

Predatory mites of the family Phytoseiidae (Acari: Mesostigmata) in Danube Delta Biosphere Reserve (Romania)

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Original research

ABSTRACT

In Romania, phytoseiid mites was notified sporadically with the occasion of some ecological works referring to the whole Mesostigmata. Seven years of investigations carried out in Danube Delta Biosphere Reserve led to the identification of 12 species belonging to the family Phytoseiidae (Acari: Mesostigmata) namely *Amblyseius meridionalis* Berlese, *A. obtusus* (Koch) sensu Karg, *A. terreus* Kolodochka, *Graminaseius graminis* (Chant), *Neoseiulus alpinus* (Schweizer), *N. cinctutus* (Livshitz & Kuznetsov), *N. extricatus* (Kolodochka), *N. tervus* Meshkov, *Proprioseiopsis messor* (Wainstein), *P. scurra* (Wainstein & Beglyarov), *Transeius macrospermathecus* Papadoulis, Emmanouel & Kapaxidi, *Typhlodromus (Anthoseius) kerkirae* Swirski & Ragusa. With the exception of *A. meridionalis* and *A. obtusus* the rest of the species are reported for the first time from Romania.

Keywords distribution; first record; predatory mites; fauna; Romania

Introduction

Species of the family Phytoseiidae (Acari: Mesostigmata) are known especially for their role in the biological control of many pests, such as phytophagous mites, thrips and other small insects (Gerson *et al.* 2003, McMurtry *et al.* 2013). Members of this family inhabit a wide range of terrestrial substrates, such as vegetable crops, perennial shrubs and trees canopy, and occasionally can be found in moss, herbal rhizosphere and soil (Kolodochka 2006, Krantz and Walter 2009). Phytoseiid mites are widely distributed around the world and currently include 2,557 valid species belonging to three subfamilies and 94 genera (Demite *et al.* 2014, 2022). In Romania, Phytoseiidae fauna is virtually unknown, with only two species – *Amblyseius meridionalis* Berlese, 1914 and *A. obtusus* (Koch, 1839) being recorded from moss habitats (bark, rock and soil moss) sampled in different mountain forests (Manu *et al.* 2018a). Both species were also found in two central parks from Bucharest (Manu and Honciuc 2010, Manu *et al.* 2018b). An opportunity to a better knowledge of the phytoseiid species was the wide investigation carried out between 2015 and 2021 in the Danube Delta Biosphere Reserve. This ample research targeted the biodiversity of edaphic meso-fauna in different ecosystems of this important wetland of Europe. It is well known the fact that Danube Delta represents a key center for biodiversity of its various types of ecosystems such as wet, arid, and salted meadows as well as sandy and rocky areas, forests on high banks or even anthropogenic ecosystems developed

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for economic reasons. On the occasion of these investigations, among other Mesostigmata, phytoseiid mites were identified from different types of habitats.

Material and methods

The survey took place in different years (2015, 2017, 2018, 2021), in various ecosystems, such as natural forests (2), plantations (10), meadows (6), agricultural crops (9) of Danube Delta Biosphere Reserve. From the above-mentioned ecosystems 31 plots were studied, plus one plot with *Cannabis ruderalis* Janisch (Cannabaceae) (Table 1).

In all investigated plots, there were taken series of five samples (5 cm depth), those from the forest ecosystems were divided into two sub horizons – olf (litter and fermentation layer) and ah (humification layer). Each sample had an area of 100 cm². In the case of the soil samples extracted from the meadows, the herbaceous layer was not removed.

Mites from soil samples were extracted using Berlese-Tullgren funnels. Specimens were

Table 1 Main characteristics of the investigated plots.

Locality	Coordinates	Altitude (m asl)	Type of ecosystem	Vegetation cover
Letea*	45°18'50"N 29°34'22"E	5	meso-higrophilous meadow	<i>Convolvulus persicus</i> L., <i>Carex colchica</i> J. Gay, <i>Eryngium maritimum</i> L., <i>Ephedra distachya</i> L., <i>Alyssum borzeanum</i> (Nyar)
Letea-Hășmacul Mare*	45°20'25"N 29°31'32"E	5	natural forest	<i>Quercus robur</i> L., <i>Q. pedunculiflora</i> K. Koch., <i>Populus alba</i> L.
Chilia Veche	45°26'41"N 29°19'24"E	5	natural forest	<i>P. alba</i> L., <i>Salix alba</i> L., <i>Ulmus minor</i> Mill., <i>Fraxinus excelsior</i> L.
Plauru I	45°17'42"N 28°53'42"E	3	natural forest	<i>P. alba</i> L., <i>S. alba</i> L.
Plauru II	45°16'31"N 29°39'22"E	3	plantation	<i>P. x canadensis</i> Moench, <i>S. alba</i> L.
			plantation	<i>S. alba</i> L., <i>P. alba</i> L., <i>Amorpha fruticosa</i> L.
			plantation	<i>P. x canadensis</i> Moench, <i>A. fruticosa</i> L.
Pardina	45°18'28"N 28°57'24"E	2	plantation	<i>P. alba</i> L., <i>Robinia pseudoacacia</i> L.
Beștepe	45°05'15"N 29°02'27"E	20	xerophilous meadow	<i>Stipa</i> L., <i>Xeranthemum annuum</i> L., <i>Euphorbia</i> L., <i>Achillea</i> L., <i>Hypericum perforatum</i> L.
			annual crop	<i>Zea mays</i> L.
			annual crop	<i>Helianthus annuus</i> L.
			annual crop	<i>Brassica napus</i> L.
			plantation	<i>Ailanthus altissima</i> (Mill.) Swingle, <i>Fraxinus ornus</i> L., <i>Crataegus monogyna</i> Jacq.
			plantation	<i>Vitis vinifera</i> L.
			plantation	<i>P. alba</i> L., <i>Robinia pseudoacacia</i> L.
Murighiol*	45°26'6"N 29°15'9"E	11	salinized meadow	<i>Salicornia europaea</i> L., <i>Puccinellia distans</i> (L.) Parl., <i>P. limosa</i> Parl., <i>Hordeum marinum</i> Huds., <i>Trifolium fragiferum</i> L.
	45°01'55"N 29°08'12"E		annual crop	<i>Hordeum vulgare</i> L., <i>H. annuus</i> L., <i>Medicago sativa</i> L.
Plopu	45°01'23"N 29°06'34"E	8	salinized meadow	<i>S. europaea</i> L., <i>Bassia hirsuta</i> (L.) Asch.
			annual crop	<i>Triticum aestivum</i> L.
Sarinasuf	45°0.5'51"N 29°04'53"E	4	annual crop	<i>Triticum aestivum</i> L.
			perennial crop	<i>M. sativa</i> L.
			salinized meadow	<i>Spergularia marina</i> (L.) Besser, <i>S. rubra</i> J. Presl & C. Pres, <i>Puccinellia maritima</i> (Huds.) Parl., <i>Juncus gerardii</i> Loisel., <i>Halimione verucifera</i> (M.Bieb.), Aellen, <i>S. europaea</i> L.
Sarichioi	44°55'35"N 28°50'13"E	13	annual crop	<i>T. aestivum</i> L., <i>Pisum sativum</i> L.
Enisala	44°54'34"N 28°49'56"E	26	salinized meadow	<i>Limonium gmelini</i> (Willd.) Kuntze., <i>H. verucifera</i> (M.Bieb.), Aellen, <i>S. europaea</i> L.
Sabangia	44°58'30"N 28°52'59"E	3	meadow	Unidentified Poaceae
			strip of land	<i>Cannabis ruderalis</i> Janisch
Pătălăneanca	45°12'55"N 28°41'41"E	3	meadow	Unidentified Poaceae, <i>Elaeagnus angustifolia</i> L.

* strictly protected areas

cleared in lactic acid solution 70% and mounted in Hoyer's medium (Krantz and Walter 2009). Measurements of the dorsal setae at females were made and brief comments regarding the morphology of the species were provided. Measurements are given in micrometers (μm) and presented as mean followed by the range in parenthesis. We have used Chant and McMurtry's (1994, 2007) concepts on the taxonomy of the family Phytoseiidae and the world catalogue database of Demite *et al.* (2014, 2022) for distribution. The samples were collected either by Dr Adina Călugăr or by Dr Otilia Ivan from Institute of Biological Research Iași (ICBI). All examined specimens are deposited in the collection of the institute. The protonymphs and deutonymphs were noted with respectively PN and DN abbreviations. It was used the abbreviation "leg." derived from Latin expression "legit" meaning "he, she, or it collected" with reference to who collected the material.

Results

Family Phytoseiidae Berlese, 1916

Subfamily Amblyseiinae Muma, 1961

Tribe Amblyseiini Wainstein, 1962

Subtribe Amblyseiina Chant & McMurtry, 2004

Genus *Amblyseius* Berlese, 1914

Amblyseius meridionalis Berlese, 1914

Material examined — Letea-Hășmacul Mare, forest (11 May 2016) 2 ♀♀ leg. Ivan, ICBI, Pardina, *Populus alba* plantation (30 June 2021) 4 ♀♀ leg. Ivan, ICBI.

Length of setae — *j1* 23 (20–25), *j3* 47 (45–48), *j4-j6*, *J2*, *J5*, *z2-z5*, *Z1*, *S2*, *S4*, *S5*, *R1* (minute), *Z4* 97 (93–100), *Z5* 147 (145–150), *s4* 58 (55–63), *r3* 12.

World distribution — Algeria, Canada - British Columbia, Ontario, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Moldova, Azerbaijan, Morocco, Poland, Russia - Tyumen, Spain, Switzerland, Tunisia, Turkey, Ukraine, USA - Michigan (Demitte *et al.* 2022) and Romania (this study).

Hosts / Substrates — On moss, litter under *Juniperus* spp. (Cupressaceae), *Thymus* spp. (Lamiaceae), *Achillea* spp. (Asteraceae), *Androsace* spp. (Primulaceae), Poaceae, *Senecio* spp. (Asteraceae), unidentified plant (Papadoulis *et al.* 2009), humus, soil, *Hyparrhenia hirta* (L.) Stapf. (Poaceae) (Demitte *et al.* 2022).

Previously, in Romania *A. meridionalis* was reported from moss samples (bark moss, rock moss and soil moss) taken from mature (over 80 years) natural forests located between 378 and 1445 m a.s.l. (Manu *et al.* 2018a).

Remarks — Although *A. meridionalis* is mentioned as resistant to dry habitats such as agro-ecosystems, dunes or inland meadows (Manu *et al.* 2018b), in our study it was found only in forest ecosystems. Morphological characters of the examined specimens fit well with those of the redescription of Döker *et al.* (2020). At Romanian specimens of *A. meridionalis* fixed digit have four teeth (three of them are minute, and one bigger next to *pilus dentilis*), movable digit edentate. The length of setae is smaller than that of Turkish individuals and closer to that of *Amblyseius meridionalis* sensu Livshitz & Kuznetsov (1972) (Döker *et al.* 2020).

Amblyseius obtusus (Koch, 1839) sensu Karg 1960

Material examined — Murighiol, meadow (24 July 2015) 1 ♀ leg. Ivan, ICBI; Murighiol, meadow (13 July 2018) 10 ♀♀ leg. Ivan, ICBI.

Length of setae — *j1* 27 (25–28), *j3* 39 (35–43), *j4-j6*, *J2*, *J5*, *z2-z5*, *Z1* (minute), *Z4* 118 (90–139), *Z5* 282 (270–302), *s4* 97 (93–100), *S2* 9 (9–10), *S4* 9 (9–10), *S5* 9, *r3* 10, *R1* 9 (7–10).

World distribution — Algeria, Argentina, Armenia, Azerbaijan, Azores, Canada, Chile, Costa Rica, Croatia, Cuba, Czech Republic, England, France, Germany, Georgia, Greece, Haiti, Hawaii, Hungary, Iran, Ireland, Italy, Kazakhstan, Latvia, Moldova, Morocco, New Zealand, Norway, Pakistan, Poland, Portugal, Romania, Russia, Slovakia, Spain, Sweden, Tunisia, Turkey, Ukraine, USA, Venezuela (Demite *et al.* 2022).

Hosts / Substrates — The neotype was found on rotten palm leaves, but *A. obtusus* is mostly present on herbaceous – *Achillea* spp. and *Senecio* spp. (Asteraceae) (Papadoulis *et al.* 2009) and shrub plants. It was rarely observed on *Vitis vinifera* L. (Vitaceae) (Tixier *et al.* 2013). Previously, in Romania *A. obtusus* was reported from moss samples (bark and soil moss) taken from mature (over 80 years) natural forests located between 378 and 1445 m asl (Manu *et al.* 2018a).

Remarks — *Amblyseius obtusus* is a cosmopolitan species, reported in more than 30 countries (Demite *et al.* 2022). Also, its ubiquity character is showed by the fact that it was found in Greece at 2300 m asl (Papadoulis *et al.* 2009), in Romania in two parks of Bucharest (75 m asl) (Manu and Honciuc 2010), as well as at 378–1445 m asl (Manu *et al.* 2018a) and with the occasion of our study at 11 m asl. However, in our study it was found in only meadow. Morphological characters and measurements of the Romanian specimens are very close to those described by Döcker *et al.* (2020).

***Amblyseius terreus* Kolodochka, 2003**

Material examined — Letea, meadow (22 July 2015) 1 ♂ leg. Ivan, ICBI; Letea, meadow (11 May 2016) 2 ♀♀ leg. Călugăr, ICBI; Plopu, meadow (13 July 2018) 8 ♀♀, 2 ♂♂, 1 DN leg. Ivan, ICBI; Beștepe, meadow (12 July 2018) 4 ♀♀, 1 ♂ leg. Ivan, ICBI; Murighiol, meadow (13 July 2018) 33 ♀♀, 15 ♂♂ leg. Ivan, ICBI; Murighiol, *P. alba* L. (Salicaceae) and *Robinia pseudoacacia* L. (Fabaceae) plantation (30 June 2021) 4 ♀♀ leg. Ivan, ICBI.

Length of setae — *j1* 26 (25–28), *j3* 35 (30–38), *j4-j6*, *J2*, *J5*, *z5*, *Z1*, *S2*, *S4*, *S5* (minute), *z2* 22 (18–23), *z4* 22 (18–23), *Z4* 67 (63–75), *Z5* 147 (135–155), *s4* 55 (50–60), *r3* 18 (15–20), *R1* 16 (13–18).

World distribution — Ukraine (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — Soil and litter at the roots of oak (*Quercus* spp.- Fagaceae), as well as from sand and gravel from interstitial zone on sea-beach of Crimea (Kolodochka 2003; Demite *et al.* 2022).

Remarks — Our findings recommend this species as being a preferential praticolous one, in DDBR being found only in meadows, never in the samples from forests. *Amblyseius terreus* was described from Crimea and until now no other reports of this species are available. Therefore, this new record is also significant from zoogeographical point of view. With 70 specimens in total, in four stands, this species was one of the most abundant species within this survey. Morphological characters are very close to the original description.

Genus *Graminaseius* Chant & McMurtry, 2004

***Graminaseius graminis* (Chant, 1956)**

Material examined — Murighiol, meadow (13 July 2018) 29 ♀♀, 14 ♂♂, 6PN leg. Ivan, ICBI.

Length of setae — *j1* 24 (23–25), *j3* 37 (35–40), *j4* 10 (8–13), *j5* 10 (8–10), *j6* 9 (8–10), *J2* 9 (8–10), *J5* 9 (8–10), *z2* 24 (23–25), *z4* 30 (28–35), *z5* 7 (5–10), *Z1* 28 (25–30) *Z4* 65, *Z5* 72 (68–75), *s4* 52 (50–53), *S2* 30 (28–34), *S4* 10, *S5* 10, *r3* 28 (25–33), *R1* 22 (18–25).

World distribution — Algeria, Australia, Denmark, England, France, Armenia, Azerbaijan, Moldova, Ukraine, Germany, Greece, Hungary, Israel, Italy Morocco, Norway, The Netherlands, Poland, Portugal, Russia, Canary Islands, South Africa Spain, Turkey, USA, Chile (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — It has been rarely found in crops and is mostly reported on herbaceous plants (Lamiaceae), *Ficus carica* L. (Moraceae), Poaceae, in humus and moss. It has been

collected on a great variety of plants including plum, pear, apple, citrus (Ferragut *et al.* 1985; Minarro *et al.* 2002; Kreiter *et al.* 2010; Sahraoui *et al.* 2012). Also, it was reported on *V. vinifera* in France and Chile (Demite *et al.* 2022; Tixier *et al.* 2013).

Remarks — *Graminaseius graminis* is a cosmopolitan species, being reported from more than 20 countries. Its discovery on many plants supports it is a common species. Morphological characters of the examined specimens generally fit with those described by Döcker (2019).

Tribe Neoseiulini Chant & McMurtry, 2003

Genus *Neoseiulus* Hughes, 1948

Neoseiulus alpinus (Schweizer, 1922)

Material examined — Murighiol, meadow (24 July 2015) 3 ♀♀ leg. Ivan, ICBI; Murighiol, meadow (06 June 2017) 2 ♀♀ leg. Ivan, ICBI; Sarinasuf, meadow (06 June 2017) 2 ♀♀, 2 ♂♂ leg. Ivan, ICBI; Sarinasuf, meadow (10 August 2017) 2 ♂♂ leg. Călugăr, ICBI; Sarinasuf, meadow, (13 July 2018) 2 ♀♀ leg. Ivan, ICBI.

Length of setae — *jl* 15 (13–20), *j3* 17 (15–25), *j4* 16 (10–15), *j5* 11 (10–13), *j6* 12 (10–13), *J2* 13 (10–15), *J5* 12 (10–15), *z2* 14 (10–15), *z4* 14 (10–8), *z5* 11 (10–13), *Z1* 16 (15–18), *Z4* 29 (25–30), *Z5* 41 (33–45), *s4* 25, *S2* 22 (15–25), *S4* 22 (15–25), *S5* 18 (13–25), *r3* 16 (13–20), *R1* 17 (15–20).

World distribution — Algeria, Australia, Belgium, Cuba, Czech Republic, England, France, Georgia, Russia, Ukraine, Germany, Greece, Hawaii, Hungary, Italy, Jordan, Norway, Poland, Switzerland, Spain, Turkey and USA (Arizona, California, Washington) (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — On moss, grass, unidentified low-growing plants, *Pyrus malus* L. (Rosaceae), *Ballota acetabulosa* (L.) (Lamiaceae), *Ulex europaeus* L. (Fabaceae), in soil (Papadoulis *et al.* 2009, Demite *et al.* 2022).

Remarks — *Neoseiulus alpinus* is a cosmopolitan species present in more than 20 countries. Our findings indicated the preference of this species to pratical ecosystems. Morphological characters are very close to the redescrptions provided by Evans (1987) and Ferragut *et al.* (2010).

Neoseiulus cinctutus (Livshitz & Kuznetsov, 1972)

Material examined — Murighiol, meadow (24 July 2015) 1 ♀ leg. Ivan, ICBI; Letea, meadow (11 May 2016) 1 ♀ leg. Călugăr, ICBI; Sarinasuf, alfalfa crop (07 May 2017) 2 ♀♀, 1 ♂ leg. Ivan, ICBI; Sarichioi, green peas (07 June 2017) 1 ♀, 1 ♂ leg. Ivan, ICBI; Murighiol, barley crop (06 June 2017) 2 ♀♀, 2 DN leg. Ivan, ICBI; Plopu, meadow (13 July 2018) 1 ♀ leg. Ivan, ICBI; Murighiol, meadow (13 July 2018) 16 ♀♀, 8 ♂♂ leg. Ivan, ICBI; Sarinasuf, meadow (13 July 2018) 2 ♀♀ leg. Ivan, ICBI.

Length of setae — *jl* 15 (13–18), *j3* 21 (18–25), *j4* 14 (13–15), *j5* 13 (10–15), *j6* 13 (10–15), *J2* 15 (10–18), *J5* 13 (10–15), *z2* 16 (13–18), *z4* 18 (15–20), *z5* 13 (10–13), *Z1* 18 (15–28), *Z4* 38 (33–50), *Z5* 54 (53–58), *s4* 26 (25–28), *S2* 27 (25–30), *S4* 24 (20–28), *S5* 19 (18–20), *r3* 16 (15–18), *R1* 17 (15–18).

World distribution — Former USSR (Crimea, Georgia), Greece, Turkey (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — *Verbascum graecum* Heldr. & Sart (Scrophulariaceae), *Plantago* spp. (Plantaginaceae), *Aesculum hippocastanum* L. (Sapindaceae), on unidentified plants (Papadoulis *et al.* 2009, Demite *et al.* 2022).

Remarks — An occurrence analysis shows that *N. cinctutus* is one of the most frequent species in DDBR, being found in seven plots among the 24 plots under investigations. Morphological characters of the examined specimens generally fit with those of the original description and the redescription by Döcker (2019).

***Neoseiulus extricates* (Kolodochka, 1991)**

Material examined — Murighiol, meadow (06 June 2017) 1 ♀, 1 ♂ leg. Ivan, ICBI; Enisala, meadow (07 June 2017) 2 ♀♀, 4 ♂♂ leg. Ivan, ICBI; Sarinasuf, meadow (06 June 2017) 7 ♀♀, 7 ♂♂ leg. Ivan, ICBI; Sarinasuf, alfalfa crop (07 June 2017) 5 ♀♀, 6 ♂♂ leg. Ivan, ICBI.

Length of setae — *j1* 18 (15–20), *j3* 20 (15–25), *j4* 13 (10–15), *j5* 13 (10–15), *j6* 13 (13–15), *J2* 14 (13–15), *J5* 10 (8–13), *z2* 18, *z4* 18, *z5* 13, *Z1* 19 (13–23), *Z4* 27 (25–28), *Z5* 34 (28–38), *s4* 20, *S2* 21 (18–23), *S4* 19 (15–20), *S5* 19 (15–20), *r3* 14 (13–15), *R1* 18 (13–25).

World distribution — Kazakhstan, Ukraine (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — Asteraceae: *Artemisia taurica* Willd. (Asteraceae).

Remarks — Inclusive with the occasion of this study, *N. extricates* was mentioned only from three countries in the vicinity. So far, its findings in all these countries recommend this species as a pratical one. Morphological characters of the examined specimens generally fit with those of the original description.

***Neoseiulus tervus* Meshkov, 1994**

Material examined — Sarinasuf, sunflower crop (07 June 2017) 1 ♀, 1 ♂, 1PN leg. Ivan, ICBI; Murighiol, meadow (06 June 2017) 1 ♂ leg. Ivan, ICBI.

Length of setae — *j1* 16, *j3* 20, *j4* 6, *j5* 6, *j6* 8, *J2* 8, *J5* 8, *z2* 16, *z4* 16, *z5* 4, *Z1* 16, *Z4* 46, *Z5* 65, *s4* 30, *S2* 21, *S4* 14, *S5* 10, *r3* 18, *R1* 18.

World distribution — Southwestern Russia – Samara (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — Unidentified plant family: herb; Poaceae: Grass; soil (Demite *et al.* 2022).

Remarks — So far, *N. tervus* was identified only from two neighbouring countries. It seems to be a rare species, being found only in meadows and crops as few specimens. Morphological characters of the examined specimens generally fit with those of the original description.

Subtribe Proprioseiopsina Chant & McMurtry, 2004

Genus *Proprioseiopsis* Muma, 1961

***Proprioseiopsis messor* (Wainstein, 1960)**

Material examined — Letea-Hășmacul Mare, forest (11 May 2016) 1 ♀ leg. Ivan, ICBI.

Length of setae — *j1* 38, *j3* 50, *j4-j6*, *z5*, *Z1* *S2*, *S4* (minute), *J5* 10, *z2*, *z4* (broken), *Z4* 163, *Z5* 217, *s4* 120, *S5* (broken), *r3* 20, *R1* 15.

World distribution — Algeria, Argentina, Armenia, Australia, Azerbaijan, Canary Islands, Egypt, France, Gaza Strip, Georgia, Germany, Greece, Hungary, Iran, Israel, Italy, Latvia, Morocco, New Zealand, Portugal, Saudi Arabia, Slovakia, South Africa, Spain, Syria, Turkey, Turkmenistan, Ukraine, USA (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — Poaceae – grass, white clover, strawberry, apple, plum, and plants (Schicha 1987), Poaceae, pine litter, humus, moss, on *Portulaca* spp. (Portulacaceae) (Papadoulis *et al.* 2009).

Remarks — *Proprioseiopsis messor* is a cosmopolitan species reported in many countries and a common one, being found on many plants. However, only one specimen of *P. messor* was found in our study. The single collected specimen from Romania has morphological characters like the redescription provided by Ostovan *et al.* (2012). However, the dorsal setae *z4* and *z5* of the Romanian specimens are not serrate and have longer lengths than those from Iran, being comparable with populations of *P. messor* found in Ukraine (Ostovan *et al.* 2012).

***Proprioseiopsis scurra* (Wainstein & Beglyarov, 1971)**

Material examined — Letea, meadow (11 May 2016) 1 ♂ leg. Călugăr, ICBI; Plopu, meadow (13 July 2018) 1 ♂ leg. Ivan, ICBI; Murighiol, meadow (13 July 2018) 4 ♀♀ leg. Ivan, ICBI.

Length of setae — *j1* 25, *j3* (broken), *j4-j6* (minute), *J5* 8, *z2* 15, *z4* 13, *z5*, *Z1* 12 (10–13), *Z4* 73 (65–83), *Z5* 77 (68–83), *s4* 50, *S2* 10, *S4* 10, *S5* 10, *r3* 18, *R1* 10.

World distribution — Japan, Kazakhstan, Russia – Primorsky Territory (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — Unidentified herb (Demite *et al.* 2022).

Remarks — Until now *P. scurra* was reported only from Asia, but with the occasion of this research it was proved that the distribution of this species was extended to Europe as well. *Proprioseiopsis scurra* was presented only in the samples from the investigated meadows. Morphological characters of the examined specimens fit with those of the original description.

Genus *Transeius* Chant &McMurtry, 2004

Transeius macrospermathecus Papadoulis, Emmanouel & Kapaxidi, 2009

Material examined — Murighiol, meadow (13 July 2018) 16 ♀♀, 8 ♂♂ leg. Ivan, ICBI; Pardina, *Populus alba* plantation (30 June 2021) 4 ♀♀ leg. Ivan, ICBI.

Length of setae — *j1* 25 (26–27), *j3* 44 (43–45), *j4* 7 (5–8), *j5* 7 (5–8), *j6* 8 (7–9), *J2* 9 (8–11), *J5* 9 (8–11), *z2* 9 (7–10), *z4* 30 (30–32), *z5* 5 (5–6), *Z1* 13(10–15) *Z4* 84 (80–85), *Z5* 100 (98–100), *s4* 78 (75–80), *S2* 35 (30–38), *S4* 17 (13–20), *S5* 12 (8–13), *r3* 14 (13–15), *R1* 14 (13–15).

World distribution — Greece (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — On moss (Papadoulis *et al.* 2009).

Remarks — *Transeius macrospermathecus* was only known based on its original description from Greece. Morphological characters of the Romanian specimens generally fit with those of the original description.

Subfamily Typhlodrominae Scheuten, 1857; Wainstein, Chant & McMurtry, 1994

Tribe Typhlodromini Wainstein, 1962

Genus *Typhlodromus* Scheuten, 1857

Subgenus *Anthoseius* De Leon, 1959

Typhlodromus (Anthoseius) kerkirae Swirski & Ragusa, 1976

Material examined — Letea, meadow (11 May 2016) 1 ♀ leg. Călugăr, ICBI.

Length of setae — *j1* 25, *j3* 28, *j4* 13, *j5* 15, *j6* 18, *J2* 25, *J5* 10, *z2* 20, *z3* 25, *z4* 30, *z5* 15, *Z4* 38, *Z5* 50, *s4* 28, *s6* 28, *S2* 30, *S4* 30, *S5* 30, *r3* 25, *R1* 18.

World distribution — Croatia, France, Italy, Greece, Iran, Spain, Turkey (Demite *et al.* 2022) and Romania (this study).

Hosts / Substrates — This species was described from Greece on *Malus sylvestris* (L.) Mill. It is not a widely distributed species, and it has been collected only from a few host plants, mainly cultivated crops, such as *Vitis* spp. (Vitaceae) (Castagnoli and Liguori 1987) and *Ficus* spp. (Moraceae) (Demite *et al.* 2022).

Remarks — Morphological characters of the examined specimens fit with those of the original description.

Conclusions

This study is carried out in the Danube Delta Biosphere Reserve (Romania). Phytoseiid mites were found only in 11 of a total of 32 investigated plots. As a result, ten new records for the fauna of this country was determined. Two other species, namely *Amblyseius obtusus* and *A. meridionalis* were previously reported from Romania, but only one – *A. obtusus* is mentioned

in the world database of Phytoseiidae as being identified in Romania as well (Demite *et al.* 2022). Thus, the fauna of Phytoseiidae of Romania is now compound of 12 species belonging to Amblyseiini (8), Neoseiulini (3) and Typhlodromini (1). From zoogeographical point of view, these records are important in the sense that distribution of some species proved to be larger than it was expected until now.

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References

- Berlese A. 1914. Acari nuovi. Manipulus IX. Redia, 10 : 113-150.
- Berlese A. 1916. Centuria terza di Acari nuovi. Redia, 12 : 289-338.
- Castagnoli M., Liguori M. 1987. Mites of the grapevine in Tuscany. Integrated Pest Control Viticulture, Proc. Meeting EC Experts Group, Portoferraio, ed. R. Cavalloro, Balkema, Rotterdam: 199-206. <https://doi.org/10.1201/9781003211426-27>
- Chant D.A. 1956. Some mites of the subfamily Phytoseiinae (Acarina: Laelaptidae) from southeastern England, with descriptions of new species. Can. Entomol., 88 : 26-37. <https://doi.org/10.4039/Ent8826-1>
- Chant D.A., McMurtry J.A. 1994. A review of the subfamilies Phytoseiinae and Typhlodrominae (Acari: Phytoseiidae). Int. J. Acarol., 20 (4): 223-310. <https://doi.org/10.1080/01647959408684022>
- Chant D.A., McMurtry J.A. 2003. A review of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part I. Neoseiulini new tribe. Int. J. Acarol., 29(1): 3-46. <https://doi.org/10.1080/01647950308684319>
- Chant D.A., McMurtry J.A. 2004. A review of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part III. The tribe Amblyseiini Wainstein, subtribe Amblyseiina n. subtribe. Int. J. Acarol., 30 (3): 171-228. <https://doi.org/10.1080/01647950408684388>
- Chant D.A., McMurtry J.A. 2007. Illustrated keys and diagnoses for the genera and subgenera of the Phytoseiidae of the world (Acari: Mesostigmata). Michigan: Indira Publishing House, pp. 220.
- De Leon D. 1959. Two new genera of phytoseiid mites with a note on *Proprioseius meridionalis* Chant (Acarina: Phytoseiidae). Entomol. News, Philad., 70 (10): 257-262.
- Demite P.R., McMurtry J.A., Moraes G.Jde. 2014. Phytoseiidae Database: a website for taxonomic and distributional information on phytoseiid mites (Acari). Zootaxa, 3795 (5): 571-577. <https://doi.org/10.11646/zootaxa.3795.5.6>
- Demite P.R., Moraes G.J.de, McMurtry J.A., Denmark H.A., Castilho R.C. 2022. Phytoseiidae Database. Available from: <https://www.lea.esalq.usp.br/phytoseiidae>.
- Döker I. 2019. First report of *Neoseiulus cinctus* (Livshitz & Kuznetsov) for Turkey, with an identification key for Turkish Neoseiulus Hughes (Acari: Phytoseiidae). Türk. Biyo. Mucadele Derg., 10 (1): 73-81.
- Döker I., Kazak C., Karut K. 2020. The genus *Amblyseius* Berlese (Acari: Phytoseiidae) in Turkey with discussion on the identity of *Amblyseius meridionalis*. Syst. Appl. Acarol, 25 (8): 1395-1420. <https://doi.org/10.11158/saa.25.8.4>
- Evans G.O. 1987. The status of three species of Phytoseiidae (Acari) described by Carl Willmann. J. Nat. Hist, 21: 1461-1467. <https://doi.org/10.1080/00222938700770921>
- Ferragut F., Costa-Comelles J., Gomez Bernardo J., Garcia Mari F. 1985. Contribucion al conocimiento de los acaros fitoseidos (Gamasida: Phytoseiidae) de los cultivos espanoles. Actas II Congreso Iberico Entomol. Lisboa: 223-231.
- Ferragut F., Pérez Moreno I., Iraola V., Escudero A. 2010. Ácaros depredadores em las plantas cultivadas. Familia Phytoseiidae. Ediciones Agrotécnicas, Madrid, pp. 202.
- Gerson U., Smiley R.L., Ochoa R. 2003. Mites (Acari) for pest control. Blackwell Science, Oxford, UK. pp. 539. <https://doi.org/10.1002/9780470750995>

- Hughes A. M. 1948. The mites associated with stored food products. Ministry of Agriculture and Fishery, H.M. Stationary Office, London. pp. 168.
- Karg W. 1960. Zur Kenntnis der Typhlodromiden (Acarina: Parasitiformes) aus Acker- und Grünlandböden. Z. Angew. Entomol., 47: 440-452. <https://doi.org/10.1111/j.1439-0418.1960.tb02848.x>
- Koch C.L. 1839. Deutschlands Crustaceen, Myriapoden und Arachniden. Ein Beitrag zur Deutschen Fauna. F. Pustet, Regensburg. pp. 270.
- Kolodochka L. A. 1991. New Phytoseiid mites of the genus *Amblyseius* (Parasitiformes, Phytoseiidae) [In Russian]. Vestn. Zool., 3: 17-26.
- Kolodochka L.A. 2003. A New Species of Phytoseiid Mites on the genus *Amblyseius* (Parasitiformes, Phytoseiidae) from Crimea [in Russian]. Vestn. Zool., 37 (5): 73-76. Kolodochka L.A. 2006. Phytoseiid mites of the Palaearctic Region: faunistics, taxonomy, ecomorphology, evolution [in Russian]. Vestn. Zool., 21: 1-250.
- Krantz G.W., Walter D.E. 2009. A Manual of Acarology. Texas Tech. University Press, third ed. pp. 807.
- Kreiter S., Tixier M.-S., Sahraoui H., Lebdi-Grissa K., Ben Chaabane S., Chatti A., Chermiti B., Khouldia O., Ksantini M. 2010. Phytoseiid mites (Acari: Mesostigmata) from Tunisia: Catalogue, biogeography and key for identification. Tun. J. Plant Prot., 5: 151-178.
- Livshitz I.Z., Kuznetsov N.N. 1972. Phytoseiid mites from Crimea (Parasitiformes: Phytoseiidae). In: Pests and diseases of fruit and ornamental plants [in Russian]. Proceedings of The All-Union V. I. Lenin Academy of Agricultural Science, The State Nikita Botanical Gardens, Yalta, Ukraine, 61: 13-64.
- Manu M., Honciuc V. 2010. Rank correlations at the level of soil mites (Acari: Gamasida; Oribatida) from Central Parks of Bucharest city, Romania. Acta Entomol. Serb., 15 (1): 129-140.
- Manu M., Băncilă R.I., Onete M. 2018a. Importance of moss habitats for mesostigmatid mites (Acari: Mesostigmata) in Romania. Turk. J. Zool. 42 (6): 673-683. <https://doi.org/10.3906/zoo-1712-6>
- Manu M., Băncilă R.I., Onete M. 2018b. The effect of heavy metals on mite communities (Acari: Gamasina) from urban parks - Bucharest, Romania. Environ. Eng. Manag. J., 17 (9): 2071-2081. <https://doi.org/10.30638/eemj.2018.206>
- McMurtry J.A., Moraes G.J.de, Sourassou N.F. 2013. Revision of the lifestyles of phytoseiid mites (Acari: Phytoseiidae) and implications for biological control strategies. Syst. Appl. Acarol., 18 (4): 297-320. <https://doi.org/10.11158/saa.18.4.1>
- Meshkov, Y.I. 1994. Two new species of mites of the genus *Neoseiulus* (Parasitiformes, Phytoseiidae) from Russia [in Russian], Zool. Zhurnal, 731, 108-112.
- Minarro M., Dapena E., Ferragut F. 2002. Phytoseid mites (Acari: Phytoseiidae) in plantations of apples in Asturias. Bol. Sanidad Vegetal, Plagas, 28 (2): 287-297.
- Muma M.H. 1961. Subfamilies, genera, and species of Phytoseiidae (Acarina: Mesostigmata). Fla St. Mus. Bul., 5 (7): 267-302.
- Ostovan H., Faraji F., Kamyab F., Khadempour F. 2012. Notes on *Neoseiulus paspalivorus* (de Leon) and *Proprioseiopsis messor* (Wainstein) (Acari: Phytoseiidae) collected in Iran. Acarologia, 52 (1): 51-58. <https://doi.org/10.1051/acarologia/20122032>
- Papadoulis G. Th., Emmanouel N.G., Kapaxidi E.V. 2009. Phytoseiidae of Greece and Cyprus (Acari: Mesostigmata). Michigan: Indira Publishing House. pp. 200.
- Sahraoui H., Grissa K.L., Kreiter S., Douin M., Tixier M.-S. 2012. Phytoseiid mites (Acari: Mesostigmata) of Tunisian citrus orchards: Catalogue, biogeography and key for identification. Acarologia, 52 (4): 433-452. <https://doi.org/10.1051/acarologia/20122072>
- Schicha E. 1987. Phytoseiidae of Australia and Neighboring Areas. Michigan: Indira Publishing House. pp. 187.
- Scheuten A. 1857. Einiges über Milben. Archiv für Naturgeschichte, 23: 104-112.
- Schweizer J. 1922. Beitrag zur Kenntnis der terrestrischen milbenfauna der Schweiz. Verhandlungen der Naturforschenden Gesellschaft, 33: 23-112. <https://doi.org/10.5962/bhl.part.3644>
- Swirski, E., and S. Ragusa. 1976. Notes on predacious mites of Greece, with a description of five new species (Mesostigmata: Phytoseiidae). Phytoparasitica 4: 101-122. <https://doi.org/10.1007/BF02980341>
- Swirski E., Ragusa S. 1976. Notes on predacious mites of Greece, with a description of five new species (Mesostigmata: Phytoseiidae), Phytoparasitica, 4: 101-122. <https://doi.org/10.1007/BF02980341>
- Tixier M.-S., Baldassar A., Duso C., Kreiter S. 2013. Phytoseiidae in European grape (*Vitis vinifera* L.): bio-ecological aspects and keys to species (Acari: Mesostigmata). Zootaxa, 3721 (2): 101-142. <https://doi.org/10.11646/zootaxa.3721.2.1>
- Wainstein B.A. 1960. New species and subspecies of the genus *Typhlodromus* Scheuten (Parasitiformes, Phytoseiidae) of the USSR fauna [in Russian], Zool. Zh.: 683-690.
- Wainstein B.A. 1962. Révision du genre *Typhlodromus* Scheuten, 1857 et systématique de la famille des Phytoseiidae (Berlese 1916) (Acarina: Parasitiformes). Acarologia, 4: 5-30.
- Wainstein B.A., Beglyarov G.A. 1971. New species of the genus *Amblyseius* (Parasitiformes: Phytoseiidae) from the Primorsky Territory [in Russian], Zool. Zh., 50: 1803-1812.