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Subscriptions: Year 2020 (Volume 60): 450 €
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Previous volumes (2010-2018): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

Acarologia is under free license and distributed under the terms of the Creative Commons-BY-NC-ND which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.
Phytoseiid mites of Slovenia (Acari: Mesostigmata): new records and first description of the male of Amblyseius microorientalis

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Original research

ABSTRACT

Slovenia is a small country of Central Europe. Until recently, only limited surveys had been carried out of the Phytoseiidae fauna. The occurrence of 14 species had been documented in two international papers: 6 belonging to the subfamily Amblyseiinae, 1 to the subfamily Phytoseiinae and 7 to the subfamily Typhlodrominae. Four additional species (3 Amblyseiinae and 1 Phytoseiinae) were recorded and published recently but in a national journal and not mentioned in the world online database of Phytoseiidae. Here, we present results from 2018 and 2019 field surveys and add a total of 22 new records (18 if we consider national published records): 14 Amblyseiinae, 3 Phytoseiinae and 5 Typhlodrominae. The Phytoseiidae fauna of Slovenia contains after our study 36 species: 20 Amblyseiinae, 4 Phytoseiinae and 12 Typhlodrominae. Among the 22 new record species, at least 8 species are well-known biological control agents (BCA). In addition to the intrinsic value of phytoseiid mite biodiversity in temperate environments, demonstration of the natural occurrence of efficient BCAs is of great agricultural, commercial and strategic interests.

Keywords survey; collection; taxonomy; systematics

Zoobank http://zoobank.org/FA20102C-186C-4F32-90CA-EFDD21E8DAE2

Introduction

Phytoseiidae is an important family of predatory mites as several species in this family are important natural enemies controlling phytophagous mite and small insects in natural area, open field and protected crops all around the world (McMurtry and Croft 1997; McMurtry et al. 2013). However despite the huge numbers of faunistic surveys carried out for more than 70 years, the fauna of some countries and particular ecosystems remain little explored (Tixier et al. 2008). Consequently, it is important to make surveys in these poorly investigated areas to get more information on the biodiversity and to find there already known biological control agents (BCA) but also potential new BCA, especially in the context of new international and state regulations limiting import-export on natural enemies (Kreiter et al. 2020a, b). This family is widespread all over the world and consists presently of 2,521 valid species dispatched in three sub-families and 94 genera (Demite et al. 2014, 2020).

Slovenia is a small country of the Eastern Europe (29,273 km²), the 150th on 194 countries with continental, temperate and Mediterranean areas.
The Slovenian phytoseiid mites fauna is presently officially composed of only 14 species (Demite et al. 2020) (6 belonging to the sub-family Amblyseiinae, 1 to the Phytoseiinae and 7 to the sub-family Typhlodrominae), namely: *Amblyseius andersoni* (Chant), *A. rademacheri* Dosse, *Neoseiulus cucumeris* (Oudemans), *N. reductus* (Wainstein), *Euseius finlandicus* (Oudemans), *Kampimodromus aberrans* (Oudemans), *Phytoseius macropilis* (Banks), *Neoseiulella tiliarum* (Evans), *Paraseiulus soleiger* (Ribaga), *P. talbii* (Athias-Henriot), *P. triporus* (Chant and Yoshida-Shaul), *Typhlodromus (Anthoseius) bakeri* (Garman), *T. (A.) rhenanus* (Oudemans), and *T. (Typhlodromus) pyri* Scheuten. In this world database, only one international paper (Bohinc and Trdan 2013) is actually indicated reporting species in Slovenia.

But more than these 14 species can be considered present in Slovenia. Actually, four additional species (three Amblyseiinae and one Phytoseiinae) were recorded and published recently but in a national journal (Bohinc et al. 2018) and not mentioned in the world database of Phytoseiidae (Demite et al. 2020). These four additional species are: *Euseius stipulatus* (Athias-Henriot), *E. gallicus* Kreiter and Tixier, *Neoseiulus californicus* (McGregor), and *Phytoseius horridus* Ribaga.

We report in this paper, which constitutes the second international contribution to the Slovenian Fauna, results of additional surveys realised in a two years project Proteus (2018 and 2019).

**Material and methods**

The survey took place in Slovenia in June 2018 and June 2019.

Plant inhabiting mites were collected from cultivated and wild plants in several locations in all parts of the country. Mites were directly collected on leaves with a fine brush or by using the leaf “dipping-shaking-washing-filtering (dswf)” method of Boller (1984) or by beating the plants (mainly shrubs or trees) and collecting the mites in a black plastic rectangular saucer 45 x 30 cm (Ref. STR 45, BHR, 71370 Saint-Germain-du-Plain, France). The method selected was depending on the plant investigated: large leaves of shrubs and trees with the direct collection method or with dswf, very small leaves or spines of shrubs and trees with the dswf or by beating and herbaceous plants with dswf.

Mites collected were transferred with a brush into small plastic vials containing 1.5 ml of 70° ethanol. Mites were then all mounted on slides using Hoyer’s medium and all identified using a phase and interferential contrast microscope (DMLB, Leica Microsystèmes SAS, Nanterre, France). Characters of specimens were measured using a graduate eyepiece (Leica, see above).

We have used Chant and McMurtry’s (1994, 2007) concepts of the taxonomy of the family Phytoseiidae the world catalogue database of Demite et al. (2014, 2020) for distribution. For identifications, the specimens were compared to the original description and re-description. In the description and re-description herein proposed, the setal nomenclature system adopted was that of Lindquist & Evans (1965) and Lindquist (1994), as adapted by Rowell et al. (1978) for the dorsum and by Chant & Yoshida-Shaul (1991) for the venter. The idiosomal setal pattern follows Chant & Yoshida-Shaul (1992). The notation for solenostomes and poroids is based on Athias-Henriot (1975). Numbers of teeth on the fixed and movable cheliceral digits do not include the respective apical teeth. Setae not referred to in the Results section should be considered as absent. All measurements are given in micrometers (µm) and presented as the mean in bold followed by the range in parenthesis.

Specimens of each species are deposited in the mite collections of Montpellier SupAgro conserved in UMR CBGP INRA/IRD/CIRAD/SupAgro Université de Montpellier.

Specimens collected in fields in Slovenia within these surveys were all identified. Very few single males or immatures collected alone were not taken into account.

The following abbreviations are used in this paper for morphological characters: dsl = dorsal shield length just under j1 to just below J5; dsw s4 = dorsal shield width at the level
of s4; Z4 ser., Z5 ser. = Z4, Z5 serrated (if Z4 and Z5 without ser. = not serrated); gensl = genital shield length; gensw post. cor. = genital shield width posteriorly; lisl = Largest inguinal sigilla (= “metapodal plate”) length; lisw = Largest inguinal sigilla (= “metapodal plate”) width; sisl = smallest inguinal sigilla (= “metapodal plate”) length; sisw = smallest inguinal sigilla (= “metapodal plate”) width; vsl = ventrianal shield length; Dist. gv3 = distance between solenostomes gv3 on the ventrianal shield; vsw ZV2 & vsw anus = ventrianal shield width at ZV2 level and at paranal setae level; scl. = calyx length; scw = calyx widest width; Fdl = fixed digit length; Mdl = movable digit length; Nb teeth Fd = number of teeth on the fixed digit; Nb teeth Md = number of teeth on the movable digit; Shaft = length of the shaft of spermatodactyl; toe = length of the toe; BCA = Biological control agents; aasl = altitude above sea level.

The following abbreviations are used in this paper for institutions: CBGP = Centre de Biologie pour la Gestion des Populations; CIRAD = Centre International de Recherche Agronomique pour le Développement; INRAE = Institut National de la Recherche en Agronomie et Environnement; IRD = Institut de Recherche pour le Développement; MSA = Montpellier SupAgro, France; UMR = Unité Mixte de Recherche.

Results and discussion

Subfamily Amblyseiinae Muma


Tribe Neoseiulini Chant & McMurtry


Genus Neoseiulus Hughes

Neoseiulus Hughes, 1948: 141.

Neoseiulus barkeri Hughes

This species belongs to the *barkeri* species group of the genus *Neoseiulus*, as the spermathecal atrium is large and forked at junction with the major duct. It belongs to the *barkeri* species subgroup as the calyx is not markedly constricted at junction with the atrium, the atrium is deeply forked at the junction with the major duct without vacuolated area, and the major duct, atrium and calyx are of approximately the same width (Chant and McMurtry 2003a).

*Neoseiulus barkeri* has a worldwide distribution (see below and Moraes et al. 2004a; Demite et al. 2020). It is a well-known predator of *T. urticae* and also of thrips, and is released in greenhouses (strawberry, cucumber, eggplant) to control them. Various studies have shown its ability to control *Frankliniella occidentalis* (Pergande) (Rodriguez-Reina et al. 1992), *Thrips tabaci* Lindeman (Broodsgaard and Hansen 1992) and *T. urticae* in cucumber (Fan and Pettit 1994b). Fan and Pettit (1994a) showed that augmentative releases of *N. barkeri* provided control of *Polyphagotarsonemus latus* (Banks) on peppers. *N. barkeri* constitutes a potential BCA in several crops especially vegetable greenhouses.

This is the first report of that species from Slovenia.

**World distribution:** Algeria, Argentina, Australia, Benin, Brazil, Burundi, Canary Islands, Cape Verde, Chile, China, Cyprus, Egypt, England, Finland, France, Georgia, Germany, Ghana, Greece, Guinea, Hawaii, Italy, Iran, Israel, Japan, Jordan, Kenya, La Réunion Island, Latvia, Madagascar Island, Malawi, Morocco, Mozambique, Netherlands, Nigeria, Norway, Oman, Portugal, Russia, Senegal, South Africa, South Korea, Spain, Sweden, Syria, Tahiti Island, Thailand, Tunisia, Turkey, Ukraine, USA, West Bank, Yemen.

**Specimens examined:** A single ♀ during the two-year survey. Bukovica (altitude above sea level = aasl 49 m, lat. 45°54'06"N, long. 13°39'30"E), 1 ♀ on *Cucumis sativus* L. (Cucurbitaceae), 20/VI/2018.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Ferragut et al. (2010) for specimens from Spain and by Kreiter et al. (2020) for specimens from La Réunion and various regions of the world.

**Neoseiulus californicus** (McGregor)

*Amblyseius wearnei* Schicha 1987: 103 (synonymy according to Tixier et al. 2014).

*Neoseiulus californicus* belongs to the *cucumeris* species group of *Neoseiulus* as the dorsocentral setae are not short relatively to dorsolateral setae. It belongs to the *cucumeris* species subgroup as spermatheca does not have a stalk between calyx and atrium, the atrium being undifferentiated or nodular and joined directly to calyx (Chant and McMurtry 2003a).

This species is distributed worldwide (see below and Moraes et al. 2004; Demite et al. 2020) and has been introduced in several countries for biological control issues. It is commercialised and released in various crops to control mite pests, especially *T. urticae* and *P. ulmi*. It is also naturally found on uncultivated plants or crops such as apple. Many studies deal with its biology. It is a specialized predator, Type 2. Nevertheless, it has characteristics of both specialist and generalist predatory mites (Castagnoli and Simoni 2003). It prefers to feed on spider mites (Gomez-Moya et al. 2009), but can also consume other mite species like...
tarsonemid mites *[Phytoseium pallidus* (Banks)] (Easterbrook *et al.* 2001), small insects such as thrips (Rodriguez-Reina *et al.* 1992) and even pollen when prey is unavailable (Rhodes and Liburd 2006). It can migrate from grasses to fruit trees or grapevines and vice versa (Auger *et al.* 1999). It is a specialist predator of *T. urticae* on annual plants and woody species, and of *P. ulmi* and various *Tetranychus* spp. (and perhaps eriophyid mites) on trees and less frequently on grapevines (Auger *et al.* 1999). *N. californicus* is well known as a BCA sold in many countries around the world for the management of spider mites in greenhouses but also in outdoor crops such as fruit crops in Europe.

This species was already recorded and mentioned in a Slovenian papers, like Bohinc and Trdan (2015) and Bohinc *et al.* (2018) but it is the first mention of that species in an international paper for Slovenia.

**World distribution:** Algeria, Argentina, Australia, Azores, Brazil, Canada, Canary Islands, Chile, Colombia, Cuba, Cyprus, France, Greece, Guadeloupe Island, Guatemala, Italy, Japan, La Réunion Island, Mexico, Morocco, Peru, Portugal, Senegal, Serbia, South Africa, South Korea, Spain, Syria, Taiwan, Tunisia, Turkey, Uruguay, USA, Venezuela.

**Specimens examined:** 27 ♀♀, 8 ♂♂ and 7 immatures in total. Bukovica (aasl 49 m, lat. 45°54'06"N, long. 13°39'30"E), 22 ♀♀, 7 ♂♂ and 7 immatures on *Cucumis sativus* L. (Cucurbitaceae), 20/VI/2018; Izola-Pivol (aasl 30 m, lat. 45°32'27"N, long. 13°40'51"E), 1 ♀ on *Pyrus communis* L. (Rosaceae), 21/VI/2018; Sečovlje (aasl 2 m, lat. 45°28'33"N, long. 13°37'06"E), 2 ♀♀ on *C. sativus*, 20/VI/2018; Spodnje Škofije-Purissima (aasl 50 m, lat. 45°34'21"N, long. 13°46'31"E), 2 ♀♀ and 1 ♂ on *Capsicum annuum* L. (Solanaceae), 11/VII/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Tixier *et al.* (2008) for specimens of the world, by Ferragut *et al.* (2010) for specimens from Spain and by Kreiter *et al.* (2020) for specimens from La Réunion and various regions in the world.

**Neoseiulus umbraticus** (Chant)


Just like the previous species and for same reasons, this species belongs to the *cucumeris* species group of the genus *Neoseiulus* and to the *cucumeris* species subgroup (Chant and McMurtry 2003a).

Very few studies exist on its biology. Knisley and Swift (1971) and Kazak *et al.* (2002) showed its ability to develop feeding on *T. urticae*. Sengonca & Dresher (2001) studied the ability of this species to develop feeding on *Thrips tabaci* Lindeman and concluded that this food alters its biological parameters in comparison to *T. urticae*. *N. umbraticus* seems able to develop and reproduce also on *Panonychus ulmi* (Koch), *Calvola lordi* (Nesbitt), *Aculus schlechtendali* (Nalepa), adults of *Quadraspidiotus perniciosus* (Comstock), and on apple and cherry pollens. Adults of *Agistemus fleschneri* Summers and winter eggs of *P. ulmi* were not fed upon.

This is the first report of that species from Slovenia.

**World distribution:** Armenia, Azerbaijan, Azores, Belarus, Caucasus Region, Denmark, England, France, Georgia, Germany, Hungary, Iran, Italy, Jamaica, Latvia, Mexico, Moldova,
Montenegro, Morocco, Norway, Poland, Russia, Slovakia, Spain, Switzerland, Turkey, Ukraine, USA.

Specimens examined: 14 ♀♀, 7 ♂♂ and 4 immatures in total. Škofljica, Guamisiče 15 (aasl 305 m, 45°58′15″N, 14°34′17″E), 1 ♀ on Carpinus betulus L. (Betulaceae), 18/VI/2019; Kranj (aasl 434 m, 46°16′6″N, 14°20′26″E), 12 ♀♀, 7 ♂♂ and 4 immatures on Rubus fruticosus L. (Rosaceae), 21/VI/2019; Ljubljana, Hotel Katrca (aasl 307 m, 46°3′19″N, 14°20′26″E), 1 ♀ on Tilia platyphyllos Scopoli (Malvaceae), 22/VI/2019.

Remarks: The description and measurements of the adult females collected agree with those provided by Chant et al. (1982) and by Ferragut et al. (2010) for specimens from Spain.

Tribe Kampimodromini Kolodochka

Subtribe Kampimodromina Chant & McMurtry

Genus Kampimodromus Nesbit
Kampimodromus Nesbitt, 1951: 53.

Kampimodromus aberrans (Oudemans)
Typhlodromus aberrans Oudemans 1930a: 48-49.
Typhlodromus (Typhlodromus) aberrans, Beglyarov 1957: 373.
Paradromus aberrans, Muma 1961: 286.
Kampimodromus (Kampimodromus) aberrans, Karg 1983: 305.
Typhlodromus vitiis Oudemans 1930c: 99 (synonymy according to Chant 1955).

Kampimodromus aberrans is a very common species in orchards, vineyards and wild plants in Europe and in North-Africa where it might be closely associated with several species of spider and eriophyid mites (Duso 1992; Schausberger 1997; Tixier et al. 1998, 2000a, b; Kreiter et al. 2000; Tsolakis and Ragusa 2017).

This species has been mentioned previously from Slovenia (Miklavc 2006; Bohinc and Trdan 2013; Bohinc et al. 2018). With 324 specimens in total in 13 locations, it is one of the most commonly species found in this survey.

World distribution: Albania, Algeria, Armenia, Austria, Azerbaijan, Belarus, Bulgaria, Canada, Caucasus Region, Croatia, Czechoslovakia, Czech Republic, England, France, Georgia, Germany, Greece, Hungary, Iran, Israel, Italy, Moldova, Montenegro, Morocco, Netherlands, Norway, Poland, Portugal, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Tunisia, Turkey, Ukraine, USA.

Specimens examined: 227 ♀♀, 48 ♂♂ and 49 immatures in total. Bukovica (aasl 49 m, lat. 45°54′06″N, long. 13°39′30″E), 2 ♀♀ on Ficus carica L. (Moraceae), 20/VI/2018; Nova Gorica, Restaurant Pri hrastu (aasl 96 m, lat. 45°57′26″N, long. 13°38′50″E), 15 ♀♀, 1 ♂ and 1 immature on Morus alba L. (Moraceae), 20/VI/2018; Izola-Pivol (aasl 30 m, lat. 45°32′27″N, long. 13°40′51″E), 1 ♀ on Prunus cerasus L. (Rosaceae) and 1 ♂ on Juglans

regia L. (Juglandaceae), 21/VI/2018; Parecag (aasl 72 m, lat. 45°37'49"E),
23 ♀♀ and 4 ♂♂ on *P. cerasus* and 47 ♀♀ and 1 ♂ on *Prunus domestica* L. (Rosaceae), 25 ♀♀, 5 ♂♂ and 5 immatures on *F. carica* and 47 ♀♀, 6 ♂♂ and 12 immatures on *Diospyros kaki* Thunberg (Ebenaceae), 21/VI/2018; Dragonja (aasl 1 m, lat. 45°27'12"N, long. 13°39'43"E),
30 ♀♀, 15 ♂♂ and 3 immatures on *F. carica*, 21/VI/2018; Ljubljana, Hotel Azur (aasl 296 m, 46°02'42"N, 14°28'25"E), 5 ♀♀ on *Corylus avellana* L. (Betulaceae), 22/VI/2018; Lucija (aasl 22 m, lat. 45°50'30"N, long. 13°36'11"E), 2 ♀♀ on *F. carica*, 11/VI/2018; Sečovlje, Parecag 15 (aasl 10 m, lat. 45 28'50"N, long. 13 37'49"E), 7 ♀♀, 9 ♂♂ and 7 immatures on *F. carica*, 19/VI/2019; Sečovlje, 58a (aasl 3 m, lat. 45°27'32"N, long. 13°39'04"E), 1 ♀, 2 ♂♂ and 2 immatures on *Malus domestica* Miller and 4 ♀♀ on *Prunus pumila* L. (Rosaceae), and 3 ♀♀ and 2 immatures on *D. kaki*, 19/VI/2019; Bertoki (aasl 28 m, lat. 45°32'48"N, 13°40'11"E), 1 ♀ on *Quercus rubra* L. (Fagaceae), 20/VI/2019; Spodnje Škofije-Purissima (aasl 50 m, lat. 45°34'21"N, long. 13°46'31"E), 4 ♀♀, on *Capsicum annuum* L. (Solanaceae), 21/VI/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Tixier *et al.* (2003) for specimens from France and with Ferragut *et al.* (2010) for specimens from Spain.

*Kampimodromus corylosus* Kolodochka


This species is often collected on hazelnut and seems a good predator of tetranychid and eriophyid mites occurring on this plant. But despite these very general observations, the biology of that species is almost totally unknown.

This is the first mention report of that species from Slovenia.

**World distribution:** Croatia, Hungary, Moldova, Ukraine.

**Specimens examined:** 16 ♀♀, 4 ♂♂ and 7 immatures in total. Kočevska Reka, Lake (aasl 567 m, 45°34'33"N, 14°47'25"E), 1 ♀, 1 ♂ and 1 immature on *Tilia platyphyllos* Scopoli (Malvaceae), 18/VI/2019; Pragersko, Kvedrova ulica (aasl 250 m, 46°23'48"N, 13°40'11"E), 2 ♀♀, 2 ♂♂ and 1 immature on *Populus tremula* L. (Salicaceae), 20/VI/2019; Juršinci, Gabrnik 55 (aasl 301 m, 46°28'43"N, 15°58'2"E), 8 ♀♀, 2 ♂♂ and 3 immatures on *Corylus avellana* L. (Betulaceae), 2 ♀♀, 1 ♂ and 2 immatures on *Prunus persica* and 1 ♀ on *Prunus cerasus* L. (Rosaceae), 20/VI/2019; Šobec (aasl 418 m, 46°21'22"N, 14°9'2"E), 1 ♀ on *C. avellana* and 1 ♀ on *Juglans regia* L. (Juglandaceae), 21/VI/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Kolodochka (2003) in the original description and by (Tixier *et al.* 2008).

**Tribe Phytoseiulini Chant & McMurtry**


**Genus Phytoseiulus Evans**

*Phytoseiulus* Evans, 1952: 397.

**Phytoseiulus persimilis** Athias-Henriot


Phytoseiulus (Phytoseiulus) persimilis, Wainstein 1962: 17.
Amblyseius tardi Lombardini 1959: 166 (synonymy according to Kennett & Caltagirone 1968).

Phytoseiulus persimilis is probably one of the best-known phytoseiid species in the world, because of its use to control T. urticae in greenhouses all over the world. It is a Mediterranean/subtropical predatory mite, a type I species, i.e. a specialist predator of the urticae species group of the genus Tetranychus (McMurtry and Croft 1997; McMurtry et al. 2013). Considerable research has been conducted on this predator-prey interactions (see review by Kostiainen and Hoy 1996), and numerous biological control programs have used P. persimilis against T. urticae on a wide range of ornamental and vegetable crops. P. persimilis was the first greenhouse biological control agents available commercially and it is one of the most successful BCA in the world. It can also be used in temperate climates on open-field crops such as strawberries. Optimum conditions are 20-27 °C and relative humidity of 60-90 %. Cooler or warmer temperatures may have a negative effect on reproduction, development and efficiency of this predatory mite (Escudero and Ferragut 2005). This species is present in Slovenia probably because of its commercial introduction and uses in vegetable and ornamental greenhouses, dispersion of some specimens released and establishment in the environment.

This is the first report of that species from the Slovenian fauna.

**World distribution:** Algeria, Australia, Canada, Canary Islands, Chile, China, Costa Rica, Cyprus, Egypt, Finland, France, Greece, Guatemala, Hungary, Iran, Israel, Italy, Japan, Jordan, Kenya, La Réunion Island, Latvia, Lebanon, Lybia, Martinique Island, Mauritius Island, Morocco, Netherlands, New Caledonia, Peru, Philippines, Portugal, Serbia, South Africa, South Korea, Spain, Syria, Tunisia, Turkey, USA, Venezuela.

**Specimens examined:** 6 ♀♀ in total. Sečovlje (aasl 2 m, lat. 45°28′33″N, long. 13°37′06″E), 6 ♀♀ on Cucumis sativus L. (Cucurbitaceae), 11/VII/2018.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Ferragut et al. (2010) for specimens of Spain and by Kreiter et al. (2018, 2020) for specimens from Mauritius, La Réunion and various regions in the world.

**Tribe Typhlodromipsini Chant & McMurtry**


**Genus Typhlodromips De Leon**


**Typhlodromips driggeri (Specht)**

Typhlodromips driggeri, Moraes et al. 1986: 140; 2004: 212.
Typhlodromips assimiboin Chant & Hansell 1971: 728 (synonymy according to Denmark & Evans 2011).

According to Denmark and Evans (2011), species of Typhlodromips have macrosetae on legs II, III and IV (and also on leg I, see above) and species of Neoseiulus have in general no macrosetae on legs I to III. The specimens here observed have macrosetae on all legs and is thus a Typhlodromips and not a Neoseiulus. According with the same authors, T. driggeri is a senior synonym of Typhlodromips assimiboin (Chant and Hanssell) placed by Chant and McMurtry (2007) in the genus Typhlodromips and not in the genus Neoseiulus (oppositely to the species driggeri placed in Neoseiulus by these two authors). Demite et al. (2020) following Moraes et al. (1986, 2004) placed also this species in the genus Typhlodromips and according with those authors, this species is considered to be a Typhlodromips and not a Neoseiulus.
According Chant & McMurtry (2007), this species belongs to the *lugubris* species group as seta *Z1* is absent, and the calyx of the spermatheca is elongate, tubular.

The biology of that species is totally unknown. It was collected in orchard in Northern America and Canada but was never recorded outside of Northern America.

This is consequently the first report of that species from Slovenia and the first mention in Europe. Why this species is recorded in Slovenia as it was never recorded in other countries well investigated in Europe remain totally unknown.

**World distribution**: Canada, USA.

**Specimens examined**: 3 ♀♀ in total. Straža pri Raki (aasl 240 m, lat. 45°55’28”N, long. 15°24’26”E), 3 ♀♀ on *Cucumis sativus* L. (Cucurbitaceae), 19/VI/2018.

**Remarks**: The measurements of the three adult females collected agree quite well with those provided by Specht (1968) for specimens collected in New Jersey in apple orchards and with Chant and Hansell (1971) for specimens from various places in Eastern Canada (Québec, Manitoba, Ontario), with only some slight variations (Table 1).

### Tribe Amblyseiini Muma

Amblyseiini Muma, 1961: 68.

### Subtribe Amblyseiina Muma


**Table 1** Character measurements of adult females of *Typhlodromips driggeri* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

<table>
<thead>
<tr>
<th>Characters</th>
<th>Slovenia (3)</th>
<th>Canada (?)</th>
<th>USA (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dsl</td>
<td>332 (310 – 363)</td>
<td>340</td>
<td>354 (346 – 362)</td>
</tr>
<tr>
<td>Dsw s4</td>
<td>229 (213 – 245)</td>
<td>220</td>
<td>214 (211 – 217)</td>
</tr>
<tr>
<td>j1</td>
<td>25</td>
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Sources of measurements – Canada (cited as *Amblyseius assiniboin* Chant & Hansell, junior synonym of *T. driggeri* according to Denmark & Evans 2011): Chant & Hansell (1971); USA: original description of Specht 1968); - : not provided.
Genus *Transeius* Chant & McMurtry


**Transeius fragilis** (Kolodochka & Bondarenko)

*Amblyseius fragilis* Kolodochka & Bondarenko 1993: 34.

*Typhlodromips fragilis*, Moraes et al. 2004: 213.


This species belongs to the *bellottii* species group as seta *z4* is not as long as 2/3 distance between its base and that of seta *s4*. The spermatheca has the calyx bell-shaped and that keys to *bellottii* species subgroup.

This species was described by Kolodochka and Bondarenko (1993) with specimens collected in the Black Sea National Biosphere Reserve, Solenoozernyy, Kherson Region, Ukraine, on *Taraxacum* sp. for the holotype and on *Frankenia hirsuta* L. and *Cirsium* sp. for the paratypes.

The biology of that species is totally unknown.

This is the first report of that species from Slovenia.

**World distribution**: Ukraine.

**Specimens examined**: 3 ♀♀ in total. Podgorje (aasl 228 m, lat. 46°42′18″N, long. 15°49′13″E), 1 ♀ on *Phaseolus vulgaris* L. (Fabaceae) and 2 ♀♀ on *Fragaria* sp. (Rosaceae), 12/VII/2018.

**Remarks**: The measurements of the three adult females (Table 2) collected agree quite well with those provided by Kolodochka and Bodarenko (1993) for specimens collected on diverse plant species from Ukraine, with only slightly longer setae *z4* and *S2*, and slightly shorter macrosetae of the leg IV in the Slovenian specimens.

**Transeius volgini** (Wainstein & Beglyarov)


*Amblyseius* (*Amblyseius*) *volgini*, Wainstein 1979: 140, 142.


Like *T. fragilis*, this species belongs to the *bellottii* species group and to the *bellottii* species subgroup (Chant and McMurtry 2004a).

The biology of that species is totally unknown.

This is the first report of that species from Slovenia.

**World distribution**: China, Russia, South Korea.

**Specimens examined**: 2 ♀♀ and 3 ♂♂ in total. Šobec (aasl 418 m, lat. 46°21′22″N, long. 14°9′2″E), 2 ♀♀ and 2 ♂♂ on *Picea abies* (Pinaceae) and 1 ♂ on *Corylus avellana* L. (Betulaceae), 21/VI/2019.

**Remarks**: The description and measurements of the two adult females and the three adult males (Table 3) collected agree well with those provided by Wainstein and Beglyarov (1971) for Russia, by Wu (1987) for China [for *T. magnus*, junior synonym of *T. volgini* according to Ryu and Ebara (1991)] and by Ryu and Ebara (1991) for South Korea. *T. volgini* is similar to *T. herbarius* Wainstein but with important differences in setae measurements and less teeth in both digits in chelicerae.

Genus *Amblyseius* Berlese

*Amblyseius* Berlese, 1914: 143.
**Amblyseius andersoni** (Chant)

*Typhlodromus andersoni* Chant 1957: 296.


*Amblyseius (Multiseius) andersoni*, Denmark & Muma 1989: 84.


*Amblyseius charui* Gupta (synonymy according to Gupta 1985).

*Amblyseius reflexus* Knisley & Denmark 1978: 8-10 (synonymy according to Chant & Yoshida-Shaul 1990).


This species belongs to the *obtusus* species group with presence of setae J2 and Z1, seta...

### Table 2

Comparison of character measurements of adult females of *Transeius fragilis* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

<table>
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<th><strong>Ukraine</strong> (?)</th>
<th><strong>Characters</strong></th>
<th><strong>Slovenia</strong> (3) (this study)</th>
<th><strong>Ukraine</strong> (?)</th>
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<td>Gensw post.corn.</td>
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<td>-</td>
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<td>Lisl</td>
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<td>j4</td>
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<td>Lisw</td>
<td>6 (5 – 7)</td>
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<td>j5</td>
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<td>Sisl</td>
<td>17 (13 – 20)</td>
<td>-</td>
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<td>j6</td>
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<td>10 – 12</td>
<td>Sisw</td>
<td>3</td>
<td>-</td>
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<td>Vsl</td>
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<td>Vsw ZV2</td>
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<td>22</td>
<td>StII</td>
<td>24 (23 – 25)</td>
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Sources of measurements – Ukraine: Kolodochka & Bodarenko (1993); - : not provided.
Table 3  Character measurements of adult females and males of *Transeius volgini* collected in this study and those in previous studies (localities followed by the number of specimens measured between brackets).

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Sources of measurements for ♂ & ♀ — China (cited as *Amblyseius magnus* Wu, junior synonym of *T. volgini* according to Ryu & Ehara 1991); Wu (1987); Russia: Wainstein & Beglyarov (1971); South Korea: Ryu & Ehara (1991); : not provided.
Z4 short not as long as 2/3 between its base and that of seta s4, female ventrianal shield not vase-shaped/divided into separate ventral and anal shield and not wider at the level of anus than at the level of setae ZV2. It belongs to the andersoni species subgroup of this species group having calyx cup-shaped.

This species is distributed worldwide but is mainly reported from Europe. It has been observed on cultivated plants in orchards (apple, peach, pear and citrus) and vineyards, particularly in humid areas (Chant & Hansell 1971; Papadoulis & Emmanouel 1991; Ivancich-Gambaro 1994; Papaioannou-Souliotis et al. 1994; Nicotina 1996; Duso & Pasini 2003; Ragusa 2006). Several studies focused on the biology of A. andersoni and on its ability to feed on plant pests. It is reported to feed on P. ulmi, Frankiullini occidentalis (Pergande) and Aculops lycopersici (Masse) (Koveos & Broufas 2000; Fischer and Mourrut-Salesse 2005; Houten et al. 2005; Lorenzon et al. 2012). This species was already known from Slovenia. With 204 specimens collected in total (see above) in 23 locations, it was one of the most abundant and more widespread species reported in this survey. It has been observed in various locations, probably because of the high relative humidity in these regions.

Amblyseius andersoni was already mentioned from the Slovenian fauna (Miklavc 2006; Bohine and Trdan 2013; Bohinc et al. 2018).

World distribution: Algeria, Austria, Azerbaijan, Canada, Cyprus, Czechoslovakia, Czech Republic, Denmark, England, France, Georgia, Germany, Greece, Hungary, Italy, Japan, Latvia, Moldova, Morocco, Netherlands, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Turkey, Ukraine, USA.

Specimens examined: 135 ♀♀, 33 ♂♂ and 36 immatures in total. Straža pri Raki (aasl 240 m, lat. 45°55'28"N, long. 15°24'26"E), 3 ♀♀ on Acer pseudoplatanus L. (Aceraceae), 1 immature on Capsicum annuum L. (Solanaceae), 2 ♀♀ on Vitis vinifera L. (Vitaceae), 21 ♀♀ and 5 ♂♂ and 3 immatures on P. cerasus (Rosaceae), 1 ♀ on Rubus fruticosus L. and 2 ♀♀ on P. cerasus, and 14 ♀♀, 1 ♂ and 2 immatures on Tilia cordata Miller (Malvaceae), 19/VI/2018; Ljubljana, Hotel Azur (aasl 296 m, 46°02'42"N, 14°28'25"E), 1 ♀ on M. domestica, 19/VI/2018 and 8 ♀♀ and 1 immature on Bambusa vulgaris Schrader (Poaceae), 21/VI/2018; Budovica (aasl 49 m, lat. 45°54'06"N, long. 13°39'30"E), 11 ♀♀, 5 ♀♂ and 3 immatures on P. cerasus and 1 ♀ on Ficus carica L. (Moraceae), 20/VI/2018; Bilje (aasl 72 m, lat. 45°53'60"N, long. 13°38'41"E), 2 ♀♀ on V. vinifera L. 20/VI/2018; Prvačina (aasl 47 m, lat. 45°53'22"N, long. 13°42'54"E), 2 ♀♀ on Prunus persica L. (Rosaceae), 1 ♀ and 1 immature on M. domestica, and 4 ♀♀, 1 ♂ and 2 immatures on P. pumila L. (Rosaceae), 20/VI/2018; Izola-Pivol (aasl 30 m, lat. 45°32'27"N, long. 13°40'51"E), 1 ♀ and 1 immature on Pyrus communis L. (Rosaceae) and 1 ♂ on Juglans regia L. (Juglandaceae), 21/VI/2018; Pareč (aasl 72 m, lat. 45°28'44"N, long. 13°37'49"E), 1 ♀ on Prunus domestica L. (Rosaceae), 21/VI/2018; Maribor, Plant Protection Institute (aasl 267 m, lat. 46°34'07"N, long. 15°03'01"E), 1 ♀ on Acer campestre L. (Aceraceae), 18/VI/2019; Ljubljana, Biotechnical Faculty (aasl 307 m, 46°23'48"N, 14°20'26"E), 1 ♀ on Cornus mas L. (Cornaceae), 18/VI/2019; Ljubljana, Hotel Katrca (aasl 307 m, 46°3'19"N, 14°20'26"E), 1 ♀ on Carpinus betulus L. (Betulaceae), 18/VI/2019, and 1 ♀ on Tilia platyphyllos Scopoli (Malvaceae), 22/VI/2019; Sečovlje, 58a (aasl 3 m, lat. 45°28'43"N, long. 13°37'28"E), 2 ♀♀ on J. regia and on Cornus sanguinea L. (Cornaceae), 19/VI/2019; Dragona (aasl 3 m, lat. 45°27'32"N, long. 13°39'04"E), 3 ♀♀ on V. vinifera, 2 ♀♀ and 1 immature on P. pumila, and 1 ♂ on F. carica, 19/VI/2019; Bertoki (aasl 28 m, lat. 45°32'55"N, long. 13°47'13"E), 1 ♀ on Actinidia deliciosa (A. Chevalier) C.F. Liang & A.R. Ferguson (Actinidiaceae), 19/VI/2019; Pragersko, Kvedrova ulica (aasl 250 m, 46°23'48"N, 13°40'11"E), 2 ♀♀ and 1 ♂ on Pinus
strobus L. and 2 ♀♀ and 1 ♂ on P. sylvestris L. (Pinaceae), 20/VI/2019; Juršinci, Gabrnik 55 (aasl 301 m, lat. 46°28’43”N, long. 15°58’2”E), 1 ♀ and 1 immature on Rhus tomentosus Borkhausen (Rosaceae), 20/VI/2019; Veržej, Near the football stadium (aasl 182 m, lat. 46°35’27”N, long. 16°10’1”E), 2 ♀♀ and 2 immatures on P. sylvestris, 20/VI/2019; Šobec (aasl 418 m, lat. 46°21’22”N, long. 14°9’2”E), 2 ♂♂ and 2 immatures on Q. robur, 21/VI/2019; Kranj (aasl 434 m, lat. 46°16’6”N, 14°20’26”E), 4 ♀♀ and 1 ♂ on P. abies and 4 immatures on Sambucus nigra L. (Adoxaceae), 21/VI/2019; Spodnje Škofije-Purissima (aasl 50 m, lat. 45°34’21”N, long. 13°46’31”E), 3 ♀♀ and 1 ♂ on Capsicum annuum L. (Solanaceae), 11/VII/2019.

Remarks: The description and measurements of the adult females collected agree with those provided by Chant and Yoshida (1990), by Ferragut et al. (2010) for specimens from Spain and by Doker et al. (2019) for specimens from Bosnia-Herzegovina, a close country of Slovenia.

Amblyseius microorientalis Wainstein & Beglyarov

Amblyseius (Amblyseius) microorientalis, Wainstein 1979: 141.

Like the previous species, A. microorientalis belongs to the obtusus species group of the genus Amblyseius but having the calyx of the spermatheca long and saccular, it belongs to the nicola species subgroup.

The biology of that species is totally unknown.

This is the first report of that species from Slovenia.

World distribution: Russia.

Specimens examined: 3 ♀♀ and 1 ♂ in total. Veržej, Near the football stadium (aasl 182 m, lat. 46°35’27”N, long. 16°10’1”E), 3 ♀♀ and 1 ♂ on Fraxinus excelsior L. (Oleaceae), 20/VI/2019.

Remarks: The description and measurements of the three adult females (Table 4) collected agree well with those provided by Wainstein and Beglyarov (1971) and by Denmark and Muma (1989) for specimens from Russia with some slightly longer setae (j1, Z4, Z5, JV5, SgeIV and StiIV) in the Slovenian specimens. The male of that species is unknown and the description of the single specimen male collected is provided thereunder.

Description of the adult male of Amblyseius microorientalis Wainstein & Beglyarov

(n = 1) (Figs 1 a – d)

Diagnosis — The following combination of characters indicated below in the description of the male of this species is quite similar to the few described males of species of Amblyseius belonging to the obtusus species group and to the nicola species subgroup. Not many characters allow to distinguish it from all males of other species if no females are collected in the same time: the peritreme reaching the level of setae j1, an absence of reticulation of the dorsal shield, some dorsal setae length, especially z2, z4, r3 and S2 approximately of the same length (12 – 15) and s4 = Z4 (60), a spermatodactyl with a terminal part elongate with a large open angle with the shaft, additional macrosetae on all other legs than the leg IV, macrosetae of the leg IV subequal, a large sternogenital shield reticulated on margins, only three pairs of preanal setae, one pair of crateriform gv3 in-between and very close to setae JV2. All described males [Amblyseius articus Chant and Hansell, A. indocalami Zhu and Chen, A. longisaccatus Wu and Lin, Amblyseius obtusus (Koch), A. pseudoorientalis Chinniah and Mohanasundaram, A.
tubae Karg, A. valpoensis Gonzalez and Schuster)] have similar ventrianal shield reticulated with 3 pairs of preanal setae but the shaft and toe are quite different. The closest species is A. indocalami but shaft and toe are shorter and the angle between shaft and toe is less open. All other species have shaft and toe with an angle close to 90°.

**Dorsum** — (Fig. 1a). Dorsal shield fused with the peritremal shield at the level of z2 – z4 position, with no reticulations, 268 long and 158 wide, with eight pairs of solenostomes (gd 1, 2, 3, 4, 5, 6, 8, 9) and 10 pairs of poroids. The dorsal shield bears 17 pairs of dorsal setae and 2 pairs of sub-lateral setae on the dorsal shield: j1 24, j3 45, j4 8, j5 5, j6 8, J2 8, J5 5, z2 13, z4 15, z5 6, Z1 8, Z4 60, Z5 137, s4 60, S2 12, S4 10, S5 10, r3 14, RI 8. All setae smooth except Z4 and Z5 serrated.

**Peritreme** — (Fig. 1a). Extending to the level of j1. Peritremal shield fused with dorsal shield.

**Venter** — (Fig. 1b). Sternal shield smooth except on edges which are reticulated. Distances between st1 – st1 50, st2 – st2 58, st3 – st3 58, st1 – st5 113, st4 – st4 45, st5 – st5 33. Ventrianal shield with three pairs of pre-anal setae, JV1, JV2, and ZV2, and one pair crateriform gv3, between JV2 but very close from these setae, 20 between gv3 (distance between centers of solenostomes). One pair of iv5 and four pairs of poroids ivo discernible on the unique specimen examined. Soft cuticle surrounding ventrianal shield with one pair of setae (JV5); ventrianal

<table>
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<th>Russia 2 (1)</th>
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<td>200</td>
<td>188</td>
</tr>
<tr>
<td>j1</td>
<td>31</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>j3</td>
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<td>j5</td>
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<td>5</td>
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</tr>
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<td>13</td>
</tr>
<tr>
<td>S4</td>
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<td>160</td>
</tr>
<tr>
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<td>st4-st4</td>
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**Character measurements of adult females of Amblyseius microorientalis**

Table 4 Character measurements of adult females of Amblyseius microorientalis collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

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</tr>
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</tr>
<tr>
<td>j6</td>
<td>7 (6 – 8)</td>
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<td>5</td>
</tr>
<tr>
<td>J2</td>
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<td>5</td>
</tr>
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<td>7</td>
</tr>
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<td>st4-st4</td>
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</table>

Sources of measurements – Russia 1: Wainstein & Beglyarov (1971); Russia 2: Denmark & Muma (1989) for the holotype; - : not provided.
shield 114 long, 153 wide at anterior corners and 65 wide at level of paranal setae. JV5 smooth, 43 long. A pair of lyrifissures isp near JV5.

Chelicera — Fixed digit 23 long, with 8-9 teeth and movable digit 23 long with 1-2 teeth. Spermatodactyl elongate, with an elongate shaft (Fig. 1c) 25 long, and an elongate toe 13 with a large open angle between them, which makes the toe almost in alignment with the shaft.

Legs — (Fig. 1d). Legs IV with three pointed macrosetae like in the female: Sgel 33, SgelII 28, SgelIII 31, StIII 28, SgelIV 58, StIV 50, StIV’ 55. Chaetotactic formula of genu II and III similar to that of females.

Specimens examined — 1 ♂ collected, 1 ♂ measured. Veržej, Near the football stadium (aasl 182 m, lat. 46°35'27"N, long. 16°10'1"E), 1 ♂ on Fraxinus excelsior L. (Oleaceae), 20/VI/2019.

Type material — One male on one slide deposited in Montpellier SupAgro–INRA Acarology collection.

Remarks — Characters of males are very similar to that of females except of course length of setae and other characters. Ventriangular shield of the male is strongly reticulated and the ventriangular shield of the female not or very slightly, the sternogenital shield is larger in the male at the level of the seta st2, of normal size and not larger in the female. The male has also less teeth in FD and MD than female has.

Amblyseius rademacheri Dosse

Typhlodromus (Amblyseius) rademacheri, Chant 1959: 89.
Amblyseius (Typhlodromopsis) rademacheri, Muma 1961: 287.
Typhlodromus (Typhlodromus) rademacheri, Westerboer & Bernhard 1963: 658.
Typhlodromips rademacheri, Moraes et al. 1986: 145; Moraes et al. 2004: 221.

This species belongs to the same species group and the same species subgroup as A. andersoni.

Amblyseius rademacheri was found together with T. urticae on S. melongena in Turkey (Soysal and Akyazi 2018). In previous studies, it was found on various fruits, weeds, forest trees in association with tetranychid and eriophyid mites (Hajizadeh 2007). Tixier et al. (2013) also reported A. rademacheri on Vitis vinifera. Komi et al. (2008) found this species on pepper and eggplant in Japan. However, despite these records on cultivated plants, the biology of that species is unknown.

Amblyseius rademacheri was already mentioned from the Slovenian fauna (Miklavc 2006; Bohinc and Trdan 2013).

World distribution: Armenia, Austria, Azerbaijan, China, Czechoslovakia, Denmark, Georgia, Germany, Hungary, Iran, Italy, Japan, Latvia, Moldova, Netherlands, Poland, Russia, Slovakia, Slovenia, South Korea, Spain, Switzerland, Ukraine.

Specimens examined: 6 ♀♀ and 2 immatures in total. Straža pri Raki (aasl 240 m, lat. 45°55’28”N, long. 15°24’26”E), 3 ♀♀, 2 ♂♂ and 2 immatures on Cucumis sativus L. (Cucurbitaceae), 6 ♀♀, 2 ♂♂ and 2 immatures on Diospyros kaki Thunberg (Ebenaceae), 19/VI/2018; Škofljica, Gumnisšče 15 (aasl 305 m, lat. 45°58’15”N, long. 14°34’17”E), 1 ♀ and 1 immature on Rubus fruticosus L. (Rosaceae), 18/VI/2019; Juršinci, Gabrnik 55 (aasl 301 m, lat. 46°28’43”N, long. 15°58’2”E), 1 ♀ on Prunus cerasus L. and 1 ♀ on Pyrus communis L. (Rosaceae), 20/VI/2019; Kranj (434 m, lat. 46°16’6”N, long. 15°58’2”E), 1 ♀ on Prunus cerasus L. and 1 ♀ on Pyrus communis L. (Rosaceae), 20/VI/2019; Kranj (434 m, lat. 46°16’6”N, long. 15°58’2”E), 1 ♀ on Prunus cerasus L. and 1 ♀ on Pyrus communis L. (Rosaceae), 20/VI/2019; Kranj (434 m, lat. 46°16’6”N, long. 15°58’2”E), 1 ♀ on Prunus cerasus L. and 1 ♀ on Pyrus communis L. (Rosaceae), 20/VI/2019; Kranj (434 m, lat. 46°16’6”N, long. 15°58’2”E), 1 ♀ on Prunus cerasus L. and 1 ♀ on Pyrus communis L. (Rosaceae), 20/VI/2019; Kranj (434 m, lat. 46°16’6”N, long.
Figure 1 Male of *Amblyseius microorientalis* Wainstein and Beglyarov. a – Dorsal shield and peritreme; b – Ventral shields; c – Chelicera and spermatodactyl, d – Macrosetae on leg IV.
14°20′26″E), 2 ♀♀ and 1 immature on *Urtica dioica* L. (Urticaceae) and 1 ♀ on *Cornus mas* L. (Cornaceae), 21/VI/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Ryu and Ehara (1992), Kolodochka and Gwiazdowicz (2016) and Ferragut et al. (2010) for specimens from Spain.

*Amblyseius swirskii* Athias-Henriot

*Amblyseius swirskii* Athias-Henriot 1962: 5.


*Amblyseius capsicum* (Basha, Yousef, Ibrahim & Mostafa) (synonymy according to Abo-Shnaf & Moraes 2014).

*Amblyseius enab* El-Badry ((synonymy according to Abo-Shnaf & Moraes 2014).


Like the previous species, *A. swirskii* belongs to the same species group and the same species subgroup as *A. andersoni*.

The predatory mite *A. swirskii* is one of the most efficient Phytoseidae; it is currently released in more than 50 countries of the world. It originates from the East Mediterranean coast and has been described in 1962 from almond [Prunus dulcis (Mill.) D.A.Webb.] in Bet Dagan, Israel by Athias-Henriot (1962). This species was then reported along the coast of Israel, Middle Eastern countries, Southern Europe, Sub-Saharan Africa and the America (Demite *et al.* 2020).

This species is able to develop not only in the Mediterranean basin but also in subtropical and tropical areas (Zannou and Hanna 2011). Since this species is not entering diapause, it can be used throughout much of the season where daytime temperatures regularly exceed 22 °C (Calvo *et al.* 2015). *A. swirskii* is commonly used to control whiteflies and thrips in greenhouse vegetables (especially cucumber, pepper and eggplant) and some ornamental crops, in Europe and North America (Calvo *et al.* 2015). The biology of this species and its importance for biocontrol were recently reviewed by Calvo *et al.* (2015) and Buitenhuis *et al.* (2015).

This is the first record of that species in Slovenia, probably originating from dispersion in the environment after greenhouse releases.

**World distribution:** Argentina, Azerbaijan, Benin, Burundi, Cape Verde, Dr Congo, Egypt, Gaza Strip, Georgia, Ghana, Israel, Italy, Kenya, La Réunion Island, Saudi Arabia, Senegal, Spain, Syria, Tanzania, Turkey, USA, Yemen.

**Specimens examined:** 1 ♀ and 1 immature in total. Spodnje Škofije-Purissima (aasl 50 m, lat. 45°34′21″N, long. 13°46′31″E), 1 ♀ and 1 immature on *Capsicum annuum* L. (Solanaceae), 11/VI/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Ferragut *et al.* (2010) for specimens from Spain and by Kreiter *et al.* (2016a, b) for specimens from La Réunion and from various countries in the world.

**Sub-tribe Proprioseiopsina Chant & McMurtry**


**Genus Proprioseiopsis Muma**

Proprioseiopsis bordjelaini Athias-Henriot


This species is mentioned as an uncertain species by Chant and McMurtry (2005a) having an uncertain identity because of incomplete description. This species is quite rare and has been only reported from the Mediterranean basin and Canary Islands. The biology of that species is totally unknown.

This is the first report of that species from Slovenia.

World distribution: Algeria, Canary Islands, Morocco, Spain, Tunisia.

Specimens examined: A single ♀ during the two years-study. StražapriRaki(aasl 240 m, lat. 45°55’28”N, long. 15°24’26”E), 1 ♀ on Cucumis sativus L. (Cucurbitaceae), 19/VI/2018.

Remarks: The description and measurements of the adult females collected agree with those provided by Ferragut et al. (2010) for specimens from Spain (Table 5).

Proprioseiopsis okanagensis (Chant)

Typhlodromus okanagensis Chant 1957: 293.
Proprioseiopsis levis Wainstein 1960: 686 (synonymy according to Karg 1971b).

Oppositely to the case of the previous species, P. okanagensis belongs to the belizensis species group of the genus Proprioseiopsis having macrosetae on genu I and to the belizensis...
species subgroup having a calyx of the spermatheca bell-shaped. The biology of that species is totally unknown.

This is the first report of that species from Slovenia.

**World distribution:** Austria, Azerbaijan, Canada, China, Czech Republic, Finland, Germany, Greenland, Latvia, Moldova, Norway, Poland, Russia, Slovakia, Sweden, Turkey, Ukraine, USA.

**Specimens examined:** A single ♀ during the two years-study. Juršinci, Gabrnik 55 (aasl 301 m, lat. 46°28'43"N, long. 15°58'2"E), 1 ♀ on *Prunus cerasus* L. (Rosaceae), 20/VI/2019.

**Remarks:** The measurements of the adult female collected agree with those provided by Chant (1957) in the original description.

**Tribe Euseiini Chant & McMurtry**


**Sub-tribe Typhlodromalina Chant & McMurtry**


**Genus Amblydromalus Chant & McMurtry**


**Amblydromalus limonicus** (Garman & McGregor)


*Amblydromalus garmani* Chant 1959: 81 (unjustified replacement name for *Amblydromalus limonicus* according to Chant 1959).


*Amblyseius (Typhlodromalus) rapax* De Leon 1965: 125 (synonymy according to Moraes et al. 1982)

This species belongs to the *limonicus* species group as seta Z4 is much shorter than 40 % of the distance between its base and that of seta Z5.

*Amblydromalus limonicus* was described in 1956 from citrus in California. Its distribution range covers North and South America, Australia and New Zealand. It was detected for the first time in 2011 on tomatoes in several locations of the northeastern Spain and has extended its area of distribution since this date (Chorazy et al. 2016). It first caught the attention as natural enemy of the spider mites *Oligonychus puniceus* (Hirst) and *T. urticae* in avocados and other fruit trees (Knapp et al. 2013). In laboratory studies, *A. limonicus* developed into adults and laid eggs on several species of mites, thrips, whiteflies and scale insects, as well as on pollen (Knapp et al. 2013). Interest into *A. limonicus* re-emerged in the early 1990s after *F. occidentalis* had spread nearly all over the world. It was collected during surveys for *F. occidentalis* biocontrol agents in New Zealand and Australia. Laboratory and semi-field experiments in the Netherlands and Australia showed that *A. limonicus* was a very promising candidate for biological control of *F. occidentalis* in several greenhouse crops (Knapp et al. 2013). However, it was not possible to establish a commercially viable mass rearing system at this time. At around the same time *A. limonicus* was also identified in surveys in South America.
for classical biocontrol agents for the cassava green mite, *Mononychellus tanajoa* (Bondar).

Recently, a mass production system for *A. limonicus* was developed and this species became commercially available in January 2012. With the material from this mass production system, more semi-field and field trials could be conducted. Results showed that *A. limonicus* is also an excellent biocontrol agent for greenhouse whiteflies *Trialeurodes vaporariorum* (Westwood) in various ornamental and vegetable greenhouse crops. As this predatory mite originates from temperate areas, it is a good complement to *A. swirskii* and *Transeius montdorensis* (Schicha). Both species originate from sub-tropical regions and have a higher optimum temperature than *A. limonicus*. This is the first record of that species in Slovenia, probably originating from dispersion in the environment after greenhouse releases.

**World distribution:** Bolivia, Brazil, Colombia, Costa Rica, Cuba, Ecuador, French Guiana, Guatemala, Guyana, Hawaii, Honduras, Jamaica, Mexico, New Zealand, Nicaragua, Puerto Rico, Spain, Suriname, Trinidad, USA, Venezuela.

**Specimens examined:** 2 ♀♀ in total. Sečovlje, 58a (aasl 3 m, lat. 45°28’43”N, long. 13°37’28”E), 2 ♀♀ on *Cucurbita pepo* L. (Cucurbitaceae), 19/VI/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Moraes and McMurtry (1983) and by Moraes et al. (1994).

**Subtribe Euseiina Chant & McMurtry**


**Genus Euseius Wainstein**


**Euseius finlandicus** (Oudemans)

Seiulus finlandicus Oudemans 1915: 183.

*Typhlodromus finlandicus*, Oudemans 1930a: 50.


*Amblyseius finlandicus*, Athias-Henriot 1958: 34.


*Euseius finlandicus* has been reported in orchards and grapevines in various countries in Europe. This species is widespread, mainly in the Palaearctic region. It feeds on *P ulmi* and various eriophyid mites. It is a type IV predatory mite with its highest reproductive capacity reached when feeding on pollen (McMurtry and Croft 1997; Broufas and Koveos 2000; McMurtry *et al.* 2013).

This species was already known from Slovenia (Miklavc 2006; Bohinc and Trdan 2013; Bohinc *et al.* 2018). With 375 specimens in total in 21 locations, it is one of the more common and widespread in that survey.

**World distribution:** Albania, Algeria, Angola, Argentina, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Caucasus Region, China, Croatia, Cyprus, Czechoslovakia, Czech Republic, Denmark, England, Finland, France, Georgia, Germany, Greece, Hungary, India, Indonesia, Iran, Italy, Japan, Kazakhstan, Latvia, Lithuania, Macedonia, Mexico, Moldova, Montenegro, Netherlands, Nicaragua, Norway,
Poland, Portugal, Russia, Scandinavia, Serbia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Tunisia, Turkey, Ukraine, USA.

**Specimens examined:** 234♀♀, 61♂♂ and 80 immatures in total. Straža pri Raki (aasl 240 m, lat. 45°55′28″N, long. 15°24′26″E), 1♀ on *Vitis vinifera* L. (Vitaceae), 19/VI/2018; Ravni (aasl 300 m, lat. 45°56′44″N, long. 15°24′21″E), 4♀♀ on *Prunus cerasus* L. (Rosaceae), 19/VI/2018; Arnowo Selo (aasl 192 m, lat. 47°58′07″N, long. 15°33′49″E), 4♀♀ on *P. cerasus* and 24♀♀, 5♂♂ and 6 immatures on *Rubus fruticosus* L. (Rosaceae), 2♀♀ and 1♂♂ on *Juglans regia* L. (Juglandaceae) and 10♀♀, 1♂ and 1 immature on *Tilia cordata* Miller (Malvaceae), 19/VI/2018; Ljubljana, Hotel Azur (aasl 296 m, lat. 46°02′42″N, long. 14°28′25″E), 10♀♀, 4♂♂ and 2 immatures on *T. cordata*, 13♀♀, 2♂♂ and 1 immature on *Acer pseudoplatanus* L. (Aceraceae), 3♀♀ and 2♂♂ on *Malus domestica* L. (Rosaceae), 19/VI/2018 and 11♀♀ and 1♂♂ on *Aesculus hippocastanum* L. (Hippocastanaceae), 22/VI/2018; Bukovica (aasl 49 m, lat. 45°54′06″N, long. 13°39′30″E), 4♀♀ and 1♂ on *P. cerasus* and 1 immature on *Ziziphus jujuba* Miller (Rhamnaceae), 20/VI/2018; Izola-Pivol (aasl 30 m, lat. 45°32′27″N, long. 13°40′51″E), 4♀♀ on *P. cerasus*, 7♀♀, 4♂♂ and 1 immature on *J. regia*, 21/VI/2018; Parecag (aasl 72 m, lat. 45°32′44″N, long. 13°37′49″E), 34♀♀, 2♂♂ and 2 immatures on *P. cerasus*, 21/VI/2018; Pesnica (aasl 256 m, lat. 46°02′42″N, long. 14°28′25″E), 10♀♀, 4♂♂ and 2 immatures on *T. cordata*, 13♀♀, 2♂♂ and 1 immature on *Acer pseudoplatanus* L. (Aceraceae), 3♀♀ and 2♂♂ on *Malus domestica* L. (Rosaceae), 19/VI/2018 and 11♀♀ and 1♂♂ on *Aesculus hippocastanum* L. (Hippocastanaceae), 22/VI/2018; Bled, Lake (aasl 478 m, lat. 46°02′42″N, long. 14°05′06″E), 1♀ and 1♂ on *Alnus glutinosa* (L.) Gaertn (Betulaceae), 10♀♀, 8♂♂ and 5 immatures on *A. pseudoplatanus* and 3♀♀, 1♂ and 2 immatures on *Ulmus minor* L. (Ulmaceae), 21/VI/2019; Kranj (aasl 434 m, lat. 46°16′6″N, 14°20′26″E), 1♀ on *C. mas*, 4♀♀, 2♂♂ and 3 immatures on *C. betulus*, 1♀ and 2 immatures on *Picea abies* (L.) H. Karsten (Pinaceae) and 1♂ and 2 immatures on *Sorbus aucuparia* L. (Rosaceae), 21/VI/2019; Ljubljana, Hotel Katrca (aasl 307 m, lat. 46°3′19″N, 14°20′26″E), 2♀♀ and 1♂ on *Tilia platyphyllos* Scopoli (Malvaceae), 22/VI/2019.

**Remarks:** The measurements of the adult females collected agree with those provided by Ferragut and Escudero (1997) and Ferragut et al. (2010) for specimens from Spain.

**Euseius gallicus** Kreiter & Tixier


*Euseius gallicus* is a phytoseiid species described from southern France (Tixier et al. 2010). It has also been recorded from Tunisia, Belgium, Germany, the Netherlands, and Turkey (Kreiter et al. 2010; Döker et al. 2014).
Unlike the phytoseiid species mentioned above, which are classified as generalist predators of small insects and mites (type III), *Euseius* species are pollen-feeding generalist predators (type IV) (McMurtry and Croft 1997; McMurtry et al. 2013). Type III phytoseiids also feed on pollen but prefer or show better performance on insect or mite prey. Type IV predatory mites have their highest reproductive capacity when feeding on pollen, and populations in the field often increase significantly when the crop or the surrounding vegetation is flowering (McMurtry et al. 2013).

Recently, *E. gallicus* has shown potential as a biocontrol agent for thrips and whiteflies in roses when *Typha sp.* (cattail) pollen is supplied as an additional food source (Biobest 2013; Wackers 2013). Provision of pollen as a supplementary food source can improve biological control of whiteflies and thrips by type III phytoseiids (van Rijn and Sabelis 1993; Nomikou et al. 2010), and control works excellently in crops where pollen is naturally available (Calvo et al. 2012). The population of *Euseius* species can grow faster than the population of type III phytoseiids when pollen is provided as a food source.

This species was already recorded and mentioned in a Slovenian paper (Bohinc et al. 2018) but it is the first mention of that species in an international paper for Slovenia.

**World distribution:** Belgium, Czech Republic, France, Germany, Italy, the Netherlands, Tunisia, Turkey.

**Specimens examined:** 30 ♀♀, 4 ♂♂ and 4 immatures in total. Parecag (aasl 72 m, lat. 45°28′44″N, long. 13°37′49″E), 1 ♀ on *Diospyros kaki* Thunberg (Ebenaceae), 21/VI/2018; Dragonja (aasl 1 m, lat. 45°27′12″N, long. 13°39′43″E), 1 ♀ on *Pistacia terebinthus* L. (Anacardiaceae), 21/VI/2018; Lucija (aasl 22 m, lat. 45°30′30″N, long. 13°36′11″E), 1 ♀ and 1 immature on *Cucumis sativus* L. (Cucurbitaceae), 11/VI/2018; Ljubljana, Hotel Katrca (aasl 307 m, 46°3′19″N, 14°20′26″E), 2 ♀♀ on *Physocarpus opulifolius* (L.) Maximowicz (Rosaceae) and 1 ♀ and 1 immature on *Carpinus betulus* L. (Betulaceae), 18/VI/2019; Sečovlje, 58a (aasl 3 m, lat. 45°28′43″N, long. 13°37′28″E), 13 ♀♀, 4 ♂♂ and 1 immature on *Aesculus hippocastanum* L. (Hippocastanaceae), 19/VI/2019; Bertoki (aasl 28 m, lat. 45°32′55″N, long. 13°47′13″E), 3 ♀♀ on *Prunus persica* L. (Rosaceae) and 1 ♀ on *Actinidia delicosa* (A. Chevalier) C.F. Liang & A.R. Ferguson (Actinidiaceae), 19/VI/2019; Ankaran (aasl 19 m, lat. 45°34′20″N, long. 13°45′29″E), 3 ♀♀ and 1 immature on *Quercus robur* L. (Fagaceae), 19/VI/2019; Ljubljana, Hotel Katrca (aasl 307 m, 46°3′19″N, 14°20′26″E), 1 ♀ on *Tilia platyphyllos* Scopoli (Malvaceae), 22/VI/2019.

**Remarks:** The measurements of the adult females collected agree with those provided by Okassa et al. (2009), Tixier et al. (2010) and Döker et al. (2014).

**Euseius stipulatus** (Athias-Henriot)


This species was described from Algeria (Athias-Henriot 1960). This species is mainly known from the south of the Western Palearctic region. It is a very common species reported from many plants, including crops such as peach, avocado orchards and vineyards. It is especially abundant in citrus orchards (Ragusa 1977; Ferragut et al. 1983; Papaioannou-Sooliotis et al. 1994; Ragusa 2006; Kreiter et al. 2010; Sahraoui et al. 2012). Several studies have shown its ability to feed on pollen but also on pests such as *T. urticae* and *P. citri* or eriophyid mites (Ferragut et al. 1992; Santaballa et al. 1994; Abad-Moyano et al. 2009; Pina et al., 2012). This species was already recorded and mentioned in a Slovenian paper (Bohinc et al. 2018) but it is the first mention of that species in an international paper for Slovenia.

**World distribution:** Algeria, Azores, Canary Islands, France, Greece, Hungary, Iran, Italy, Madeira Island, Montenegro, Morocco, Peru, Portugal, Spain, Syria, Tunisia, Turkey, USA.
Specimens examined: 23 ♀♀, 5 ♂♂ and 10 immatures in total. Izola-Pivol (aasl 30 m, lat. 45°32’27”N, long. 13°40’51”E), 6 ♀♀, 1 ♂ and 1 immature on Prunus persica L. (Rosaceae), 1 ♂ and 1 immature on Ulmus minor Miller (Ulmaceae), 3 ♀♀, 3 ♂♂ and 3 immatures on Pyrus communis L. (Rosaceae) and 1 ♀ on Juglans regia (Juglandaceae), 21/VI/2018; Parecag (aasl 72 m, lat. 45°28’44”N, long. 13°37’49”E), 7 ♀♀ and 2 immatures on Prunus domestica L. (Rosaceae), 21/VI/2018; Sečovlje, Parecag 15 (aasl 10 m, lat. 45°28’50”N, long. 13°37’49”E), 1 ♀ and 1 immature on Prunus cerasus L. (Rosaceae), 19/VI/2019; Sečovlje, 58a (aasl 3 m, lat. 45°28’43”N, long. 13°37’28”E), 1 ♀ on P. persica and 1 ♀ on Salix daphnoides Villars (Salicaceae), 19/VI/2018; Dragonja (aasl 3 m, lat. 45°27’32”N, long. 13°46’31”E), 1 ♀ on Capsicum annuum L. (Solanaceae), 11/VII/2019.

Remarks: The description and measurements of the adult females collected agree with those provided by Ferragut and Escudero (1997) and by Ferragut et al. (2010) for specimens from Spain.

Sub-family Phytoseiinae Berlese
Phytoseiini, Berlese 1913: 3; Phytoseiinae, Vitzthum 1941: 768.

Genus Phytoseius Ribaga
Phytoseius Ribaga 1904: 177

Phytoseius finitimus Ribaga

Having seta R1 and J2 present, this species belongs to the plumifer species group of the genus Phytoseius (Chant and McMurtry 2007).

This species is mainly reported in Mediterranean countries, and is especially frequent in Israel and Greece. It has been observed mainly on shrubs. A big confusion between P. finitimus and Phytoseius plumifer (Canestrini and Fanzago) has existed for a long time and a tentative solution has been proposed by Duso and Fontana (2002). We herein follow these authors and do not considered valid the synonymy between these species indicated in Moraes et al. (2004). Phytoseius finitimus has been reported on grapevines and fig tree orchards in several countries in Europe. It seems to feed on P. ulmi (Duso and Moretto 1994) and various eriophyid mites (Rasmy and El-Banhawy 1974b), and it consumes pollen (Zaher et al., 1969; Rasmy and El-Banhawy 1975). High relative humidities and very hairy-leaved plants or varieties seem to be very suitable for P. finitimus (Rasmy and El-Banhawy 1974a; Duso and Moretto 1994).

This is the first report of that species from Slovenia.

World distribution: Algeria, Azores, Egypt, France, Greece, Iran, Israel, Italy, Montenegro, Morocco, Portugal, Spain, Syria, Tunisia, Turkey, USA.

Specimens examined: 2 ♂♂ collected in total. Sečovlje, 58a (aasl 3 m, lat. 45°28’43”N, long. 13°37’28”E), 1 ♀ on Cornus sanguinea L. (Cornaceae) and 1 ♀ on Aesculus hippocastanum L. (Sapindaceae), 19/VI/2019.

Remarks: The measurements of the two adult males collected agree with those provided by Duso and Fontana (2002) and by Tixier et al. (2017).
**Phytoseius horridus** Ribaga


*Phytoseius (Phytoseius) horridus*, Moraes *et al.* 1986: 222.

Having seta *R1* and *J2* absent, this species belongs to the *horridus* species group of the genus *Phytoseius* (Chant and McMurtry 2007). The biology of this species seems totally unknown.

This species was already recorded and mentioned in a Slovenian paper (Bohinc *et al.* 2018), and in an international conference paper (Trdan and Bohinc, 2016).

**World distribution:** Algeria, France, Greece, Italy, Montenegro, Portugal, Spain.

**Specimens examined:** 23 ♀♀ and 1 ♂ in total. Parecag (aasl 72 m, lat. 45°28′44″N, long. 13°37′49″E), 15 ♀♀ and 1 ♂ on *Prunus domestica* L. (Rosaceae), 21/VI/2018; Škofljica, Gumnišče 15 (aasl 305 m, lat. 45°58′15″N, long. 14°34′17″E), 4 ♀♀ on *Acer campestre* L. (Sapindaceae) and 1 ♀ on *Carpinus betulus* L. (Betulaceae), 18/VI/2019; Dragonja (aasl 3 m, lat. 45°27′32″N, long. 13°39′4″E), 2 ♀♀ on *Prunus pumila* L. (Rosaceae) and 1 ♀ on *Ficus carica* L. (Moraceae), 19/VI/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Denmark (1966) and by Ferragut *et al.* (2010) for specimens from Spain.

**Phytoseius juvenis** Wainstein & Arutunjan

*Phytoseius (Dubininellus) juvenis* Wainstein & Arutunjan, 1970: 1501.

*Phytoseius (Phytoseius) juvenis*, Moraes *et al.* 1986: 223.


*Phytoseius ciliatus* Wainstein (synonymy according to Rahmani *et al.* 2010).

Like the previous species and for the same reasons, *P. juvenis* species belongs to the *horridus* species group of the genus *Phytoseius* (Chant and McMurtry 2007). The biology of this species seems totally unknown.

This is the first report of that species in Slovenia.

**World distribution:** Armenia, Czechoslovakia, Czech Republic, Finland, France, Hungary, Iran, Kazakhstan, Latvia, Moldova, Poland, Russia, Serbia, Slovakia, Slovenia, Ukraine.

**Specimens examined:** 6 ♀♀, 1 ♂ and 3 immatures in total. Arnovo Selo (aasl 192 m, lat. 47°58′07″N, long. 15°33′49″E), 6 ♀♀, 1 ♂ and 3 immatures on *Malus domestica* L. (Rosaceae), 19/VI/2018.

**Remarks:** The measurements of the adult females collected agree with those provided by Kolodochka (1978) and by Karg (1991).

**Sub-family Typhlodrominae** Wainstein


**Tribe Typhlodromini** Wainstein

*Typhlodromus* Scheuten, Evans 1953: 449.

*Typhlodromus (Typhlodromus)*, Chant 1957c: 528.


**Genus Typhloseiulus** Chant & McMurtry

Typhloseiulus calabriae (Ragusa & Swirski)

Typhloseiulus calabriae, Moraes et al. 2004: 373-374.

This species is mentioned only from few European countries. Its biology remains totally unknown.

**World distribution:** Croatia, Greece, Italy, Ukraine.

**Specimens examined:** 2 ♀♀ in total. Ljubljana, near Hotel Azur (aasl 296 m, lat. 46°02'42"N, long. 14°28'25"E), 2 ♀♀ on Acer pseudoplatanus L. (Aceraceae), 19/VI/2018.

**Remarks** The measurements of the adult females collected agree with those provided by Chant and Yoshida-Shaul (1983) and by Doker (2018) in a recent re-description.

Genus Neoseiulella Muma


Neoseiulella aceri (Collyer)

Typhlodromus (Nesbitteius) aceri, Wainstein 1962: 23.
Setius (Typhloctonus) aceri, Beglyarov 1981: 19.
Neoseiulella (Typhloctona) aceri, Denmark & Rather 1996: 60.

This species belongs to the tiliarum species group as JV3 is present, dorsal setae are medium and relatively uniform in length and chelicerae with few teeths.

Neoseiulella aceri was the second most common species on walnut in Czech Republic and the co-occurrence this species and E. finlandicus was often observed (Kabicek 2010).

Despite these observations, the biology of this type III species (McMurtry et al. 2013) is almost totally unknown. This species is mostly reported on Acer species (Kanouth et al. 2012).

This is the first mention of that species for the Slovenian fauna.

**World distribution:** Azerbaijan, Belgium, Croatia, Czech Republic, England, Finland, France, Greece, Hungary, Italy, Moldova, Norway, Serbia, Slovakia, Sweden, Turkey, Ukraine, USA.

**Specimens examined:** A single ♀ during the two years-study. Verzej, Near the football stadium (aasl 182 m, lat. 46°35'27"N, long. 16°10'1"E), 1 ♀ on Acer pseudoplatanus L. (Aceraceae), 20/VI/2019.

**Remarks** The measurements of the adult females collected agree with those provided by Kanouh et al. (2012) for the holotype.
Neoseiulella tiliarum (Oudemans)

Typhlodromus tiliarum Oudemans 1930a: 51-52.
Typhlodromus (Typhlodromus) tiliarum, Chant 1959: 65.
Typhloctonus tiliarum, Muma 1961: 299.
Typhlodromus (Nesbitteius) tiliarum, Wainstein 1962: 22-23.
Seiulus (Typhloctonus) tiliarum, Beglyarov 1981: 19.

Like the previous species, N. tiliarum belongs to the tiliarum species group.

Neoseiella tiliarum is more common in this study than the previous Neoseiella species (see above). It was the most common phytoseiid species on the surveyed urban linden trees in Czech Republic in a recent study (Kabicek 2019). Significantly more specimens of N. tiliarum were captured in this Czech study within the well-developed domatia created by overlapping trichomes in the vein axils and near the raised hairy veins on the underside of leaves of Tilia platyphyllos, and all specimens of N. tiliarum were detected within the similar sheltered leaf tuft domatia microhabitat on the abaxial leaf area of Tilia cordata (Barret 1994; Kabicek 2019). The vast majority of specimens of N. tiliarum sheltered more deeply within the domatia and persisted within the protected leaf domatia and vein microhabitats when they were repeatedly disturbed. The obvious preference for the sheltered leaf microhabitats among N. tiliarum detected on both surveyed Tilia spp. is consistent with the results obtained from grapevines (Kreiter et al. 2000, 2002) and Tilia spp. (Barret 1994). The frequent occurrence and persistence of slowly moving specimens of N. tiliarum on the unprotected leaf surface could be hazardous to them, so they prefer the sheltered leaf microhabitats and use the same shelter-based method of defensive strategy to avoid possible macro-predators, similarly to N. aceri and K. aberrans (Kabicek 2005, 2008). Neoseiella tiliarum has been observed on diverse deciduous trees (Chant and Yoshida-Shaul 1989), plant supports observed below can provide appropriate habitat niches for the survival and persistence of this generalist predator type III (McMurtry et al. 2013) in urban and non-urban areas. Despite this information, the biology of that species remains totally unknown.

This species was already recorded from Slovenia (Miklavc 2006; Bohinc and Trdan 2013).

**World distribution:** Algeria, Austria, Azerbaijan, Canada, Croatia, Czechoslovakia, Czech Republic, Denmark, England, France, Georgia, Germany, Greece, Hungary, Iran, Italy, Macedonia, Moldova, Montenegro, Netherlands, Norway, Poland, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Tunisia, Turkey, Ukraine, USA.

**Specimens examined:** 14 ♀♀ and 1 ♂ in total. Arnovo Selo (aasl 192 m, lat. 47°58’07”N, long. 15°33’49”E), 4 ♀♀ and 1 ♂ on Rubus fruticosus L. (Rosaceae), 19/VI/2018; Izola-Pivol (aasl 30 m, lat. 45°32’27”N, long. 13°40’51”E), 1 ♀ on Juglans regia L. (Juglandaceae), 21/VI/2018; Ljubljana, Botanical garden (aasl 296 m, lat. 46°02’02”N, long. 14°30’51”E), 4 ♀♀ on Celtis australis L. (Cannabaceae), 21/VI/2018; Ljubljana, Azur Hotel (aasl 296 m, lat. 46°02’42”N, long. 14°28’25”E), 1 ♀ on Aesculus hippocastanum L. (Sapindaceae), 21/VI/2018; Pragersko, Kvedrova ulica (aasl 250 m, lat. 46°23’48”N, long. 13°40’11”E), 1 ♀ on Prunus cerasus L. (Rosaceae), 20/VI/2019; Veržej, Kasač Restaurant (aasl 182 m, lat. 46°34’44”N, long. 16°09’45”E), 1 ♀ on Ulmus minor L. (Ulmaceae), 20/VI/2019; Bled, Lake (aasl 478 m, lat. 46°35’27”N, long. 16°10’1”E), 1 ♀ on Ulmus minor L. (Ulmaceae), 20/VI/2019; Bled, Lake (aasl 478 m, lat. 46°02’42”N, long. 14°28’25”E), 1 ♀ on Aesculus hippocastanum L. (Sapindaceae), 21/VI/2018; Pragersko, Kvedrova ulica (aasl 250 m, lat. 46°23’48”N, long. 13°40’11”E), 1 ♀ on Prunus cerasus L. (Rosaceae), 20/VI/2019; Veržej, Kasač Restaurant (aasl 182 m, lat. 46°34’44”N, long. 16°09’45”E), 1 ♀ on Tilia cordata Miller (Malvaceae), 20/VI/2019; Veržej, Near the football stadium (aasl 182 m, lat. 46°35’27”N, long. 16°10’1”E), 1 ♀ on Ulmus minor L. (Ulmaceae), 20/VI/2019; Bled, Lake (aasl 478 m, lat. 46°22’4”N, long. 14°05’06”E), 1 ♀ on U. minor, 21/VI/2019.

**Remarks:** The measurements of the adult females collected agree well with those provided by Kanouh et al. (2012) for the holotype and with Ferragut et al. (2010) for specimens from Spain.
Genus *Typhlodromus* (*Anthoseius*) Scheuten


**Typhlodromus (Anthoseius) bakeri** (Garman)

*Seiulus bakeri* Garman, 1948: 15.

*Typhlodromus (Neoseiulus) bakeri* Nesbitt 1951: 36-37.


*Anthoseius (Aphanoseius) clavatus*, Wainstein 1972: 1481 (synonymy according to Evans & Edland 1998).

Having setae S4, JV3 and JV4 present, setae on dorsal shield setiform approximately equal in length except for Z4 and Z5, which are sometimes longer, setae r3 and R1 on lateral integument, and setae of z-Z and z-S series shorter than distances between their bases, this species belongs to the *rhenanus* species group.

Almost nothing is known about the biology of that species.

This species was already recorded from Slovenia (Miklavc 2006; Bohinc and Trdan 2013).

**World distribution:** Alaska, Armenia, Australia, Austria, Azerbaijan, Canada, Caucasus Region, Czechoslovakia, Czech Republic, Denmark, England, Finland, France, Germany, Georgia, Greece, Hawaii, Hungary, India, Iran, Italy, Latvia, Montenegro, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, USA.

**Specimens examined:** 28 ♀♀ and 7 ♂♂ in total. Škofljica, Gumnišče 15 (aasl 305 m, lat. 45°58'15"N, long. 14°34'17"E), 1 ♀ on *Carpinus betulus* L. (Betulaceae) and 1 ♂ on *Rubus fruticosus* L. (Rosaceae), 18/VI/2019; Kočevska Reka, Lake (aasl 567 m, 45°34'33"N, 14°47'25"E), 1 ♀ on *Crateagus monogyna* Jacquin (Rosaceae), 1 ♀ and 1 ♂ on *Abies alba* Miller (Pinaceae), and 1 ♀ on *Corylus avellana* L. (Betulaceae), 18/VI/2019; Ljubljana, Faculty of Biotechnology campus (aasl 250 m, lat. 46°23'48"N, long. 13°39'4"E), 2 ♀♀ and 1 ♂ on *Pinus sylvestris* L. (Pinaceae), 20/VI/2019; Juršinci, Gabrnik 55 (aasl 301 m, lat. 46°28'43"N, 15°58'2"E), 2 ♀♀ on *Picea abies* (L.) H.Karsten (Pinaceae), and 1 ♀ on *Prunus cerasus* L. (Rosaceae), 21/VI/2019; Šobec (aasl 3m, lat. 45°21'22"N, 14°9'2"E), 1 ♀ on *Picea abies* (L.) H. Karsten (Pinaceae) and 1 ♀ on *P. sylvestris*, 2 ♀♀ and 1 ♂ on *Q. robur*, 1 ♀ and 1 ♂ on *Prunus padus* L. (Rosaceae) and 1 ♀ on *F. excelsior*, 21/VI/2019; Bled, Lake (aasl 478 m, lat. 46°22'4"N, long. 14°05'06"E), 1 ♀ on *Alnus glutinosa* L. (Betulaceae), 21/VI/2019; Kranj (aasl 434 m, 46°16'6"N, 14°20'26"E), 1 ♀ on *C. mas*, 21/VI/2019.

**Remarks:** The description and measurements of the adult females collected agree with those provided by Chant *et al.* (1974), by Karg (1982) and by Ferragut *et al.* (2010) for specimens from Spain.
Typhlodromus (Anthoseius) foenilis Oudemans

Typhlodromus foenilis Oudemans 1930b: 70.
Anthoseius (Amblydromellus) foenilis, André 1986: 111.
Amblydromella foenilis, Moraes et al. 1986: 173.
Amblydromella (Aphanoseia) foenilis, Denmark & Welbourn 2002: 308.

For same reasons than the previous species, this species belongs to the rhenanus species group.

The biology of this type III species (McMurtry et al. 2013) is almost totally unknown.
This is the first mention of that species for the Slovenian fauna.

World distribution: Belgium, Cyprus, England, Greece, Ireland, Morocco, Netherlands, Norway, Spain, Syria, Tunisia, Turkey.

Specimens examined: A single ♀ during the two years-study. Ankaran (aasl 19 m, lat. 45°34’20”N, long. 13°45’29”E), 1 ♀ on Quercus robur L. (Fagaceae), 19/VI/2019;

Remarks: The description and measurements of the adult females collected agree with those provided by Faraji et al. (2007) and by Ferragut et al. (2010) for specimens from Spain. This species is very close to T. (A.) cryptus, considered to be a junior synonym by several authors.

Typhlodromus (Anthoseius) recki Wainstein

Typhlodromus recki Wainstein 1958: 203.
Typhlodromus (Typhlodromus) recki, Chant 1959: 62.
Typhlodromella recki, Muma 1961: 299.
Typhlodromus (Neoseiulus) recki, Ehara 1966: 18.
Amblydromella recki, Moraes et al. 1986: 171.
Amblydromella (Aphanoseia) recki, Denmark & Welbourn 2002: 308.

For same reasons than the previous species, this species belongs to the rhenanus species group.

This species is commonly found in uncultivated areas and sometimes in crops in Europe, mainly on plants of the family Lamiaceae. However, no data on its biology were available until recently. Five populations of this species collected in South of France have been studied. Their abilities to eat Tetranychus urticae as well as their fecundity were assessed in lab experiments. Differences between the five populations have been observed. The fecundity rates (number of eggs/ female/ day) ranges between 0.5 and 1.4. The number of eggs of T. urticae consumed per female and per day ranges between 8 and 18. When the amount of prey is important in first days of the experiment, predation rates higher than 40 eggs consumed per female per day have been observed (Tixier et al. 2016). The number of prey consumed for some of the populations herein tested is quite similar to those reported for some predatory mite species used in biological control, such as Neoseiulus californicus, for example. Such results emphasize the potential capacity of that species to regulate T. urticae. Furthermore, as this species is endemic of Europe, such results open new insights for using endemic biodiversity to limit side effects of biological control within international exchange rules. However, additional studies are clearly needed to determine optimal rearing conditions, prey ranges and predation behaviour in field conditions (Tixier et al. 2016).

This is the first mention of that species for the Slovenian fauna.
World distribution: Algeria, Armenia, Austria, Azerbaijan, Caucasus Region, Cyprus, France, Georgia, Greece, Hungary, Iran, Israel, Italy, Kazakhstan, Lebanon, Moldova, Morocco, Portugal, Russia, Syria, Tunisia, Turkey, Ukraine.

Specimens examined: 4 ♀♀ in total. Parecag (aasl 72 m, lat. 45°29′06″N, long. 13°37′41″E), 1 ♀ on Fragaria sp. (Rosaceae), 11/VII/2018; Škofljica, Gumnišče 15 (aasl 305 m, lat. 45°58′15″N, long. 14°34′17″E), 1 ♀ on Carpinus betulus L. (Betulaceae), 18/VI/2019; Bled, Lake (aasl 478 m, lat. 46°22′4″N, long. 14°05′06″E), 1 ♀ on Ulmus minor L. (Ulmaceae), 21/VI/2019; Spodnje Škofije-Purissima (aasl 50 m, lat. 45°34′21″N, long. 13°46′31″E), 1 ♀ on Capsicum annuum L. (Solanaceae), 11/VII/2019.

Remarks: The description and measurements of the adult females collected agree with those provided by Ferragut et al. (2010) for specimens from Spain and by Ferragut (2018) for specimens from the Azores Archipelago.

**Typhlodromus (Anthoseius) rhenanus (Oudemans)**

Seiulus rhenanus Oudemans 1905: 78.


Typhlodromella rhenana, Muma 1961: 299.

Anthoseius rhenanus, Wainstein and Kolodochka 1974: 28

Anthoseius (Amblydromella) rhenanus, Kolodochka 1978: 63-64.

Typhlodromus (Amblydromella) rhenanus, Gupta 1985: 396.

Amblydromella rhenana, Moraes et al. 1986: 172.


Amblydromella (Aphanoseia) rhenana, Denmark and Welbourn 2002: 308.


Anthoseius tortor Beglyarov and Malov, 1978: 7 (synonymy according to Evans and Edland 1998).

For same reasons than the previous species, this species belongs to the *rhenanus* species group.

Almost nothing is known about the biology of that species.

This species was already recorded from Slovenia (Miklavc 2006; Bohinc and Trdan 2013).

**World distribution:** Algeria, Azerbaijan, Belarus, Belgium, Brazil, Canada, Cyprus, Denmark, England, Finland, France, Germany, Greece, Hungary, India, Iran, Israel, Italy, Kazakhstan, Latvia, Lithuania, Madeira Island, Moldova, Montenegro, Netherlands, Nicaragua, Northern Ireland, Norway, Poland, Portugal, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Tunisia, Turkey, Ukraine, USA.

Specimens examined: 2 ♀♀ in total. Rakitnica, Dolenjava vas (aasl 490 m, lat. 45°41′12″N, long. 14°45′20″E), 2 ♀♀ on Corylus avellana L. (Betulaceae), 18/VI/2019.

Remarks: The description and measurements of the adult females collected agree with those provided by Ferragut et al. (2010) for specimens from Spain.

**Genus Typhlodromus (Typhlodromus) Scheuten**


**Typhlodromus (Typhlodromus) ernesti Ragusa & Swirski**


The biology of this type IIIspecies (McMurtry et al. 2013) is almost totally unknown. This is the first mention of that species for the Slovenian fauna.

**World distribution:** Austria, France, Hungary, Israel, Italy, Norway, Russia, Spain, Sweden, Tunisia, Ukraine.

**Specimens examined:** 11 ♀♀, 3 ♂♂ and 2 immatures in total. Rakitnica, Dolnenja vas (aasl 490 m, lat. 45°41′12″N, long. 14°45′20″E), 2 ♀♀ on *Picea abies* (L.) H. Karsten (Pinaceae), 18/VI/2019; Pragersko, Kvedrova ulica (aasl 250 m, lat. 46°23′48″N, long. 13°40′11″E), 1 ♀ on *P. abies*, 20/VI/2019; Šobec (aasl 418 m, 14°05′06″E), 5 ♀♀, 3 ♂♂ and 2 immatures on *P. abies*, 21/VI/2019; Bled, Lake (aasl 478 m, lat. 46°10′17″N, long. 14°23′12″E), 1 ♀ on *P. abies*, 21/VI/2019.

**Remarks:** The measurements of the adult females collected agree with those provided by Tixier et al. (2019).

*Typhlodromus (Typhlodromus) pyri* Scheuten

*Typhlodromus pyri* Scheuten 1857: 104; Moraes et al. 1986: 246.

*Typhlodromus (Typhlodromus) pyri*, Chant 1959: 64.


This species is cosmopolitan but is the dominant species in vineyards and orchards in the western part of Europe. It has been introduced in various countries such as Australia and New Zealand for biological control purposes. It has been reported on a wide range of plants, essentially on cultivated and uncultivated shrubs and trees. This species is an active predator of red and yellow spider mites and eriophyid mites mainly in orchards and vineyards and of the grape thrips *Drepanothrips reuteri* (Uzel) in France (Serrano et al. 2004).

This species was one of the more abundant collected species within this survey.

This species was already recorded from Slovenia (Miklavč 2006; Bohinc and Trdan 2013).

**World distribution:** Australia, Austria, Azerbaijan, Belarus, Belgium, Canada, Chile, Croatia, Czechoslovakia, Czech Republic, Denmark, Egypt, England, Finland, France, Germany, Greece, Hungary, Italy, Madeira Island, Moldova, Montenegro, Netherlands, New Zealand, Northern Ireland, Norway, Poland, Portugal, Russia, Saudi Arabia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Turkey, Ukraine, USA.

**Specimens examined:** 112 ♀♀, 12 ♂♂ and 7 immatures. Ravni (aasl 300 m, lat. 45°56′44″N, long. 15°24′21″E), 7 ♀♀, 1 ♂♂ and 2 immatures on *Vitis vinifera* L. (Vitaceae), 19/VI/2018; Arnovolo selo (aasl 192 m, lat. 47°58′07″N, long. 13°31′49″E), 5 ♀♀, 3 ♂♂ and 2 immatures on *Malus domestica* L. (Rosaceae) and 9 ♀♀ and 1 immature on *Tilia cordata* Miller (Malvaceae), 19/VI/2018; Bilje (aasl 72 m, lat. 45°53′60″N, long. 13°38′41″E), 4 ♀♀ and 1 immature on *V. vinifera*, 20/VI/2018; Dragonja (aasl 3 m, lat. 45°27′12″N, long. 13°39′43″E), 1 ♀ on *V. vinifera*, 21/VI/2019; Maribor, Plant Protection Institute (aasl 267 m, lat. 46°34′07″N, long. 15°38′12″E), 43 ♀♀ and 2 ♂♂ on *M. domestica* and 28 ♀♀, 6 ♂♂ and 1 immature on *V. vinifera*, 22/VI/2018; Pesnica (aasl 256 m, lat. 46°37′02″N, long. 15°40′58″E), 3 ♀♀ and 1 immature on *M. domestica*, 22/VI/2018; Škofljica, Gumnišče 15 (aasl 305 m, lat. 45°58′15″N, long. 14°34′17″E), 1 ♀ on *Carpinus betulus* L. (Betulaceae) and 2 ♀♀ on *Rubus fruticosus* L. (Rosaceae), 18/VI/2019; Juršinci, Gabrnik 55 (aasl 301 m, lat. 46°28′43″N, long. 15°58′2″E), 1 ♀ on *M. domestica* and 1 ♀ on *Rubus tomentosus* Borkhausen (Rosaceae), 20/VI/2019; Bled, Lake (aasl 478 m, lat. 46°22′4″N, long. 14°05′06″E), 2 ♀♀ on *Acer pseudoplatanus* L. (Sapindaceae), 21/VI/2019; Kranj (aasl 434 m, 14°16′6″N, long. 14°20′26″E), 1 ♀ on *Picea abies* (L.) H. Karsten (Pinaceae), 21/VI/2019.

**Remarks:** The measurements of the adult females collected agree with those provided by Ferragut et al. (2010) for specimens from Spain and by Tixier et al. (2019) for specimens from France.
Conclusion

Fourteen species were previously reported from Slovenia with four additional species published in a national journal (Bohinc et al. 2018) and not mentioned in the world database of Phytoseiidae (Demite et al. 2020).

In this study carried out in 2018 and 2019 within an international project Proteus France-Slovenia, we add 18 new recorded species for the country and four additional species published in a national journal but not referenced at international level (Demite et al. 2020).

This is surprising that 6 Phytoseiidae species already mentioned were not here recovered: *Neoseiulus cucumeris* (Oudemans), *N. reductus* (Wainstein), *Phytoseius macropilis* (Banks), *Paraseilus soleiger* (Ribaga), *P. talhii* (Athias-Henriot) and *P. triporus* (Chant and Yoshida-Shaul).

The fauna of Phytoseiidae of Slovenia is now of 36 species, 22 Amblyseiinae, 4 Phytoseiinae and 10 Typhlodrominae.

We add also 9 BCA for the country, potentially usable in biological control in Slovenia without introduction permits as they are recorded in the country.

Acknowledgements

This paper presents the results obtained within a France-Slovenia project Proteus 2018-2019 (40155XG). We are very grateful to Campus France and to Slovenian Research Agency ( programme Horticulture P4-0013) and the Ministry of Agriculture, Forestry, and Food of Republic Slovenia - Administration for Food Safety, Veterinary Sector and Plant Protection (Professional Tasks from the Field of Plant Protection) for funding and managing the project.

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