀ (same slide and locality as in the holotype); "allotype" ♂, #1368 b, [East Crimea] Karadag, *Stachys cretica*, 10.06.1975 (Kolodochka) (SIZK).

Non-type. 90 specimens (71 ♀, 19 ♂) — Autonomous Republic of Crimea.

Redescription. Female. Dorsal shield (fig. 7, *1*) well sclerotised, elongated oval, tapering anteriorly, with small lateral emarginations, covered with distinct sculpture in the form of parallel striation; 2 pairs of distinct solenostomes (*iv, ic;* missing *it, id, isc, il, is*). Setae PM4 almost as long as PM3, pointed, thin, with 1–3 serrations (fig. 7, *10*). Seta AM1 longer than distance to the theca of seta AL1. The rest of the setae do not reach the next setae. Peritremes extend beyond bases of setae AS, but do not reach level of theca AL1. Sternal shield weakly sclerotised, elongated. Setae MSt on individual scutes. The genital and ventrianal shields are well sclerotised. The epigynium of the genital shield is weakly sclerotised, covered with striation in the form of thin branching lines. Ventrianal shield (fig. 7, *2*) with

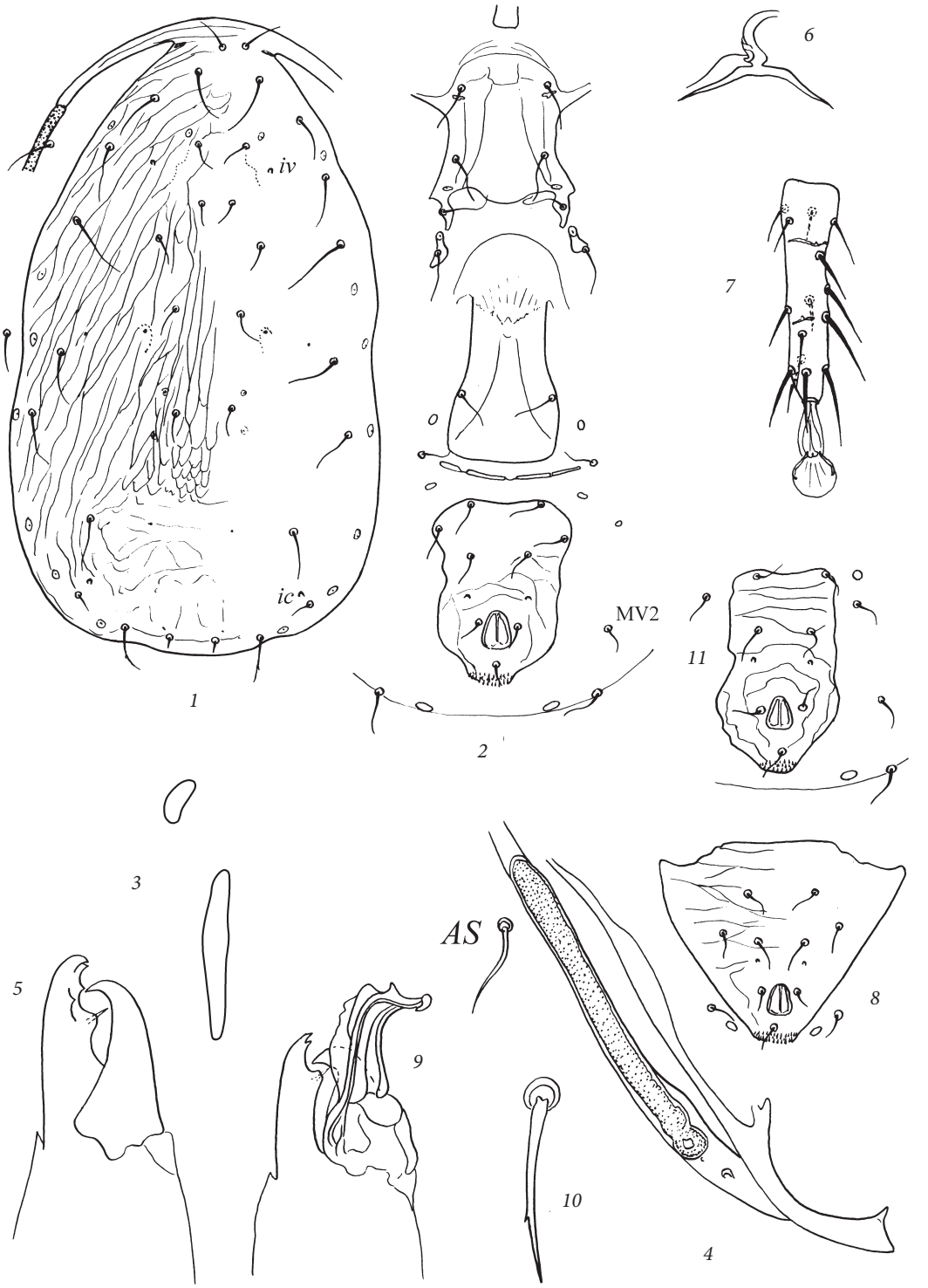

Fig. 7. *Eharius (Zavicus) kuznetzovi* (Kolodochka) ♀ (*1–7*), ♂ (*8, 9*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — seta AS, peritreme with peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — chelicerae with spermatodactil; *10* — seta PM4; *11* — samples of aberrations in the placement of preanal setae.

lateral emarginations and concave anterior margin, wider than genital shield in its anterior part; anal pores small, spaced. The pair of opisthoventral setae MV1 is absent. 3 pairs of preanal setae on ventrianal shield usualy. Sometimes one or both setae V2 are located outside the shield on the interscutal membrane. Metapodal scutes small, rounded anterior scutellum smaller than elongated posterior one (fig. 7, *3*). The posterior end of the peritremal shield is curved, notched at the end (fig. 7, 4). Gnathosoma and chelicerae with usual proportions. Chelicera with Df forked at the end, and with 2 teeth in front of pilus dentilis, Dm without teeth (fig. 7, *5*). The spermatheca is saucer-shaped, the atrium is located on a short neck (fig. 7, *6*). Distal part of tarsus with thick fig.ened setae (fig. 7, *7*).

Measurements. Lds 360, Wds 200, Lvas 103, Wvas 78, Lian 31, Ltar IV 54; setae length: AD1 15; AD2 18; AD3 17; AD4, PD1 19; PD4 6; AM1 28; AM2 15; AL1 28; AL3 33; AL4 34; PL1 29; PL3 9; PM1 28; PM3 25; PM4 22; AS 31; PS 19; PV 20.

Male. Preanal setae 3 pairs; anal pores small (fig. 7, *8*). Spermatodactyl L-shaped (fig. 7, *9*). Lds 260.

Diagnosis. In addition to the characters given in the guide to subgenera, it differs from *E.* (*E.*) *kostini* in the following features: the ventrianal shield in the anterior half is wider than the genital one; setae PM4 almost equal to PM3, pointed, thin, with 2–3 serrations; peritreme extends beyond the level of the theca seta AS; seta AL1 does not protrude from the common arc of setae of row AL.

Distribution, habitat, occurrence. Europe (Greece, Ukraine). In Ukraine: Karadag (eastern Crimea), Crimean Mountains (alpine steppe-Yayla, Outer Ridge), Mykolaiv Region; closely associated with *Stachys cretica*, concentrated in inflorescences reaching high abundance; common.

Notes. 1. Description, illustrations and morphometry are based on type specimens.

2. The close association of *E. kuznetzovi* with *Stachys cretica* and the concentration of individuals in the inflorescences of the host plant, similar to that observed for *E. kostini*, make the presence of obligate pollenophagy very likely in both species. It should be added that the habitation of individuals of these species on other plants has never been reported, nor has their colonisation of a single host plant (*Marrubium vulgare* or *Stachys cretica*), which further supports the conclusion that both feeding and habitation of each mite species can only occur on a particular host plant species.

Tribe Typhlodromipsini

Genus *Typhlodromips* De Leon, 1965
Typhlodromips De Leon, 1965: 23.
Type species: *Typhlodromus (Typhlodromips) simplicissimilis* De Leon, 1959: 117.
Amblyseius (*Typhlodromips*): Wainstein, 1983: 183.
tee species group: Schicha, 1987: 113.
ochii species group: Ehara & Amano, 1998: 41.

Genus profile (according to Chant & McMurtry, 2005 b). Dorsal shield (fig. 8, *1*) bears 17 pairs of setae: AD1, AD2, AD3, AD4; PD1, PD4; AM1, AM2; AL1, AL3, AL4; PL1, PL2, PL3; PM1, PM3, PM4 — on the dorsal shield; AS, PS (both on interscutal membrane). The shield much longer than wide, usually with pronounced reticulate sculpture, normally with lateral emarginations at level of seta PS; dorsal setae middle in size, smooth, pointed, except for setae PM3 and PM4, which are elongated, thickened, serrated and sometimes ending in a club; ventrianal shield of female usually pentago-

nal, smooth, with 3 pairs of preanal setae arranged in a triangle; anal pores are small to medium in size; ventrianal shield with constriction; male with 3 (sometimes 4) pairs of preanal setae; peritremal shield frontally fused with dorsal shield; the structure of the spermatheca is quite diverse; on Df up to 10 or more teeth, Dm usually with 3 teeth; legs II, III, and sometimes I pairs with macrochaetes; legs IV usually have 3 thickened macrochaetes, blunt or spatulate at the end.

Diagnosis. Species of the genus *Typhlodromips* differ from morphologically similar species of the tribe Neoseiulini by the presence of macrosetaes on the legs of pairs IV, II, and III, as well as by numerous teeth on Df chelicerae. Being similar to species of the genus *Neoseiulus*, they differ in large anal pores on an elongated vase-shaped ventrianal shield, strong thickened setae PM4, a peculiar structure of the female spermatheca, and the structure of a massive male spermatodactyl with a thick branch.

The scope and distribution of the genus. There are 61 species in the genus (Chant & McMurtry, 2007) of which more than half are found in the Nearctic, the remaining species are found in the Oriental, African and Australian subregions and even fewer in China and India. In the countries of the temperate zone, only 6 species are registered, of which 1 is known in Ukraine. It is a first record of representative of the tribe, the genus, and the species in Ukraine.

Typhlodromips mistassini (Chant & Hansell, 1971) (fig. 8)

Neoseiulus mistassini Chant & Hansell, 1971: 709.
Typhlodromalus mistassini: Moraes et al., 1986: 132; Chant & McMurtry, 2007: 63.

Material. **Type.** Holotype ♀: #11984, Canada, Quebec, Mistassini Territory, Lake LeCordier, on silver birch [*Betula pendula*], 17.08.1971, Canadian National Collection, Ottawa (CNC).

Non-Type. Ukraine, Chernigiv Region, Ripky District, env. Oleshnia village, near river, *Alnus glutinosa*, 17.07.1984, specimen #4706, 2 ♀, 1 ♂, 51°56'02,0" N 31°05'21.0" E (Kolodochka) (SIZK).

Redescription. Female. Dorsal shield (fig. 8, *1)* relatively weakly sclerotised, elongate-oval with slight lateral emarginations, smooth, with narrow stripe of thin oblique striation only along lateral margins; 7 pairs of medium-sized solenostomes (*it, iv, id, isc, il, is, ic*). Setae of dorsal shield short, pointed, smooth, except for thickened and serrated PM4 and PM3 with 1–3 serrations. Seta AM1 equal or shorter than distance to theca AL1. Setae of rows AL and PL short, do not reach the theca of subsequent setae, only PM3 is sometimes equal to the distance to the theca PL4. Peritremes reach level of setae AM1. Ventrianal shield not wider than genital one (fig. 8, *2*), elongated, vase-shaped, weakly sclerotised and finely transversely striated, with three pairs of preanal setae; anal pores large, oval. The anterior metapodal shield is linear, the posterior one is elongated (fig. 8, *3*). The posterior part of the peritremal shield is curved, rounded at the end with a coracoid process (fig. 8, *4*). There are 8 teeth on Df of the chelicerae, and 2 on Dm (fig. 8, *5*). Spermatheca with a cone-shaped funnel, often asymmetric; atrium sessile, pressed into funnel, which is covered with very small tubercles in the part adjacent to atrium (fig. 8, *6*). Leg IV with 3 short thickened sharp macrochaetes (fig. 8, *7*). Genu of legs III–II with short macrochaete.

Measurements. Lds 400, Wds 224; Lvas 111, Wvas 73; Lian 25; Ltar 115; setae length: AD1 25; AD2 18; AD3 18; AD4 19; PD2 23; PD4 9; AM1 36; AM2 10; AL1 32; AL3 38; AL4 42; PL1 32; PL2 30; PL3 29; PM1 27; PM3 38; PM4 63; AS 25; PS 20; PV 36. MCh IV: ge 32, ti 32, ta 32, MCh III: ge 29; MCh II: ge 23.

Fig. 8. *Typhlodromips mistassini* (Chant & Hansell) ♀ (*1–8*), ♂ (*8, 9*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plates; *4* — caudal part of peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — Dm of chelicerae with spermatodactil.

Male. There are 3 pairs of preanal setae, an additional pair may be present, in which both setae are not always present; the anal pores are closer together than in the female (fig. 8, *8*). Spermatodactyl with a short and wide stem as well with developed branch extending from stem at a right angle (fig. 8, *9*). Lds 330.

Diagnosis. *Neoseiulus mistassini* easily differs from other species of phytoseiids living in Ukraine by the combination of features: a vase-shaped ventrianal shield with large displaced anal pores, a spermatheca funnel partially covered with tiny tubercles, and a massive L-shaped male spermatodactyl.

Distribution, habitat, occurrence. Europe (Lithuania, Russia, Ukraine), North America (Canada). In Ukraine: Novgorod-Siversk Polissia, trees (*Alnus glutinosa*); rare.

Note. The holotype was measured. Description and illustrations are based on non-type specimens from Chernihiv District, Ukraine

Tribe Euseiini
Subtribe **Euseiina**

Genus ***Euseius*** Wainstein, 1962
Type species: *Seius finlandicus* Oudemans, 1915: 183.
finlandicus group: Athias-Henriot, 1957: 23; Chant, 1959: 67.
Amblyseius (*Amblyseius*) section *Euseius* Wainstein, 1962: 15.
Amblyseius (*Amblyseius*) section *Afrodromus* Wainstein, 1962: 17.
Amblyseius (*Euseius*): De Leon, 1965: 121.
Euseius: De Leon, 1967: 86; Kolodochka, 2006: 98; Chant & McMurtry, 2007: 118; Papadoulis et al., 2009: 26.
Amblyseius: Kolodochka, 1978: 20 (in part).
victoriensis group: Schicha, 1987: 24.
Amblyseius (*Amblyseius*) *finlandicus* group: Ueckermann & Loots, 1988: 61.

Genus profile. Idiosome shields are weakly sclerotised. The dorsal shield of the female is smooth or with weakly reticulate sculpture, with 17 pairs of setae and up to 7 pairs of solenostomes (*it, iv, id, isc, il, is, ic*; the *it* pair may be absent in some species not found on the territory of Ukraine). Dorsal shield with 17 pairs setae: AD1, AD2, AD3, AD4; PD1, PD4; AM1, AM2; AL1, AL3, AL4; PL1, PL2, PL3; PM1, PM3, PM4 — on the dorsal shield; AS; PS (both on interscutal membrane), setae smooth, medium in size, even in length, except for PM3, which are longer than the others and usually serrated. Peritremes shortened (reaching level of setae AM1) or shorter (extending beyond level AS only), with chaetoids. Sternal shield with 3 pairs of setae, 2 pairs of slit-like or oval pores, and a central lobe-like process along its posterior margin (fig. 9, *2*; 10, *2*). Metapodal scutes 1 pair (anterior scutellum reduced). Ventrianal shield one-piece, elongated, with lateral notches; distinct anal pores oval. Preanal setae arranged in almost regular transverse row. The legs are thin, elongated. Three macrochaete distinctly expressed on basitarsus of legs IV. The other legs may also have short macrochaetes. Gnathosoma of normal proportions in relation to idiosoma. Chelicerae are relatively small, teeth on Df are small.

Diagnosis. Spesies of this genus differs from other mites of tribes in the arrangement of ventroanal setae in an almost regular transverse row and in the presence of only one pair of metapodal scutes.

There are 187 nominal species in the genus (Chant & McMurtry, 2007: 61); only two are recorded in Ukraine.

Fig. 9. *Euseius finlandicus* (Oudemans, 1915) ♀ (*1–8*), ♂ (*9, 10*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plate; *4* — posterior part of peritremal shield; *5* — chelicera; *6* — spermatheca; *7* — fragment of leg IV (only macrosetae shown); *8* — ventrianal shield; *9* — chelicerae with spermatodactil.

Euseius finlandicus (Oudemans, 1915) (fig. 9)*

Seiulus finlandicus Oudemans, 1915: 183.
Typhlodromus pruni Oudemans, 1929: 32.
Typhlodromus finlandicus: Nesbitt, 1951: 25.
Amblyseius finlandicus: Livschitz & Kuznetzov, 1972: 22; Kolodochka, 1978: 20.
Amblyseius (*Euseius*) *finlandicus*: Arutunjan, 1977: 39.
Euseius finlandicus: Hajizadeh et al., 2002: 374; Kolodochka, 2006: 98; Papadoulis et al., 2009: 31.

Material. **Types.** Holotype ♀, Finland, Turun Porin Laani, Åbo, on *Prunus domestica*, *Euseius pruni* (Oudemans, 1929): 32; (Junior synonym of *Seius finlandicus* Oudemans, 1915: 183). This species is represented by three preparations, nos. 377 (figs 117–119 in the Archive für Naturges), 378 and 379 kept in the Oudemans collection at the Leiden Museum, Finland, Åbo, on *Salix caprea*" (Nesbitt, 1951: 25) (not examined) (RMNH).

Non-type. 6725 specimens (5574 ♀, 1151 ♂) — throughout Ukraine.

Redescription. Female. Dorsal shield (fig. 9, *1*) weakly sclerotised, oval, with pronounced lateral emarginations and indistinct reticulate sculpture; 6 pairs of solenostomes (*iv, id, isc, il, is, ic; it* missing). Setae of dorsal shield short, except for elongated and weakly serrated PM4. Peritremes short, barely extending beyond the thecae of setae AL2. Ventrianal shield (fig. 9, *2*) elongated, with distinct lateral emarginations; anal pores rounded, distinct, not close together. One pair of metapodal scutes (anterior scutes are reduced). They are elongated, caudally pointed (fig. 9, *3*). The peritreme shield consists of three fused cuticle lobes of varying degrees of sclerotization, the boundaries between which are indicated by sculpture lines. The posterior end of the shield widens caudally and bears a round pore (fig. 9, *4*). Df chelicera with 6 small teeth, Dm with 1 tooth (fig. 9, *5*). Spermatheca with short neck and small funnel (fig. 9, *6*). Leg IV has 3 pointed macrochaetes; approximately equal in length on tibia and stifle, distinctly longer on basitarsus, often characteristically curved at end (fig. 9, *7*).

Measurements. Lds 330, Wds 195; Lvas 98, Wvas 65, Lian 23; Lt 123; setae length: AD1 28; AD2 15; AD3 15; AD4 17; PD1 17; PD4 6; AM1 32; AM2 14; AL1 27; AL3 27; AL4 36; PL1 21; PL2 22; PL3 23; PM1 17; PM3 19; PM4 45; AS 18; PS 17; PV 31; MCh IV: ti, 33, ge 31, ta 54.

Male. Ventrianal shield (fig. 9, *8*) with 3 pairs of preanal setae; anal pores rounded. Spermatodactyl smoothly curved, tapering towards the end (fig. 9, *9*). Lds 250.

Diagnosis. With signs of the genus. For information about the differences between *E. finlandicus* and closely related *E. ucrainicus* Kolodochka, see the species profile of the latter.

Distribution, habitat, occurrence. Known in the fauna of both hemispheres and is often the most common species of the family on deciduous trees and shrubs, to which it gives a clear advantage, although it is also found on grasses. It can be found on conifers too, but such a find is always accidental. According to our data, *E. finlandicus* inhabits more than 70 plant species in Ukraine. It is common in natural and cultivated cenoses, — parks and green spaces along roads and city streets, plantings of summer cottages and household plots, abandoned gardens. Often dominates in phytoseiid complexes; mass.

Note. Description, morphometry, and illustrations are based on specimens from env. Kyiv after comparing them with illustrations of this species in the publications of various authors.

* Only the most important references for the subject of this study are provided; for more references to this species in publications see Demite et al. (2022).

Fig. 10. *Euseius ucrainicus* (Ko1odochka, 1979) ♀ (*1–8*), ♂ (*9, 10*): *1* — dorsal shield; *2* — ventral body surface; *3* — metapodal plate; *4* — posterior part of peritremal shield; *5* —chelicera; *6* — spermatheca; *7* — fragment of leg IV; *8* — ventrianal shield; *9* — chelicerae with spermatodactil.

Euseius ucrainicus (Kolodochka, 1979) (fig. 10)

Amblyseius (*Euseius*) *ucrainicus* Kolodochka, 1979 b: 33.
Euseius ucrainicus: Chant & McMurtry, 2005 a: 187; Chant & McMurtry, 2007: 123; Hajizadeh et al., 2002: 374.

Material. **Type.** Holotype ♀, allotype ♂: #2273, Ukraine, Lviv Region, Busskiy District, surroundings of the vil. Olesko, *Quercus* sp., 24.08 1976 (Kolodochka) (SIZK).
Non-type. 214 specimens (180 ♀, 34 ♂) — Transcarpathian, Lviv, Sumy, and Chernihiv Regions.

Redescription. Female. Dorsal shield (fig. 10, *1*) weakly sclerotised, smooth, oval, with small lateral emarginations; bears 6 pairs of round, distinct solenostomes (*it*, *iv*, *isc*, *il*, *is*, *ic*; pair *id* missing). Setae PM4 longer than others, thickened and slightly serrated; the rest are short and smooth. Peritremes short, barely projecting beyond the level of seta AS (fig. 10, *1*). Ventrianal shield with shallow lateral emarginations, preanal setae elongated; anal pores rounded, distinct, not contiguous (fig. 10, *2*). There is one pair of metapodal scutes (the scutes of the anterior pair are reduced) (fig. 10, *3*). The posterior end of the peritremal shield has a round pore and consists of three narrow, undivided parts of varying degrees of sclerotization (fig. 10, *4*). There are 5 teeth on Df and 1 on Dm (fig. 10, *5*). Spermatheca (fig. 10, *6*) with a smoothly curved tubular funnel, sharply expanding towards the sac in the last third. On the border of the beginning of the expansion there is a well-marked annular sclerotised collar directed towards the sac; sitting atrium. Leg IV with 3 macrochaetes, longest on basitarsus (fig. 10, *7*).

Measurements. Lds 350; Wds 205, Lvas106, Wvas max 76, Lian 30, LtarIV 131; setae length: AD1 31, AD2 19; AD3 19; AD4 19; PD1 20, PD4 6, AM1 33; AM2 18; AL1 27; AL3 29; AL4 36; PL1 24; PL2 24; PL3 24; PM1 19; PM3 23; PM4 52; AS 19; PS 19; PV 38; MCh IV: gen 33, tib 35, tar 62.

Male. Preanal setae 3 pairs; anal pores large, rounded, well visible (fig. 10, *8*). Spermatodactyl curved, sharply thinning distally after bending, with small process directed downwards (fig. 10, *9*). Lds 270.

Diagnosis. *Euseius ucrainicus* can be easily differentiated from *E. finlandicus*, in the structure of the spermatheca with a long tubular funnel and a developed collar on it, almost twice as long preanal setae, and less teeth on Df.

Distribution, habitat, occurrence. Europe (Ukraine). In Ukraine: Transcarpathia, Polissia; trees and shrubs; frequent.

Note. Description, illustrations and morphometry are based on type specimens.

Key to genera and species of Ukrainian fauna

1. Dorsal shield of adult female strongly sclerotised, tuberculate in middle part, its margins bent ventrally in posterior half (fig. 1, 1). Peritremes long, almost reaching to setae AD1. All dorsal setae short, approximately equal in length. Ventrianal shield without anal pores .....Paragigagnathus Amitai and Grinberg
One species in Ukraine — *Paragigagnathus insuetus* (Livschitz & Kuznetzov)
— Different combination of characters 2
2. Dorsal pores crater-like, very large (fig. 2, *1*). Ventrianal shield with 1 pair of preanal setae, anal pores absent ..... *Carinoseius* Wainstein
One species in Ukraine, *C. improvisus* Kolodochka, Bondarev & Gwiazdowicz
— Dorsal pores of normal size for most species of the family. Ventrianal shield with 3 pairs of preanal setae, anal pores present 3
3. Dorsal shield without PL2 setae 4
— Pair PL2 on the dorsal shield 8
4. Setae on dorsal shield are in marginal rows (AD1, AM1, AL1, AL3, AL4, PL1, PM3, PM4, as well as AS and PS) and serrated. Sternal shield square *Kampimodromus* Nesbitt.....5

— All setae of dorsal shield thin, flexible, smooth except for PM4, which have 1–2 notches. Sternal shield longitudinally elongated *Eharius* Tuttle & Muma 7
5. Dorsal shield bears 4 pairs of small solenostomes (*it, iv, il, ic*) .....*K. aberrans* (Oudemans)
— Dorsal shield bearing 5 pairs of conspicuous solenostomes (*it, iv, il, is, ic*) 6
6. Length of dorsal seta PM3 approximately equal to distance from its theca to solenostome *ic* ....*K. corylosus* Kolodochka.
— Length of dorsal seta PM3 exceeds distance from its theca to solenostome *ic* and almost reaches the theca of seta PM4 ..... *K. karadaghensis* Kolodochka
7. Gnatosoma with gnathobrachium, elongated gnathobase and chelicerae. Opistoventral setae MV1 and MV2 absent. Peritremes short, not reaching level of seta AS ..... *Eharius* (*Eharius*) One species in Ukraine, *E.* (*E.*) *kostini* (Kolodochka)
— Gnathobase with normal proportions for the family. Opistoventral setae MV1 absent, seta MV2 present. Perithremes extend beyond bases of setae AS. .... *Eharius* (*Zavicus*) One species in Ukraine, *E.* (*Z.*) *kuznetzovi* (Kolodochka, 1979)
8. Setae of the ventrianal shield have a triangular pattern. The posterior margin of sternal shield is almost even, without a lobe. Peritremes long, reach level of setae AD1 ..... *Typhlodromips* De Leon One species in Ukraine, *T. mistassini* (Chant & Hansell)
— Setae of ventrianal shield placed in transvers row (fig. 9, *1*). The posterior edge of sterna shield is provided with a median lobe. Peritremes shortened, projecting beyond the thecae of setae *Euseius* Wainstein. 9
9. Preanal setae short, do not extend beyond anal pores ..... *E. finlandicus* (Oudemans)
— Preanal setae long, extending half their length beyond the level of the anal pores ....*E. ucrainicus* (Kolodochka)

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References

Amitai, S. & Grinberg, T. 1971. Description of a new phytoseiid genus and species (Acarina: Mesostigmata) from Israel. *Israel Journal of Entomology,* 6**,** 327–335.

Amitai, S. & Swirski, E. 1978. A new genus and new records of phytoseiid mites (Mesostigmata: Phytoseiidae) from Israel. *Israel Journal of Entomology,* 12, 123–143.

Arutunjan, E. S. 1973. A new genus and a new species from the family Phytoseiidae (Acarina, Parasitiformes) from Armenia. Doklady Akademii Nauk Armianskoy SSR, 57, 2, 115–117 [In Russian].

Arutunjan, E. S. 1977. *Identification manual of phytoseiid mites of agricultural crops of the Armenian SSR*. Izdatelstvo Akademii Nauk Armianskoy SSR, Erevan, 1–177 [In Russian].

Athias-Henriot, C. 1958. Phytoseiidae & Aceosejidae (Acarina, Gamasina) d'Algérie. II. Phytoseiidae: clé des genres, genres, *Amblyseius* Berlese (suite) & *Seiulus* Berlese. *Bulletin of Society of History Naure Afrique Nord,* 49 (1/2), 23–43.

Athias-Henriot, C. 1960. Nouveaux *Amblyseius* d'Algerie (Parasitiformes, Phytoseiidae). *Acarologia*, 2 (3), 288–299.

Beglyarov, G. A. 1981 a. Key to phytoseiid predatory mites (Parasitiformes, Phytoseiidae) of the USSR fauna. Part 1. *Information Buletin East-Palearctic section, International organization for Biological Control of Noxious Animals and Plants (IOBC)*, 2, 1–97 [In Russian].

Beglyarov, G. A. 1981 b. Key to phytoseiid predatory mites (Parasitiformes, Phytoseiidae) of the USSR fauna. Part 2. *Information Buletin East-Palearctic section, International organization for Biological Control of Noxious Animals and Plants (IOBC)*, 3, 1–39 [In Russian].

Cargnus, E., Girolami, V. & Zandigiacomo, P. 2012. Re-examination of specimens of three species of *Kampimodromus* Nesbitt (Acari: Phytoseiidae) from north-eastern Italy, with first report on *Kampimodromus corylosus* Kolodochka in Italy. *International Journal of Acarology*, 38 (7), 583–594.

Cargnus, E. & Zandigiacomo, P. 2014. Taxonomic value of morphological and morphometrical characters in the immature stages of four species of *Kampimodromus* Nesbitt (Acari: Phytoseiidae) from Italy and Croatia. *Zootaxa* 3857 (2), 207–224. www.mapress.com/zootaxa/ Article 207 http://dx.doi.org/10.11646/zootaxa.3857.2.3

Chant, D. A. 1955. Notes on mites of the genus *Typhlodromus* Scheuten, 1957 (Acarina: Laelaptidae), with descriptions of the male of some species and the female of a new species. *Canadian Entomologist*, 87 (11), 496–503.

Chant, D. A. 1959. Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of 38 new species. *Canadian Entomologist*, 91, 45–166. https://doi.org/10.4039/entm9112fv

Chant, D. A. 1965. Generic concepts of the family Phytoseiidae (Acarina). *Canadian Entomologist,* 97 (4), 351–374. https://doi.org/10.4039/Ent97351-4

Chant, D. A 1993. Paedomorphosis in the family Phytoseiidae (Acari: Gamasina). *Canadian Journal of Zoology,* 71 (7)**,** 1334–1349.

Chant, D. A. & Hansell, R. I. C. 1971. The genus *Amblyseius* (Acarina: Phytoseiidae) in Canada and Alaska. *Canadian Journal of Zoology*, 49 (5), 705–758.

Chant, D. A. & McMurtry, J. A. 2003. A revew of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part II. The tribe Kampimodromini Kolodochka. *International Journal of Acarology*, 29 (3), 179–224. https://doi.org/10.1080/01647950308684331

Chant, D. A. & McMurtry, J. A. 2005 a. A revew of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part VI. The tribe Euseiini n. tribe, subtribes Typhlodromalina n. subtribe, and Ricoseiina n. subtribe. *International Journal of Acarology*, 31(3), 187–224.

Chant, D. A. & McMurtry, J. A. 2005 b. A revew of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part VII. The tribe Typhlodromipsini. *International Journal of Acarology*, 32(4), 315–340.

Chant, D. A. & McMurtry, J. A. 2006. A revew of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part VIII. The tribes Macroseiini Chant, Denmark and Baker, Phytoseiulini n. tribe, Afroseiulini n. tribe and Indoseiulini Ehara and Amano. *International Journal of Acarology*, 32 (1), 3–15.

Chant, D. A. & McMurtry, J. A. 2007. *Illustrated keys and diagnosis for the genera and subgenera of the Phytoseiidae of the world (Acari: Mesostigmata)*. Indira Publishing House, West Bloomfield, Michigan, USA, 1–220.

Chaudhri, W. M., S. Akbar and A. Rasool 1979. *Studies of the predatory leaf inhabiting mites of Pakistan.* University Agriculture, Faisalabad, Pakistan. 1–243.

De Leon, D. 1959. Seven new *Typhlodromus* from Mexico with collection notes on three other species (Acarina: Phytoseiidae). *Florida Entomoljgist*, 42, 113–121.

De Leon, D. 1965. A note on *Neoseiulus* Hughes, 1948 and new synonymy (Acarina: Phytoseiidae). *Prociedings Entomoljgical Society*, Washington, 67 (1), 23.

De Leon, D. 1967. *Some mites of the Caribbean Area. Part I. Acarina on plants of Trinidad, West Indies.* Allen Press Inc., Lawrence, Kansas, 1–66.

Demite, P. R., Moraes, G. J. de, McMurtry, J. A., Denmark, H. A. & Castilho, R. de C. 2023. *Phytoseiidae Database*. http://www.lea.esalq.usp.br/phytoseiidae/ (Accessed 22 September 2023)

Denmark H. A. & Evans, G. F. 2019. *Additions to the world fauna of the family Phytoseiidae (Acari: Mesostigmata) with an illustrated key to the families, tribes, subtribes and genera of Phytoseiidae of the world*. Indira Publishing House, West Bloomfield, Michigan, USA, 1–315.

Döker, İ., Kazak, C., Karaca, M. & Karut, K. 2017. Two new records of the genus *Kampimodromus* Nesbitt (Acari: Phytoseiidae) for Turkey with a revised key to the World species. *Acarologia,* 57 (2), 355–363, 10.1051/acarologia/20164160

Ehara, S. & Amano, H. 1998. A revision of the mite family Phytoseiidae (Acari: Gamasina), with remarks on its biology. *Species Diversity*, 3 (1), 25–73.

Hadjizadeh, J., Hosseini, R. & McMurtry, J. A. 2002. Phytoseiid mites (Acari: Phytoseiidae) associated with eriophyid mites (Acari: Eriophyidae) in Guilan Province of Iran. *International Journal of Acarology*, 28, 273–378.

Karg, W. 1983. Systematische untersuhungder Gattungen und Untergattungen der Raubmilbenfamilie Phytoseiidae Berlese, 1916, mit der beschreibung von 8 nouen Arten. *Mitteilungen aus dem Zoologischen Museum in Berlin*, 59 (2), 293–328.

Karg, W. 1993. *Acari (Acarina), Milben Parasitiformes (Anactinochaeta), Cohors Gamasina Leach, Raubmilben, 59 Teil.* Gustav Fischer Verlag, Jena–Stuttgart–New York, 1–523.

Kolodochka, L. A. 1978. *Guidelines for the identification of plant–dwelling phytoseiid mites.* Naukova dumka, Kyiv, 1–78 [In Russian].

Kolodochka, L. A. 1979a. New species of phytoseiid mites from the Crimea (Parasitiformes, Phytoseiidae). *Vestnik Zoologii*, 2, 8–13 [In Russian].

Kolodochka, L. A. 1979b. Four new species of phytoseiid mites of the fauna of the USSR (Parasitiformes, Phytoseiidae). *Vestnik Zoologii*, 5, 32–40 [In Russian].

Kolodochka, L. A. 1982. New phytoseiid mites from Turkmenistan (Parasitiformes, Phytoseiidae). *Vestnik Zoologii*, 6, 7–13 [In Russian].

Kolodochka, L. A. 1989. Revision of phytoseiid mites of the genus *Pamiroseius* Wain. (Parasitiformes, Phytoseiidae). *Entomologicheskoie obozrenie*, 68(1), 221–229 [In Russian].

Kolodochka, L. A. 1990. New in the structure of spermateca of female phytoseiid mites (Parasitiformes, Phytoseiidae). *Vestnik Zoologii*, 1, 74–75 [In Russian].

Kolodochka, L. A. 1995 a. Revision of the genus *Eharius* (Parasitiformes, Phytoseiidae). *Zhurnal Ukrainskogo entomologichnogo tovarystva* (1993), 1 (3–4), 79–96 [In Russian].

Kolodochka, L. A. 1995 b. Revision of the genus *Paragigagnathus* (Parasitiformes, Phytoseiidae). Part I. History and new conception of the family. *Zhurnal Ukrainskogo entomologichnogo tovarystva* (1994), 2 (1), 3–8 [In Russian].

Kolodochka, L. A. 1996. Revision of the genus *Paragigagnathus* (Parasitiformes, Phytoseiidae). Part 2. Redescription of species. *Zhurnal Ukrainskogo entomologichnogo tovarystva* (1994), 2 (2), 3–20 [In Russian].
Kolodochka, L. A. 1998. Two new tribes and the main results of the revision of the Palearctic phytoseiid mites (Phytoseiidae, Parasitiformes) with the conception of family system. *Vestnik Zoologii,* 32 (1–2), 51–63 [In Russian].
Kolodochka, L. A. 2003 A new species of the genus *Kampimodromus* (Parasitiformes, Phytoseiidae) from Ukraine and Moldova. *Acarina*, 11, 51–55 [In Russian].
Kolodochka, L. A. 2005 A new species of the genus *Kampimodromus* (Parasitiformes, Phytoseiidae) from Crimea. *Acarina*, 13, 23–27 [In Russian].
Kolodochka, L. A. 2006. Palearctic phytoseiid mites (Parasitiformes, Phytoseiidae): faunistics, taxonomy, ecology, evolution. *Vestnik Zoologii*, Supplement 21, 1–250 [In Russian].
Kolodochka, L. A. 2022. The predatory mites (Phytoseiidae, Parasitiformes) in the fauna of Ukraine: a new species and a new subgenus of the genus *Graminaseius*. *Zoodiversity*, 56 (6), 463–472. https://doi.org/10.15407/zoo2022.06.463
Kolodochka, L. A. 2023. The predatory mites (Phytoseiidae, Parasitiformes) in the fauna of Ukraine: a review with a key to species and new combinations in the genus *Transeius*. *Zoodiversity*, 57 (3), 191–214. https://doi.org/10.15407/zoo2023.03.191
Kolodochka, L. A., Bondarev, V. Ju. & Gwiazdowicz, D. J. 2015. First record of the genus *Typhloseiella* (Acari, Phytoseiidae) in European area of Palearctic with description of a new species and redescription of *T. perforata*. *Systematic and Applied Acarology*, 20 (7), 839–845.
Livshitz, I. Z. & Kuznetzov, N. N. 1972. Phytoseiid mites from Crimea (Parasitiformes: Phytoseiidae), 13–64. *In*: *Pests and diseases of fruit and ornamental plants. The State Nikita Botanical Gardens*, Proceeding 61. Yalta, 1–144 [In Russian].
Moraes G. J. de, McMurtry, J. A. & Denmark, H. A. 1986. *A Catalog of the mite family Phytoseiidae. References to Taxonomy, Synonymy, Distribution and Habitat*. EMBRAPA — DDT, Brasilia, 1–353.
Muma, M. H. 1961. Subfamilies, genera, and species of Phytoseiidae (Acarina: Mesostigmata). *Bulletin of the Florida State Museum. Biological sciences*, 5 (7), 267–302.
Nesbitt, H. H. J. 1951. A taxonomic study of the Phytoseiinae (family Laelaptidae) predaceous upon Tetranychidae of economic importance. *Zoologische Verhandelingen*, 12, 1–64.
Oudemans, A. C. 1915. Acarologische Aanteekeningen LVI. *Entomologische Berichten*, 4, 180–188.
Oudemans, A. C. 1929. Acarologische Aanteekeningen XCIX. *Entomologische Berichten*, 8, 28–36.
Oudemans, A. C. 1930 a. Acarologische Aanteekeningen CI. *Entomologische Berichten*, 8, 48–53.
Oudemans, A. C. 1930 b. Acarologische Aanteekeningen CII. *Entomologische Berichten*, 8, 69–74.
Oudemans, A. C. 1930 c. Acarologische Aanteekeningen CIII. *Entomologische Berichten*, 8, 97–101.
Papadoulis, G. Th., Emmanouel, N. G. & Kapaxidi, E. 2009. *Phytosiidae of Greece and Cyprus (Acari: Mesostigmata).* Indira Publishing House. West Bloomfield, Michigan, USA, 1–200.
Pritchard, A.E. & Baker, E. W. 1962. Mites of the family Phytoseiidae from central Africa, with remarks on the genera of the world. *Hilgardia*, 33 (7), 205–309.
Schicha, E. 1987. *Phytosiidae of Australia and neighboring areas*. Indira Publishing House, Michigan, 1–182.
Tixier, M.-S. 2022. Statistical approaches to assess intraspecific variations of morphological continuous characters: the case study of the family Phytoseiidae (Acari: Mesostigmata). *Cladistics*, 28, 489–502.
Tuttle, D. M. & Muma, M. H. 1973. Phytosiidae (Acarina: Mesostigmata) agricultural and other plants in Arizona. *Agricultural Experiment Station. University of Arizona. Technical Bulletin*, 208, 1–55.
Ueckermann, E. A. & Loots, G. C. 1985. The African species of the subgenus *Kampimodromus* Nesbitt (Acarina: Phytoseiidae). *Phytophylactica*, 17, 195–200.
Wainstein, B. A. 1962. Revision du genre *Typhlodromus* Scheuten, 1857 & systematique de la famille des Phytoseiidae (Berlese, 1916). *Acarologia*, 4 (1), 5–30.
Wainstein, B. A. 1973 a. On the position of the genus *Evansoseius* Sheals in system of the family Phytoseiidae (Parasitiformes). *Zoologicheskiy Zhurnal*, 52 (2), 274–277 [In Russian].
Wainshtein, B. A. 1973 b. On the structure of some taxonomically important organs of Phytoseiidae (Parasitiformes). *Zoologicheskiy Zhurnal*, 52 (12), 1871–1872 [In Russian].
Wainstein, B. A. 1973 c. New genus and species Phytoseiidae (Parasitiformes). *Zoologicheskiy Zhurnal*, 52 (6), 953–955 [In Russian].
Wainshtein, B. A. 1980. New species and genus of predatory mites of the family Phytoseiidae (Parasitiformes). *Zoologicheskiy Zhurnal*, 59 (1), 149–151 [In Russian].
Wainstein, B. A. 1983. Predaceous mites of the family Phytoseiidae (Parasitiformes) of Hawaii. *Entomologicheskoe obozrenie*, 62 (1), 181–186 [In Russian].
Yousef, A. T. A. 1974. A new genus of the family Phytoseiidae (Acarina: Parasitoidea). *Bulletin of Entomological Society of Egypte*, 58, 381–383.

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