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Integrated taxonomy supports the identification of some species of Phytoseiidae (Acari: Mesostigmata) from Georgia

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Original research

ABSTRACT

The present study reports results of a survey carried out mostly on *Citrus* sp. and *Rubus* sp. in Georgia. Morphological and molecular (12S rRNA, COI and CytB mtDNA markers) data were analysed in a framework of integrative taxonomy. Eleven species were identified and among them seven are new for the Georgian fauna. *Euseius stipulatus* and *Phytoseius finitimus* were the most abundant species during this survey. We assume that *Amblyseius eharai*, only reported from eastern Asia, was most probably introduced. *Neoseiulus californicus*, retrieved from uncultivated vegetation, was almost certainly originating from commercial strains. DNA sequences comparisons disclosed phylogenetic closeness between *Amblyseius andersoni* and *Transeius wainsteini,* despite these species (i) being morphologically well differentiated and (ii) classified in different genera, thereby questioning the reliability of the genus *Transeius*. General morphological characters, including measurements, are provided for species for which diagnoses were doubtful.

Keywords Phytoseiidae; CytB mtDNA; COI mtDNA; 12S rRNA; taxonomy; distribution

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Introduction

Mites of the family Phytoseiidae are predators used for biological control of mite and small insect pests of various crops (McMurtry and Croft 1997; McMurtry *et al.* 2013; Knapp *et al.* 2018). The family Phytoseiidae, distributed worldwide, contains 2,521 valid species, with some biogeographic regions characterised by the highest number of species and associated reports, namely the Neotropic and Palearctic regions (Tixier *et al.* 2008b, 2012a; Demite *et al.* 2021). However, the species diversity and distribution of phytoseiids are only partially known and the fauna of some countries remains poorly investigated (Demite *et al.* 2021). Gaining in the knowledge on the distribution of Phytoseiidae is interesting for meta-analysis approaches aiming to characterise factors affecting diversity at local and global scales (i.e. Tixier *et al.* 2008b; Tixier and Kreiter 2009; Tixier 2018). Furthermore, this information is particularly relevant in biological control studies, by providing background data on the availability of

natural enemy species / populations adapted to specific environmental conditions or pest availabilities.

The Phytoseiidae fauna in Georgia has been partially explored (Demite *et al.* 2021). As an additional contribution to the knowledge of this group of mites in the country, this paper presents results of surveys carried out in 2019. Among the 53 valid species of Phytoseiidae reported from Georgia, we were particularly interested in detecting *Amblyseius swirskii* Athias-Henriot, as this species is known for its interest in biocontrol (Knapp *et al.* 2018). It was introduced from the Middle-East in the 1960s to control *Panonychus citri* (McGregor) on citrus and according to Wainstein and Vartapetov (1973), it seemed to have successfully acclimated and was recovered three years later on citrus and *Rubus* spp. According to these objectives, surveys focused on regions where this species was previously reported in the country: Western coast of Adjara (Wainstein and Vartapetov 1973) and Eastern plains along Kura connected to Azerbaijan (Abbasova 1970). Eleven species were identified from our surveys, including seven that are new for the Georgian Fauna. While we did not find *A. swirskii*, a very closely related species, *Transeius wainsteini* (Gomelauri) was identified. Identifications were performed using an integrative taxonomy approach, including morphological analyses and molecular markers.

Material and methods

Field surveys were carried out in June 2019. Leaves and sprouts were carefully examined with a hand magnifier and when mites were detected, the plant parts were collected in paper or plastic bags for later examination in the laboratory. Mites were directly collected on leaves under a stereoscopic microscope, and transferred to vials: (i) filled with 70% ethanol for further morphological studies and (ii) filled with 100% ethanol for molecular analyses. Mites were mounted in Hoyer's medium and identified with a phase and interferential contrast microscope (Leica DLMB, Leica Microsystems) (400x magnification).

The generic classification proposed by Chant and McMurtry (2007) was used. The terminologies used for chaetotaxy were those proposed by Lindquist and Evans (1965) as adapted by Rowell *et al.* (1978) for dorsal idiosomal setae of Phytoseiidae and by Chant and Yoshida-Shaul (1991) for ventral idiosomal setae. Adenotaxy and poroidotaxy terminologies are those proposed by Athias-Henriot (1975). All measurements are given in micrometers (µm), average value provided first followed by minimum and maximum values into brackets. Specimens are deposited at the SupAgro-CBGP Acari collection at Montpellier, France.

For specimens preserved in 100% ethanol, DNA sequences of CytB, COI mtDNA and 12S rRNA markers were obtained for assisting morphological diagnosis (Tixier *et al.* 2012b, Dos Santos and Tixier 2017). DNA extraction and amplification follow the protocols well detailed by Kanouh *et al.* (2010) and Tixier *et al.* (2012b), respectively. The primers used are those proposed by Tixier *et al.* (2012b) for Cytb and COI mtDNA fragments and by Jeyaprakash and Hoy (2002) for the 12S rRNA fragment. After DNA extraction, voucher specimens were retrieved as described in Tixier *et al.* (2010b) to confirm molecular assignment. For the COI and CytB fragments, a preliminary analysis was conducted to check for the absence of stop codons. The sequences were analysed both strands (forward and reverse). The consensus sequences obtained were compared to those included in the NCBI GenBank database to detect possible contaminations. DNA sequences were aligned (using ClustalW) and analysed using MEGA 6.0.6® (Tamura *et al.* 2013). Genetic distances (using the Kimura 2 parameter) were calculated for comparing DNA sequences to references (sequences published in Genbank). Neighbour-Joining phylogenetic trees were built to assess relationships (i) between *T. wainsteini*, *A. swirskii*, and *Amblyseius andersoni* (Chant) and (ii) between *Amblyseius eharai* Amitai & Swirski, *A. largoensis* (Muma) and *A. herbicolus* (Chant). For all these phylogenetic trees, *Euseius stipulatus* (Athias-Henriot) was used as out-group.

Results

The Phytoseiidae species identified during the survey are listed below. Measurements of morphological characters are provided when they were necessary for species identification and comparison with morphologically close species. Table 1 presents the localities where species were retrieved and Genbank accession numbers of the DNA sequences obtained. When available, biological information is provided, especially for traits relevant to biological control. Data on the known distribution of the species is retrieved from the online Phytoseiidae catalogue (Demite *et al.* 2021).

Amblyseius eharai Amitai & Swirski

Amblyseius eharai Amitai & Swirski 1981: 60.

Specimens examined. At Lanchkhuti, Grigoleti (42.0192° N, 41.7629° E): 10 ♀♀ and 2 ♂♂ on *Rubus* sp. (Rosaceae), one ♀ on *Citrus trifoliata* (L.) Rafinesque (Rutaceae).

Previous records. China, Hong Kong, Japan, Malaysia, South Korea, Taiwan, Thailand.

Measurements of females (5 specimens)

Dorsum. Dorsal shield 362 (340–400) long and 199 (188–212) wide, smooth, with seven pairs of solenostomes (*gd1*, *gd2*, *gd4*, *gd5* not well visible, *gd6*, *gd8* and *gd9*), 17 pairs of dorsal setae and two pairs of sub-lateral setae: *j1* 35 (32–37), *j3* 44 (42–45), *j4* 4 (2–5), *j5* 4 (2–5), *j6* 4 (2–5), *J2* 4 (2–5), *J5* 4 (2–5), *z2* 7, *Z1* 5, *z4* 4 (2–5), *z5* 4 (2–5), *Z4* 104 (100–110), *Z5* 255 (250–262), *s4* 98 (97–100), *S2* 5, *S4* 7, *S5* 5, *r3* 11 (10–12) and *R1* 7 in length. All setae smooth.

Peritreme. Extending forwards to the bases of the setae *j1*.

Venter. Sternal shield with three pairs of setae and two pairs of poroids; one pair of sternal setae (*st4*) on small metasternal platelets; posterior margin with a truncated median projection. Distances between *st1–st3* 67 (65–70), *st2–st2* 70 (67–72), *st5–st5* 72 (70–77). Two pairs of metapodal plates, the largest one 19 (17–22) long and 6 (5–7) wide, the smallest one 8 (7–10) long and 2 wide. Ventrianal shield with three pairs of pre-anal setae *JV1*, *JV2*, *ZV2* and pre-anal crescent pores (*gv3*) present, just under the setae *JV2*. Integument surrounding ventri-anal shield with four pairs of setae *ZV1*, *ZV3*, *JV4* and *JV5*; ventri-anal shield 109 (100–130) long, 57 (55–62) wide at level of anterior corners, and 72 (67–77) wide at level of anus. *JV5* 64 (60–67) long.

Legs. Legs IV with three macrosetae: on the genu 126 (120–130), tibia 90 (85–95) and basitarsus 62 (60–65). *SgeI* 46 (42–47), *SgeII* 39 (37–42), *SgeIII* 47 (45–50), *StiIII* 36 (32–37). Genu II with seven setae (2–2/0, 2/0–1), Genu III with seven setae (2–2/0, 2/0–1).

Chelicera. Fixed digit 47, movable digit 42. Dentition not visible because the chelicerae are closed, but the fixed digit is clearly multidentate.

Spermatheca. Spermatheca with elongate cervix 21 (20–22) long, distal two-thirds gradually flaring, round atrium.

Remarks. *Amblyseius eharai* is morphologically close to *A. herbicolus* (Chant). Seta lengths are clearly overlapping and do not allow differentiating between these two species (Table 2). The only clear differences are the shape of the posterior border of the sternal shield (straight for *A. herbicolus* and with a truncated median projection *for A. eharai*) and the length and shape of the cervix of the spermatheca (long (23–29), distal two-thirds gradually flaring to 2–2.5 times basal diameter in *A. herbicolus* and short (18–24), flaring distally to 2–3 times narrowest diameter in *A. eharai*) (McMurtry and Moraes 1984). Because of these minor differences and because of the distribution of *A. eharai* only reported from Asia (whereas *A. herbicolus* is a cosmopolitan species), molecular markers were applied to assess further the identity of the Georgian specimens. Six DNA sequences (three sequences for CytB mtDNA, and three sequences for the COI mtDNA) were obtained from three specimens. The COI sequences were blasted in the Genbank database and were clearly assigned to *A. eharai.* Table 4a shows the COI genetic distances between the Georgian specimens and *Amblyseius largoensis* (Muma),

Table 1 Collection data of phytoseiid species studied, followed by GenBank accession numbers for 12S rRNA, COI and CytB mtDNA sequences, and the number of specimens studied morphologically.

Phytoseiidae species	Municipality	Locality	Geographic coordinates	Plant species (family)	Genbank accession numbers			Morphological observations
					CytB mtDNA	COI mtDNA	12S rRNA	
Amblyseius eharai	Lanchkhuti	Grigoleti	42.0192°N, 41.7629°E	*Rubus* sp. (Rosaceae)	MW351876 MW351877	MW346235 MW346236		8 females, 2 males
Amblyseius eharai	Lanchkhuti	Grigoleti	42.0192°N, 41.7629°E	*Citrus trifoliata* (Rutaceae)	MW351910	MW346298		
Euseius finlandicus	Kvareli	Eniseli	41.9988°N, 45.6702°E	*Ulmus minor* (Ulmaceae)			MW330284	
Euseius stipulatus	Senaki	Sakharbedio	42.2858°N, 42.0381°E	*Corylus avellana* (Betulaceae)	MW351894 MW351895	MW346279 MW346280	MW330290 MW330313	5 females, 1 immature
Euseius stipulatus	Kobuleti	2km East Chakvi	41.7135°N, 41.7556°E	*Citrus* sp. (Rutaceae)	MW351898 MW351899 MW351904	MW346286 MW346287 MW346292 MW346293	MW330294 MW330295 MW330300	10 females, 4 males
Euseius stipulatus	Kobuleti	Daba Chakvi	41.7180°N, 41.7384°E	*Citrus* sp. (Rutaceae)	MW351900	MW346288 MW346289	MW330296 MW330297	6 females, 1 male, 1 immature
Euseius stipulatus	Kobuleti	Daba Chakvi 2	41.7184°N, 41.7384°E	*Citrus* sp. (Rutaceae)	MW351902 MW351903	MW346290 MW346291	MW330298 MW330299	7 females, 1 male
Euseius stipulatus	Kobuleti	Khala	41.7070°N, 41.7912°E	*Citrus* sp. (Rutaceae)	MW351905 MW351906	MW346294	MW330301 MW330302	6 females, 2 males
Euseius stipulatus	Kobuleti	1 km East Khala	41.7032°N, 41.8058°E	*Citrus* sp. (Rutaceae)	MW351911 MW351912	MW346299 MW346300	MW330306 MW330307	6 females, 3 males
Euseius stipulatus	Chokhatauri	Chokhatauri	42.0247°N, 42.2512°E	*Citrus lemon* (Rutaceae)	MW351913 MW351914	MW346301 MW346302	MW330308 MW330309	7 females, 1 male, 2 immatures
Euseius stipulatus	Kobuleti	Leghva	41.8517°N, 41.9003°E	*Citrus* sp. (Rutaceae)	MW351915 MW351916	MW346303 MW346304	MW330310 MW330311	6 females
Euseius stipulatus	Kobuleti	Mukhaestate	41.8413°N, 41.8629°E	*Citrus* sp. (Rutaceae)	MW351878 MW351879	MW346237 MW346238	MW330264 MW330265	8 females, 2 males
Euseius stipulatus	Chokhatauri	1 km ENE Chokhatauri	42.0233°N, 42.2598°E	*Citrus* sp. (Rutaceae)	MW351881 MW351882	MW346239 MW346240	MW330266 MW330267	3 females, 2 males
Euseius stipulatus	Ozurgeti	Nasakirali	41.9869°N, 42.0697°E	*Carpinus betulus* (Betulaceae)	MW351884	MW346241	MW330269	
Euseius stipulatus	Ozurgeti	Nasakirali	41.9869°N, 42.0697°E	*Malus orientalis* (Rosaceae)	MW351885	MW346305	MW330312	
Euseius stipulatus	Kobuleti	Khala	41.7070°N, 41.7912°E	*Rubus* sp. (Rosaceae)				1 female, 2 males, 4 immatures
Euseius stipulatus	Ozurgeti	2km NNE Nagomari	42.0097°N, 42.1236°E	*Rubus* sp. (Rosaceae)				4 females, 1 male
Euseius stipulatus	Kvareli	Eniseli	41.9988°N, 45.6702°E	*Ulmus minor* (Ulmaceae)				4 females, 1 male
Neoseiulus californicus	Ozurgeti	Nasakirali	41.9869°N, 42.0697°E	*Rubus* sp. (Rosaceae)	MW351839 MW351840 MW351841	MW346306		5 females
Neoseiulus californicus	Ozurgeti	2km NNE Nagomari	42.0097°N, 42.1236°E	*Rubus* sp. (Rosaceae)	MW351883		MW330268	3 females et 1 male
Neoseiulus umbraticus	Telavi	5km West Telavi	41.9283°N, 45.4241°E	*Salvia verticillata* (Lamiaceae)	MW351851 MW351852	MW346253		6 females, 4 males
Neoseiulus umbraticus	Gurjaani	Velistsikhe	41.8545°N, 45.8035°E	*Populus alba* (Salicaceae)	MW351860 MW351861	MW346261 MW346263	MW330281	
Transeius wainsteini	Gurjaani	Velistsikhe	41.8545°N, 45.8035°E	*Populus alba* (Salicaceae)	MW351859 MW351862	MW346260 MW346262 MW346264	MW330282	5 females
Transeius wainsteini	Telavi	5km West Telavi	41.9283°N, 45.4241°E	*Rubus* sp. (Rosaceae)	MW351864			
Transeius wainsteini	Telavi	Rd Tetri Tsklebi to Telavi	41.8870°N, 45.3636°E	*Rubus* sp. (Rosaceae)	MW351867 MW351868 MW351869	MW346270 MW346271 MW346272	MW330285 MW330286	4 females, 3 males
Transeius wainsteini	Telavi	Telavi	41.9141°N, 45.4579°E	*Quercus* sp. (Fagaceae)	MW351870 MW351871	MW346273 MW346274	MW330287 MW330288	3 females, 3 immatures
Galendromus longipilus	Kobuleti	Khala	41.7070°N, 41.7912°E	*Rubus* sp. (Rosaceae)				2 females, 1 male
Typhlodromus (Anthoseius) halinae	Terjola	Chognari	42.2305°N, 42.7781°E	*Rubus* sp. (Rosaceae)	MW351891 MW351892 MW351893	MW346275 MW346277 MW346278		
Typhlodromus (Anthoseius) kerkirae	Telavi	Rd5km West Telavi	41.9283°N, 45.4241°E	*Salvia verticillata* (Lamiaceae)	MW351850	MW346252	MW330277	
Typhlodromus (Anthoseius) kerkirae	Telavi	Rd5km West Telavi	41.9283°N, 45.4241°E	*Rubus* sp. (Rosaceae)	MW351889 MW351890	MW346266		
Typhlodromus (Anthoseius) kerkirae	Tbilisi	240 David Aghmashenebeli Alley	41.8068°N, 44.7668°E	*Eryngium caeruleum* (Apiaceae)	MW351880			
Typhlodromus (Anthoseius) recki	Telavi	5km West Telavi	41.9283°N, 45.4241°E	*Salvia verticillata* (Lamiaceae)	MW351853	MW346254		2 females, 1 male
Phytoseius finitimus	Gardabani	Vaziani	41.7004°N, 45.0543°E	*Rubus* sp. (Rosaceae)	MW351842 MW351843	MW346242 MW346243	MW330270 MW330271	7 females, 4 males
Phytoseius finitimus	Bolnisi	Kveshi	41.4401°N, 44.4463°E	*Rubus* sp. (Rosaceae)	MW351844 MW351845 MW351846	MW346244 MW346245 MW346246	MW330272 MW330273	6 females, 5 males
Phytoseius finitimus	Tetri Tskaro	Koda	41.5953°N, 44.7767°E	*Rubus* sp. (Rosaceae)	MW351847 MW351848 MW351849	MW346247 MW346248 MW346249	MW330274	9 females, 3 males
Phytoseius finitimus	Bolnisi	Parizi	41.4709°N, 44.7361°E	*Rubus* sp. (Rosaceae)	MW351886 MW351887	MW346250 MW346251	MW330275 MW330276	7 females, 5 males
Phytoseius finitimus	Sagarejo	Tokhliauri	41.7299°N, 45.4236°E	*Rubus* sp. (Rosaceae)	MW351854 MW351855 MW351856	MW346255 MW346256 MW346257	MW330278	8 females, 3 males
Phytoseius finitimus	Gurjaani	Chalaubani	41.6291°N, 45.7946°E	*Rubus* sp. (Rosaceae)	MW351857 MW351858	MW346258 MW346259	MW330279 MW330280	9 females, 3 males
Phytoseius finitimus	Kvareli	Eniseli	41.9988°N, 45.6702°E	*Ulmus minor* (Ulmaceae)	MW351863	MW346265	MW330283	
Phytoseius finitimus	Telavi	5km West Telavi	41.9283°N, 45.4241°E	*Rubus* sp. (Rosaceae)	MW351865 MW351866	MW346267 MW346268 MW346269		
Phytoseius finitimus	Terjola	Chognari	42.2305°N, 42.7781°E	*Rubus* sp. (Rosaceae)	MW351888	MW346276	MW330289	
Phytoseius finitimus	Senaki	Sakharbedio	42.2858°N, 42.0381°E	*Rubus* sp. (Rosaceae)	MW351872 MW351873 MW351874 MW351875	MW346281 MW346282 MW346283	MW330291 MW330292	5 females, 1 male, 1 immature
Phytoseius finitimus	Kharagauli	Rd S1 2.5km East Tsakva	42.0965°N, 43.4532°E	*Rubus* sp. (Rosaceae)	MW351896 MW351897	MW346284 MW346285	MW330293	11 females, 2 males, 1 immature
Phytoseius finitimus	Kobuleti	Daba Chakvi	41.7180°N, 41.7384°E	*Citrus* sp. (Rutaceae)	MW351901			
Phytoseius finitimus	Lanchkhuti	Grigoleti	42.0192°N, 41.7629°E	*Rubus* sp. (Rosaceae)	MW351907 MW351908	MW346295 MW346296	MW330303 MW330304	6 females, 3 males
Phytoseius finitimus	Lanchkhuti	Maltakva Univ. Research Center	42.0528°N, 41.7273°E	*Rubus* sp. (Rosaceae)	MW351909	MW346297	MW330305	8 females, 1 male
Phytoseius finitimus	Senaki	Sakharbedio	42.2858°N, 42.0381°E	*Corylus avellana* (Betulaceae)				1 female

A. herbicolus and *A. eharai*. The COI mtDNA sequences of the three Georgian specimens are identical (0%). They differ from *A. largoensis* and *A. herbicolus* sequences in Genbank by high genetic distances (27.2 and 29.2%, respectively), and from the 15 DNA fragments of *A. eharai* retrieved from Genbank by very low distances (2.1–3.2%), corresponding to intraspecific variation. The phylogenetic tree also illustrates that the Georgian specimens belong to the clade including the 15 DNA sequences retrieved from Genbank and assigned to *A. eharai* (JX080331–JX080345) (figure 1). No CytB mtDNA sequence of *A. eharai* is available in Genbank, whereas they are for *A. herbicolus and A. largoensis* (Supplementary Table S1b). The CytB genetic distances between the specimens herein considered and (i) *A. herbicolus* range between 39.1% and 40.3%, and (ii) *A. largoensis* range between 42.7% and 44.5%, clearly showing that Georgian specimens do not belong to these two latter species. Thus, based on morphological characteristics and molecular data, we conclude that the Georgian specimens belong to the species *A. eharai*.

It is the first time that this species is reported from this country and outside eastern Asia. In this survey, it was reported on *Rubus* sp. and *Citrus trifoliata* (L.) Rafinesque both at Lanchkhuti (near the Black Sea coast). Its unexpected presence in Georgia could be due to introduction from eastern Asia, as *C. trifoliata* is a species originating from Korea and north of China. Because *A. eharai* was also found on *Rubus* sp., it is possible that this species has adapted to new plants after its introduction into the region. *Amblyseius eharai* is considered to be an efficient natural enemy of mite pests and thrips in various crops, included citrus orchards (i.e. Ji *et al.* 2013, Park & Lee 2020).

Euseius stipulatus (Athias-Henriot)

Amblyseius stipulatus Athias-Henriot 1960: 294.
Amblyseius (*Amblyseius*) *stipulates*, Ueckermann & Loots 1988: 110.

Specimens examined. At Chokhatauri (42.0247° N, 42.2512° E): 9 ♀♀, 3 ♂♂ and 2 immatures on *Citrus limon* (L.) (Rutaceae), at Chokhatauri (1 km from Chokhatauri) (42.0233°

Table 2 Measurements of morphological features of *Neoseiulus umbraticus*, *N. californicus*, *Amblyseius eharai*, *A. herbicolus*, *Transeius wainsteini* (specimens collected in Georgia and data retrieved from original description and re-descriptions) and *A. swirskii* and *A. andersoni* (re-descriptions).

	Neoseiulus umbraticus female (n=6)			*N. umbraticus* male (n=1)	*Neoseiulus californicus* (n=4)			*Amblyseius eharai* (n=5)			*Transeius wainsteini* female (n=10)	*Transeius wainsteini* male (n=3)				
	Mean (min-max)	*N. umbraticus* (in Tixier et al. 2016)	*N. umbraticus* (original description)		Mean (min-max)	*N. californicus* (in Tixier et al. 2008)	Mean (min-max)	*A. eharai* original description	*A. eharai* (in McMurtry & Moraes 1984)	*A. herbicolus* (in Kreiter et al. 2020)	Mean (min-max)	Mean (min-max)	*T. wainsteini* (original description)	*T. waisnteini* (in Faraji et al. 2011)	*A. swirskii* (in Kreiter et al. 2016)	*A. andersoni* (in Chant & Yoshida Shaul 1990)
DSL	316 (295-325)	330	305-348	270	331 (310-340)	370 (330-405)	362 (340-400)	215-390	-	359 (343-390)	362 (340-382)	262 (255-270)	515	338-350	280-300	-
DSW	140 (132-152)	200	168-188	175	150 (135-175)	145 (130-189)	199 (188-212)		-	240 (225-265)	170 (155-177)	122 (120-125)	271	205-215	167-187	-
j1	19 (15-22)	18	-	15	19 (17-20)	22 (17-26)	35 (32-37)	35-45	-	35 (33-38)	26 (22-30)	22 (20-25)	28	30	25-31	28-29
j3	37 (35-40)	32-35	37	37	26 (22-30)	21 (22-39)	44 (42-45)	40-53	-	40 (38-45)	51 (50-55)	41 (35-45)	54	50-55	46-58	48-56
j4	25	17-20	26	27	19 (15-22)	22 (16-27)	4	5-7	-	7 (5-8)	8 (7-10)	5	9	10-11	8-10	8
j5	19 (17-20)	15	20	17	19 (17-22)	22 (16-28)	4	5-7	-	5	7	5	6	8-10	8	6-7
j6	22 (17-25)	17	23	17	25 (22-27)	17 (19-32)	4	7-8	-	7 (5-8)	8 (7-10)	9 (7-12)	9	10-12	8-11	8-10
J2	21 (20-22)	22	23	17	32 (27-37)	32 (25-40)	4	7-10	-	8 (8-10)	9 (7-10)	7	11	11	7-10	9-10
J5	7	5-7	-	5	8 (7-10)	13 (8-16)	4		-	8 (8-10)	6 (5-7)	5	6	9-10	6-8	10
z2	32 (30-32)	23	30	27	25 (22-27)	29 (20-29)	7	12-15	-	13 (8-18)	22 (17-27)	19 (17-22)	24	25-30	13-20	15
z4	41 (37-45)	32-35	33	32	26 (25-27)	29 (20-37)	4 (2-5)	8-15	-	10 (8-13)	32 (22-35)	26 (22-30)	34	35	15-26	20-21
z5	17 (15-20)	15	20	15	19 (17-22)	22 (17-27)	5	5-7	-	5 (5-8)	7 (5-7)	6 (5-7)	6	8-10	6-8	6
Z1	26 (22-27)	25	26	22	28 (27-30)	32 (20-41)	5		-	12 (10-13)	11 (7-12)	10	11	18	8-11	9-10
Z4	54 (52-60)	53	50	42	50	51 (42-49)	104 (100-110)	91-125	-	99 (93-108)	63 (60-67)	47 (45-50)	65	65-70	67-76	70-79
Z5	62 (60-65)	63	64	42	59 (57-62)	70 (59-96)	255 (250-262)	277-320	227-320	255 (248-273)	119 (110-127)	82 (80-85)	125	118-135	102-116	145-158
s4	56 (52-60)	50	50	45	34 (32-35)	35 (27-43)	98 (97-100)	88-116	86-116	98 (95-108)	68 (65-72)	56 (52-57)	75	68-73	70-81	72-78
S2	45 (42-50)	45-47	47	35	38 (37-40)	40 (30-48)	5	9-12	-	12 (10-13)	27 (25-32)	17	34	29-36	17-25	20-23
S4	27 (25-30)	25-30	30	22	34 (32-35)	37 (27-45)	7	10-15	-	11 (8-13)	13 (12-15)	12 (10-12)	13	15-18	10-14	11
S5	24 (22-27)	25-27	26	17	29 (25-32)	32 (22-42)	5	9-12	-	9 (8-10)	9 (7-10)	10 (7-12)	11	10-13	6-12	9-10
r3	35 (32-40)	27-30	-	25	24 (20-25)	25 (18-32)	11 (10-12)	12-13	-	12 (10-13)	25 (22-27)	19 (17-20)	-	28-30	19-27	21-27
R1	23 (22-25)	23	-	17	21 (20-22)	23 (17-29)	7	9-12	-	10 (10-13)	17 (15-20)	15	-	20-23	10-17	15
JV5	35 (32-37)	43-47	-	22	41 (40-42)	53 (40-70)	64 (60-67)	56-88	-	61 (53-78)	64 (60-70)	-	68	65	65-72	70-75
ST1-ST1	56 (55-57)	63	-	60	49 (47-50)	50 (45-58)	63 (60-67)	-	-	66 (63-68)	60 (55-62)	50 (47-52)	-	-	50-53	-
ST2-ST2	63 (60-65)	62-65	-	55	57 (55-60)	60 (55-69)	70 (67-72)	-	-	73 (65-78)	69 (65-72)	55	-	-	62	-
ST3-ST3	72 (70-72)	-	-	52	69 (67-70)	71 (63-82)	75 (72-80)	-	-	77 (73-83)	80 (70-85)	59 (55-62)	-	-	57-63	-
ST4-ST4	73 (67-77)	-	-	40	68 (60-72)	86 (58-142)	71 (67-75)	-	-	76 (73-80)	81 (77-87)	46 (42-50)	-	-	48-5	-
ST5-ST5	65 (62-67)	65	-	32	62 (60-65)	69 (41-78)	72 (70-77)	-	-	65 (63-70)	67 (65-70)	38 (37-40)	-	-	35-40	-
ST1-ST3	62 (60-65)	-	-	110	62 (60-62)	66 (59-75)	67 (65-70)	-	-	69 (68-73)	65 (62-70)	109 (107-112)	-	-	110-113	-
VAS length	106 (100-115)	100	101-104	105	102 (100-105)	117 (99-134)	109 (100-130)	-	-	111 (110-123)	116 (112-125)	112 (110-115)	-	-	108-110	-
VAS width 1	78 (75-80)	92-97	80-87	145	107 (100-110)	104 (88-120)	57 (55-62)	-	-	48 (43-58)	84 (80-90)	148 (140-155)	-	-	150-160	-
VAS width 2	68 (62-72)	65	-	80	80 (75-85)	73 (60-87)	72 (67-77)	-	-	69 (63-78)	82 (77-90)	96 (92-100)	-	-	75-80	-
SGEIV	33 (30-37)	30	34-37		15	-	126 (120-130)	111-163	111-163	118 (110-123)	55 (52-57)	32	-	50-53	61-66	65-72
STiIV	20 (20-22)	-	26-30		15	-	90 (85-95)	91-121	-	88 (83-93)	41 (35-40)	25 (22-27)	-	38-40	42-47	56-58
STIV	45 (42-47)	40-42	40-47	35	47	49 (30-62)	62 (60-65)	71-88	-	72 (65-78)	63 (60-70)	47 (45-50)	-	75-78	53-68	73-78
MP1 length	20 (15-25)	25	-		22 (20-25)	30 (20-36)	19 (17-22)	-	-	-	24 (22-25)	-	-	-	-	-
MP1 width	4 (2-5)	5	-		4 (3-5)	5 (4-8)	6 (5-7)	-	-	-	5 (4-5)	-	-	-	-	-
MP2 length	13 (10-15)	15-17	-		8 (7-10)	12 (6-15)	8 (7-10)	-	-	-	10 (7-12)	-	-	-	-	-
FD	29 (27-30)	-	34		27	-	47	-	-	36 (30-40)	37	-	-	-	-	-
MD	26 (23-30)	-	26		22	-	42	-	-	33 (28-35)	32	-	-	-	-	-
Spermatheca length	11	-			7	-	21 (20-22)	-	-	31 (28-35)	10	-	-	-	-	-

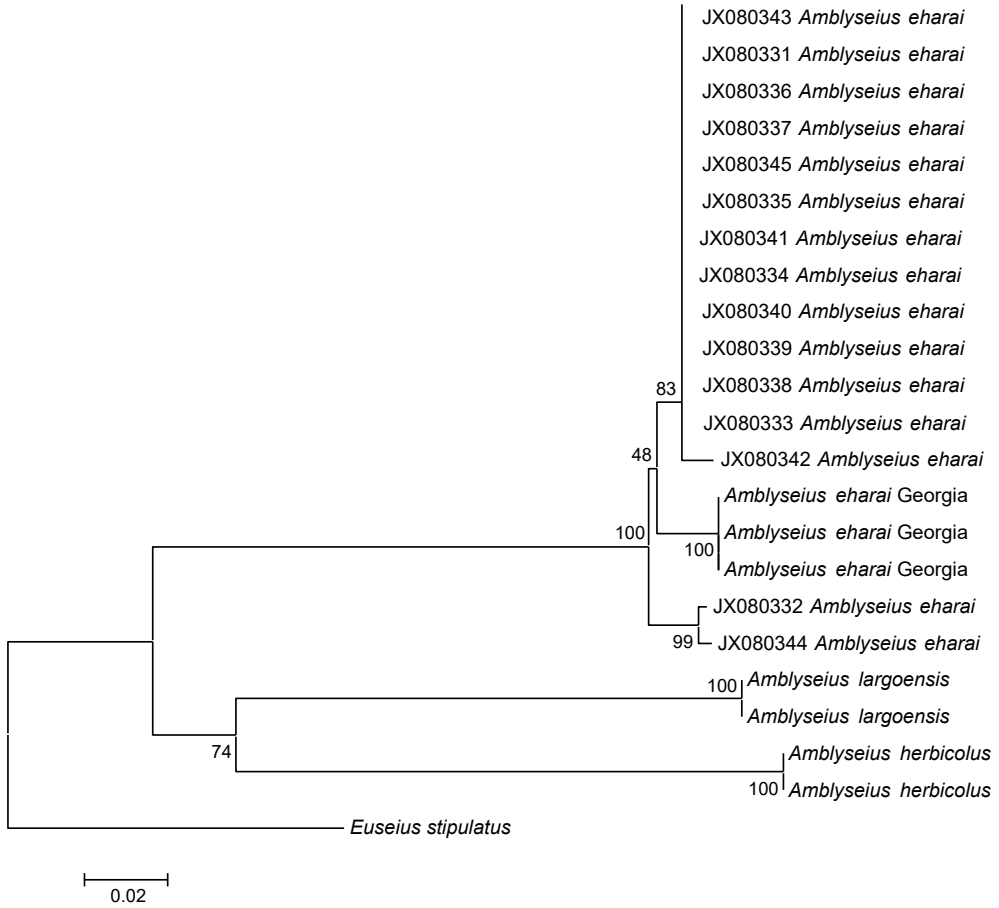


Figure 1 Neighbour joining phylogenetic tree including *Amblyseius eharai* from Georgia, specimens of *Amblyseius eharai*, *Amblyseius largoensis and A. herbicolus* from Genbank and *Euseius stipulatus* (as an outgroup) obtained with COI mtDNA fragment.

N, 42.2598° E): 5 ♀♀ and 2 ♂♂ on *Citrus* sp. (Rutaceae), at Kobuleti (1 km East Khala) (41.7032° N, 41.8058° E): 8 ♀♀ and 3 ♂♂ on *Citrus* sp. (Rutaceae), at Kobuleti (2 kms from Esat Chakvi) (41.7135° N, 41.7556° E): 14 ♀♀ and 4 ♂♂ on *Citrus* sp. (Rutaceae), at Kobuleti (Daba Chakvi) (41.7180° N, 41.7384° E): 8 ♀♀ and 1 ♂ and 1 immature on *Citrus* sp. (Rutaceae), at Kobuleti (Daba Chakvi) (41.7184° N, 41.7384° E): 9 ♀♀ and 1 ♂ on *Citrus* sp. (Rutaceae), at Kobuleti (Khala) (41.7070° N, 41.7912° E): 8 ♀♀ and 2 ♂♂ on *Citrus* sp. (Rutaceae) and 1 ♀, 2 ♂♂ and 4 immatures on *Rubus* sp. (Rosaceae), Kobuleti (Leghva) (41.8517° N, 41.9003° E): 8 ♀♀ on *Citrus* sp. (Rutaceae), at Kobuleti (Mukhaestate) (41.8413° N, 41.8629° E): 10 ♀♀ and 2 ♂♂ on *Citrus* sp. (Rutaceae), at Kvareli (Eniseli) (41.9988° N, 45.6702° E): 4 ♀♀ and 1 ♂ on *Ulmus minor* Miller (Ulmaceae), at Ozurgeti (Nasakirali) (41.9869° N, 42.0697° E): 1 ♀ on *Carpinus betulus* L. (Betulaceae) and 1 ♀ on *Malus orientalis* Uglitzkich ex Iouzptchouk (Rosaceae), at Ozurgeti (2 kms from Nagomari) (42.0097° N, 42.1236° E): 4 ♀♀ and 1 ♂ on *Rubus* sp. (Rosaceae), at Senaki (Sakharbedio) (42.2858° N, 42.0381° E): 7 ♀♀ and 1 immature on *Corylus avellana* L. (Betulaceae)

Previous records. Algeria, Azores Island, Canary Island, France, Greece, Hungary, Italy, Iran, Madeira Islands, Montenegro, Morocco, Peru, Portugal, Slovenia, Spain, Syria, Tunisia, Turkey, USA.

Remarks. *Euseius stipulatus* was the second most frequent species found (36%), with most of the specimens retrieved from citrus (78% of *E. stipulatus* specimens). This species occurs in the south of the West Palearctic region especially around the Mediterranean basin

especially on citrus orchards (Ferragut and Escudero 1997, Demite *et al.* 2021). Prior to this study only one species of *Euseius*, *E. finlandicus* (Oudemans) was known from Georgia. This is the first report of *E. stipulatus* for the Georgian mite fauna. Molecular sequences obtained (23 sequences for 12S rRNA, COI mtDNA markers and 22 sequences for CytB mtDNA fragment) were compared to those of the *Euseius* species reported from the West Palearctic region (*E. stipulatus, E. scutalis* (Athias-Henriot), *E. finlandicus and E. gallicus* Kreiter & Tixier). For all markers studied here, the sequences of the Georgian specimens are similar to the reference sequence of *E. stipulatus* (Supplementary Tables S2a, b, c). However, two specimens collected on *Citrus limon* at Chokhatauri are differentiated from the others and from the *E. stipulatus* references, by a distance of 11.1% – 12.3% for the CytB mtDNA, 2.8% for the 12S rRNA and 8.4% for the COI mtDNA (Supplementary Table S2a, b, c). Such high genetic distances in mitochondrial DNA have been already observed at the intraspecific level (up to 21.7% within *Typhlodromus* (*Anthoseius*) *rhenanoides* Athias-Henriot for the CytB mtDNA and up to 10.5% within *Neoseiulus californicus* (McGregor), for the COI mtDNA) (Okassa *et al.* 2011; Tixier *et al.* 2019). Furthermore, the genetic distances between these two specimens and *E. gallicus*, *E. finlandicus* and *E. scutalis* are high for all the DNA fragments considered, showing that these two specimens clearly do not belong to these three species (Supplementary Table S2a, b, c). We thus provisionally conclude that these two specimens belong to *E. stipulatus* and suggest that molecular difference might reflect some adaptations and different biological traits (i.e. Tixier *et al.* 2010a), but biological trials would be required to test this hypothesis.

Euseius finlandicus (Oudemans)

Seiulus finlandicus Oudemans 1915: 183.
Typhlodromus finlandicus, Oudemans 1930: 50.
Typhlodromus (*Typhlodromus*) *finlandicus*, Cunlife & Baker 1953: 19.
Amblyseius finlandicus, Athias-Henriot 1958: 34.
Typhlodromus (*Amblyseius*) *finlandicus*, Chant 1959: 67.
Typhlodromus (*Typhlodromopsis*) *finlandicus*, De Leon 1959: 113.
Amblyseius (*Typhlodromalus*) *finlandicus*, Muma (1961): 288.
Amblyseius (*Amblyseius*) *finlandicus*, Wainstein 1962: 15.
Amblyseius (*Euseius*) *finlandicus*, Arutunjan 1970: 11.
Typhlodromus pruni Oudemans 1929: 32 (synonymy according to Yoshida-Shaul & Chant 1995).

Specimens examined. At Kvareli (Eniseli) (41.9988° N, 45.6702° E): 1 ♀ on *Ulmus minor* Miller (Ulmaceae).

Previous records. Albania, Algeria, Angola, Argentina, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Caucasus Region, China, Croatia, Cyprus, 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.

Remarks. This species was reported from Georgia by Samsoniya (1972, 1977) and Wainstein and Vartapetov (1973) on tea, citrus trees and *Prunus* spp., especially in mountainous regions. It is reported to feed on eriophyid mites by Wainstein & Vartapetov (1973). One 12S rRNA sequence (from a specimen collected on *Ulmus minor* Miller) was obtained; it differs to the two DNA reference sequences of this species by 2.2 – 3.3% (Supplementary Table S2b).

Neoseiulus californicus (McGregor)

Typhlodromus californicus McGregor 1954: 89.
Amblyseius californicus, Schuster & Pritchard 1963: 271.

Cydnodromus californicus, Athias-Henriot 1977: 62.
Amblyseius (*Amblyseius*) *californicus*, Ueckermann & Loots 1988: 150; Ehara *et al.* 1994: 126.
Amblyseius (*Neoseiulus*) *californicus*, Ehara & Amano 1998: 33.

Specimens examined. at Ozurgeti (Nasakirali) (41.9869° N, 42.0697° E): 8 ♀♀ on *Rubus* sp. (Rosaceae), at Ozurgeti (2 kms from Nagomari) (42.0097° N, 42.1236° E): 4 ♀♀ and 1 ♂ on *Rubus* sp. (Rosaceae).

Previous records. Argentina, Azores, Brazil, Canada, Canary Islands, Chile, Colombia, Cuba, Cyprus, France, Greece, Guadeloupe, Guatemala, Italy, Japan, Madeira Islands (Kreiter *et al.* 2021), Mexico, Peru, Portugal, Reunion Island, Senegal, Serbia, Slovenia, South Africa, South Korea, Spain, Syria, Taiwan, Tunisia, Turkey, USA, Venezuela, Vietnam.

Measurements of females (4 specimens)

Dorsum. Dorsal shield 331 (310–340) long and 150 (135–175) wide, reticulated throughout, with three solenostomes (*gd1*, *gd6* and *gd9*), 17 pairs of dorsal setae and two pairs of sub-lateral setae: *j1* 19 (17–20), *j3* 26 (22–30), *j4* 19 (15–22), *j5* 19 (17–22), *j6* 25 (22–27), *J2* 32 (27–37), *J5* 8 (7–10), *z2* 25 (22–27), *Z1* 28 (27–30), *z4* 26 (25–27), *z5* 19 (17–22), *Z4* 50, *Z5* 59 (57–62), *s4* 34 (32–35), *S2* 38 (37–40), *S4* 34 (32–35), *S5* 29 (25–32), *r3* 24 (20–25) and *R1* 21 (20–22) in length. All setae smooth except *Z5* slightly barbed.

Peritreme. Extending forwards to the bases of the setae *j1*.

Venter. Sternal shield with three pairs of setae and two pairs of poroids; one pair of sternal setae (*st4*) on small metasternal platelets; posterior margin straight. Distances between *st1–st3* 62 (60–62), *st2–st2* 57 (55–60), *st5–st5* 62 (60–65). Two pairs of metapodal plates, the largest one 22 (20–25) long and 4 (3–5) wide, the smallest one 8 (7–10) long and 2 wide. Ventrianal shield with three pairs of pre-anal setae *JV1*, *JV2*, *ZV2* and pre-anal crescent pores (*gv3*) present, posterior-paraxial to setae *JV2*. Integument surrounding ventrianal shield with four pairs of setae *ZV1*, *ZV3*, *JV4* and *JV5*; ventrianal shield 102 (100–105) long, 107 (100–110) wide at level of anterior corners, and 80 (75–85) wide at level of anus. *JV5* 41 (40–42) long.

Legs. Legs IV with three macrosetae: on the genu 15, tibia 15 and basitarsus 47. Genu II with seven setae (2–2/0, 2/0–1) and Genu III with seven setae (1–2/1, 2/0–1).

Chelicera. Fixed digit 27, movable digit 22 (dentition not visible as the chelicerae are closed).

Spermatheca. Calyx cup-shaped 7–9 long and 7 in width, with a small atrium in base of the calyx.

Remarks. *Neoseiulus californicus* is commonly used in biological control. It is mass-released in crops, especially in vegetables for controlling *Tetranychus urticae* Koch, all over the World. This species can also naturally occur in vineyards and orchards (McMurtry and Croft 1997; Tixier *et al.* 2008a). The measurements of the Georgian specimens globally match with those reported in the re-description of Tixier *et al.* (2008a) (Table 2). Although the setae *Z5* and *JV5* are shorter on average in the Georgian specimens than in Tixier *et al.* (2008a, compiling 300 specimens from 10 populations), these differences are consistent with intraspecific variation range. Morphological identification was confirmed by DNA sequences obtained: one 12S rRNA, four cytB and one COI mtDNA. The CytB and the 12S rRNA sequences were compared to those reported in Okassa *et al.* (2011). The CytB and the 12S rRNA mean genetic distances between the Georgian and the commercial specimens (from different companies and those retrieved world-wide after commercial releases) are 0.04% and 0.1 %, respectively (Okassa *et al.* 2011). For COI sequences, the Georgian specimens are separated by distances ranging from 0.6 to 0.11% from specimens of *N. californicus* collected in apple orchards in France (Tixier *et al.* 2008a).

This is the first report of *N. californicus* collected in the wild in Georgia. Because of molecular similarity with the commercial specimens, we assume that the presence of *N. californicus* results from commercial releases and specimens herein collected on *Rubus* sp. might have dispersed from where they were released.

Neoseiulus umbraticus (Chant, 1956)

Typhlodromus umbraticus Chant 1956: 26.
Typhlodromus (*Typhlodromus*) *umbraticus*, Beglyarov 1958: 107.
Amblyseius umbraticus, Athias-Henriot 1959: 138.
Typhlodromus (*Amblyseius*) *umbraticus*, Chant 1959: 75.
Amblyseius (*Typhlodromopsis*) *umbraticus*, Muma 1961: 287.
Amblyseius (*Amblyseius*) *umbraticus*, Wainstein & Vartapetov 1973: 103.
Amblyseius (*Neoseiulus*) *umbraticus*, Karg 1991: 23.

Specimens examined. At Telavi (5 kms West from Telavi) (41.9283° N, 45.4241° E): 8 ♀♀ and 4 ♂♂ on *Salvia verticillata* L. (Lamiaceae), at Gurjaani (Velistsikhe) (41.8545° N, 45.8035° E): 3 ♀♀ on *Populus alba* L. (Salicaceae).

Previous records. Armenia, Azerbaijan, Azores Island, Belarus, Caucasus Region, Denmark, England, France, Georgia, Germany, Hungary, Iran, Italy, Jamaica, Latvia, Madeira Islands (Kreiter *et al.* 2021), Morocco, Mexico, Moldova, Montenegro, Norway, Poland, Russia, Slovakia, Slovenia, Spain, Switzerland, Turkey, Ukraine, USA.

Measurements of females (6 specimens)

Dorsum. Dorsal shield 316 (295–325) long and 140 (132–152) wide, slightly reticulated posteriorly, with five solenostomes (*gd1*, *gd2*, *gd6*, *gd8* and *gd9*), 17 pairs of dorsal setae and two pairs of sub-lateral setae: *j1* 19 (15–22), *j3* 37 (35–40), *j4* 25, *J5* 19 (17–20), *j6* 22 (17–25), *J2* 21 (20–22), *J5* 7, *z2* 32 (30–32), *Z1* 26 (22–27), *z4* 41 (37–45), *z5* 17 (15–20), *Z4* 54 (52–60), *Z5* 62 (60–65), *s4* 56 (52–60), *S2* 45 (42–50), *S4* 27 (25–30), *S5* 24 (22–27), *r3* 35 (32–40) and *R1* 23 (22–25) in length. All setae smooth except *Z5* slightly barbed.

Peritreme. Extending forwards to the bases of the setae *j3*.

Venter. Sternal shield with three pairs of setae and two pairs of poroids; one pair of sternal setae (*st4*) on small metasternal platelet; posterior margin straight. Distances between *st1–st3* 62 (60–65), *st2–st2* 63 (60–65), *st5–st5* 65 (62–67). Two pairs of metapodal plates, the largest one 20 (15–25) long and 4 (2–5) wide, the smallest one 13 (10–15) long and 2 wide. Ventrianal shield with three pairs of pre-anal setae *JV1*, *JV2*, *ZV2* and pre-anal pores (*gv3*) present, posterior-paraxial to setae *JV2*. Integument surrounding ventrianal shield with four pairs of setae *ZV1*, *ZV3*, *JV4* and *JV5*; ventrianal shield 106 (100–115) long, 78 (75–80) wide at level of anterior corners, and 68 (62–72) wide at level of anus. *JV5* 35 (32–37) long.

Legs. Legs IV with three macrosetae: on the genu 33 (30–37), tibia 20 (20–22) and basitarsus 45 (42–47). Genu II with eight setae (2–2/0, 2/1–1), Genu III with eight setae (2–2/0, 2/1–1).

Chelicera. Fixed digit 29 (27–30), movable digit 26 (23–30). Dentition not visible because the chelicerae are closed.

Spermatheca. Calyx cup-shaped 11 long and 11 in width, with an atrium well differentiated at the basis of the calyx.

Measurements on a male specimen are provided in the Table 2.

Remarks. This species was first described in England on *Rubus fructicosus* L. (Rosaceae) and then recorded mainly in the West Palearctic zone. It was reported from Georgia by Wainstein and Vartapetov (1973) on *Rubus* sp., *Alnus* sp. (Betulaceae), *Ficus carica* L. (Moraceae) and herbs. The measurements of specimens from Georgia fit with those provided by Tixier *et al.* (2016) for specimens collected from Morocco and with those of the original description (Table 2). The molecular distances range from 0 to 0.3 % between the four CytB mtDNA sequences and are null between the three COI mtDNA sequences. Only one 12S rRNA sequence was obtained. The eight DNA sequences for the three molecular fragments are now included in the Genbank database and will serve as references for further molecular identification of this species. Very few studies refer to the biology of *N. umbraticus*. This species seems able to feed on *T. urticae* and *Thrips tabaci* (Lindeman) (Sengonca and Dresher 2001, Kazak *et al.* 2002). Wainstein and Vartapetov (1973) reported that this species feeds on *P. citri* and *T. urticae*, and that it tends to prefer humid areas.

Transeius wainsteini (Gomelauri)

Amblyseius wainsteini Gomelauri 1968: 518.
Amblyseius (*Amblyseius*) *wainsteini*, Wainstein & Vartapetov 1973: 103.
Typhlodromips wainsteini, Rahmani *et al.* 2010: 498.
Transeius wainsteini, Chant & McMurtry 2004: 185,

Specimens examined. At Gurjaani (Velistsikhe) (41.8545° N, 45.8035° E): 8 ♀♀ on *Populus alba* L. (Salicaceae), at Telavi (5kms West from Telavi) (41.9283° N, 45.4241° E): 1 ♀ on *Rubus* sp. (Rosaceae), at Telavi (Rd Tetri Tsklebi to Telavi) (41.8870° N, 45.3636° E): 7 ♀♀ and 2 ♂♂ on *Rubus* sp. (Rosaceae), at Telavi (41.9141° N, 45.4579° E): 5 ♀♀ and 3 immatures on *Quercus* sp. (Fagaceae).

Previous records. Denmark, Georgia, Germany, Iran, Slovakia, Turkey.

Measurements of females (10 specimens)

Dorsum. Dorsal shield 362 (340–382) long and 170 (155–177) wide, smooth with small striation in the lateral posterial part, with seven solenostomes (*gd1*, *gd2*, *gd4*, *gd5*, *gd6*, *gd8* and *gd9*), 17 pairs of dorsal setae and two pairs of sub-lateral setae: *j1* 26 (22–30), *j3* 51 (50–55), *j4* 8 (7–10), *j5* 7, *j6* 8 (7–10), *J2* 9 (7–10), *J5* 6 (5–7), *z2* 22 (17–27), *z4* 32 (22–35), *z5* 7 (5–7), *Z1* 11 (7–12), *Z4* 63 (60–67), *Z5* 119 (110–127), *s4* 68 (65–72), *S2* 27 (25–32), *S4* 13 (12–15), *S5* 9 (7–10), *r3* 25 (22–27) and *R1* 17 (15–20) in length. All setae smooth.

Peritreme. Extending forwards to the bases of the setae *j1*.

Venter. Sternal shield with three pairs of setae and two pairs of poroids; one pair of sternal setae (*st4*) on small metasternal platelets; posterior margin straight. Distances between *st1–st3* 65 (62–70), *st2–st2* 69 (65–72), *st5–st5* 67 (65–70). Two pairs of metapodal plates, the largest one 24 (22–25) long and 5 (4–5) wide, the smallest one 10 (7–12) long and 2 wide. Ventrianal shield with three pairs of pre-anal setae *JV1*, *JV2*, *ZV2* and a pair of crescent pre-anal pores (*gv3*) present, slightly posterior-paraxial to setae *JV2*. Integument surrounding ventrianal shield with four pairs of setae *ZV1*, *ZV3*, *JV4* and *JV5*; ventrianal shield 116 (112–125) long, 84 (80–90) wide at level of anterior corners, and 82 (77–90) wide at level of anus. *JV5* 64 (60–70) long.

Legs. Legs IV with three macrosetae: on the genu 55 (52–57), tibia 41 (35–40) and basitarsus 63 (60–70). *SgeII* 31 (30–35), *SgeIII* 32 (30–35), *StiIII* 26 (25–27). Genu II with seven setae (2–2/0, 2/0–1), Genu III with seven setae (1–2/1, 2/0–1).

Chelicera. Fixed digit 37 long, movable digit 32 long. Dentition not visible because the chelicerae are closed.

Spermatheca. Spermatheca with a cup-shaped calyx 8–10 long and 5 wide, with a well differentiated round and small atrium at the base of calyx.

The table 2 provides measurements of three males.

Remarks. This species was described from Georgia (Manglisi) on *Corylus* sp. (Betulaceae) and according to Wainstein and Vartapetov (1973), it is quite common across the country. These authors also noted that *T. wainsteini* feeds on *P. citri* and *T. urticae.* The measurements of the Georgian specimens are close to those reported in the original description and in the re-description of Faraji *et al.* (2011) (from Turkey), except for the setae *STIV* that were shorter in our specimens (60–70) than in those measured by Faraji *et al.* (2011) (75–78) (Table 2). However, the difference is minor and it is the only difference with *T. wainsteini* studied by Faraji *et al.* (2011); we therefore conclude that the specimens from Georgia belong to *Transeius wainsteini* (Table 2).

Differences between *Amblyseius swirskii*, *Amblyseius andersoni* (Chant) and *T. wainsteini* are minor. *Amblyseius andersoni* differs from *A. swirskii* and *T. wainsteini* by longer setae *Z5* (Table 2). The main differences between *A. swirskii* and *T. wainsteini* are the measurements of the setae *z2*, *z4*, the ratio *s4*/*S2* and the dentition of the chelicerae.

CytB (8), 12S (5) and COI (8) DNA sequences of Georgian specimens of *T. wainsteini* were obtained, respectively. Phylogenetic trees are presented in the figure 2. The mean genetic distances between these specimens are 1.6% (0–3.1%) for the CytB mtDNA marker, 0% for the 12S rRNA fragment, and 1.2% (0–3%) for the COI mtDNA marker. The mean genetic

distances between *T. wainsteini* and *A. swirskii*, observed for the three molecular markers, support that these species are distinct taxa (CytB mtDNA marker: 44.2% (43.7% – 45.1%), 12S rRNA: 19.7%, COI mtDNA: 24.9% (23.8% – 25.9%)). *Transeius wainsteini* differs from *A. andersoni* by 26.3 % (25.5% – 27.2%) for the CytB mtDNA, 9.1% (8.8% – 9.4%) for the 12S rRNA marker and 19.9% (18.6% – 21.1%) for the COI mtDNA fragment (Supplementary Table S3a,b,c). These distances are clearly smaller than those observed between *T. wainsteini* and *A. swirskii,* suggesting that *T. wainsteini* is phylogenetically closer to *A. andersoni* than to *A. swirskii.* Interestingly, these genetic relationships do not reflect morphological similarities as (i) *A. swirskii* and *A. andersoni* are more similar to each other than to *T. wainsteini* and (ii) *T. wainsteini* is morphologically more similar to *A. swirskii* than to *A. andersoni.* The morphological similarities between *T. wainsteini* and *A. swirskii* suggest evolutionary convergence especially for the length of setae *Z5*. Further analyses would be interesting to carry out based, in particular, on the observation of spermatheca structures (atrium, calyx).

A very close relationship between *A. andersoni* and *T. wainsteini* is clearly supported by the 12S sequences (9.1%) (Supplementary Table S3b). In the absence of additional parameters (morphology and other molecular markers), this small distance could have wrongly lead to conclusion that they belong to the same species. The maximal intraspecific distance using the 12S rRNA marker for Phytoseiidae, was observed for the species *Amblyseius largoensis* (7.8% in Barbosa-Lima *et al.* 2018) and the minimal interspecific distances observed range between 9.5% and 12.5% (between *Neoseiulus californicus* and *N. fallacis* and *N. californicus* and *N. idaeus*, respectively) (Jeyaprakash and Hoy 2002; Okassa *et al.* 2011).

The phylogenetic closeness of *A. andersoni* and *T. wainsteini* questions the monophyly of the genus *Amblyseius* and the validity of the genus *Transeius*, as already stated by Tsolakis *et al.* (2012) who showed the proximity between *A. andersoni*, *A. swirskii* and *Transeius montdorensis* (Schicha). Further phylogenetic analyses would be required including additional *Amblyseius* and *Transeius* species, to conclude that *Transeius* is not a valid genus and that *Amblyseius* is paraphyletic.

Galendromus (*Galendromus*) *longipilus* (Nesbitt)

Typhlodromus longipilus Nesbitt 1951: 26.
Typhlodromus (*Typhlodromus*) *longipilus*, Cunliffe & Baker 1953: 17.
Typhlodromus (*Typhlodromus*) *longipilis* [sic], Chant 1959: 59.
Galendromus longipilis [sic], Muma 1961: 26.
Metaseiulus longipilus, Schuster 1966: 323.
Metaseiulus (*Galendromus*) *longipilus*, Wainstein 1973: 176.
Typhlodromus longipilis [sic], Ozman & Çobanoğlu 2001: 482.
Typhlodromus longipilis [sic], Çobanoğlu & Özman 2002: 92.
Galendromus longipilus, Kolodochka 2006: 171.
Metaseiulus longipilis [sic], Kulikova 2011: 59.

Specimens examined. At Kobuleti (Khala) (41.7070° N, 41.7912° E): 2 ♀♀ and 1 ♂ on *Rubus* sp. (Rosaceae).

Previous records. Austria, Bulgaria, Canada, Costa Rica, Cuba, Czech Republic, France, Galapagos, Germany, Hungary, Italy, Mexico, Moldova, Poland, Slovakia, Spain, Switzerland, Turkey, Ukraine, USA.

Measurements of females (2 specimens)

Dorsum. Dorsal shield 340 long and 155 wide, reticulated throughout, with two visible solenostomes (*gd6* and *gd9*), 16 pairs of dorsal setae and one pair of sub-lateral setae inserted in the dorsal shield: *j1* 25, *j3* 65–67, *j4* 52–55, *j5* 60–62, *j6* 65–70, *J2* 75, *J5* 8, *z2* 67, *z4* 67–70, *z5* 62, *Z4* 70–75, *Z5* 60–65, *s4* 65–70, *s6* 80–82, *S2* 75–77, *S5* 62–70 and *r3* 55–57 in length. All setae smooth.

Peritreme. Extending slightly anteriorly to the bases of the setae *z4*.

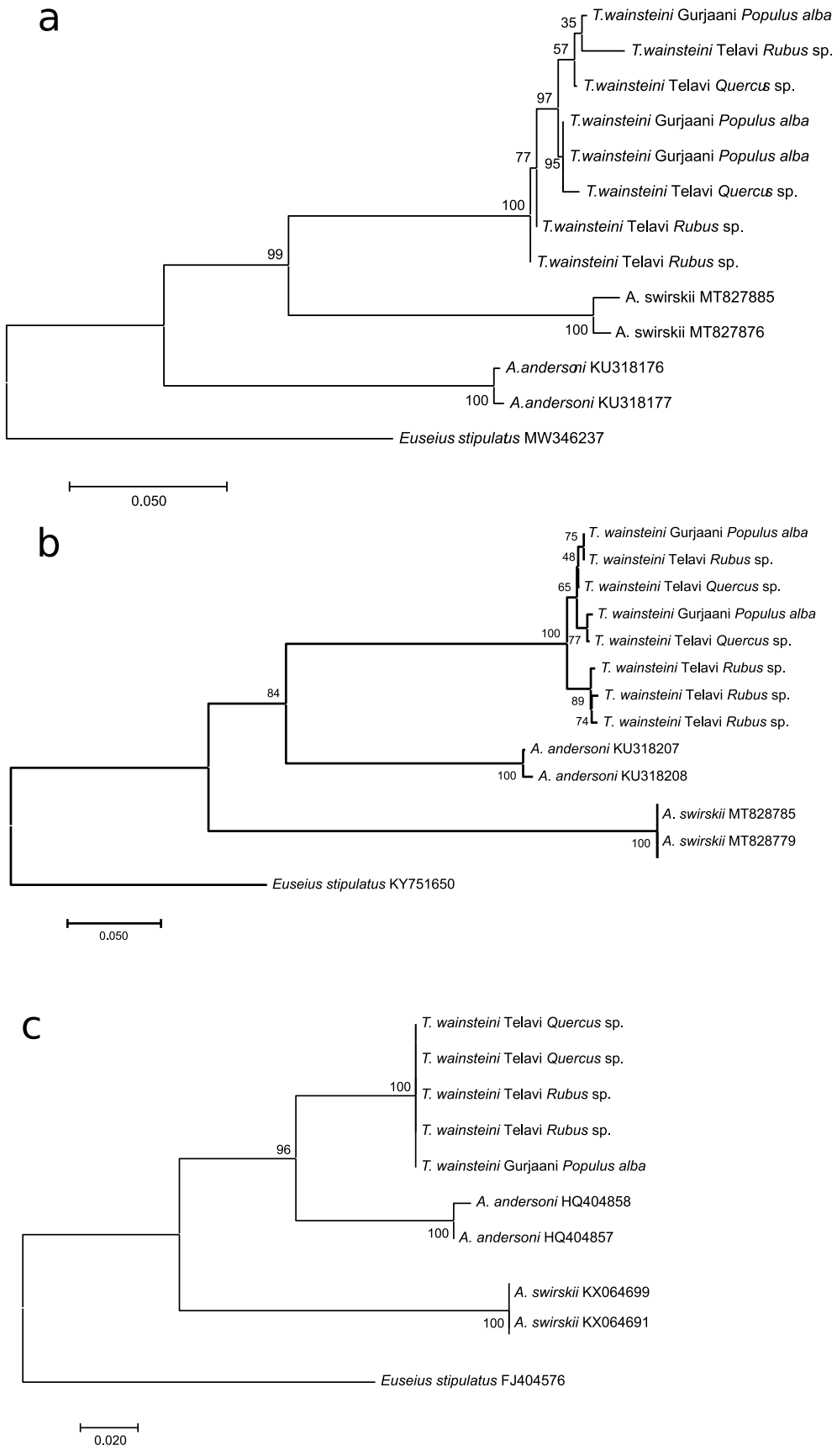


Figure 2 Neighbour joining phylogenetic trees including *Transeius wainsteini* from Georgia, *Amblyseius swirskii*, *Amblyseius andersoni* and *Euseius stipulatus* (as an outgroup) obtained with a – COI mtDNA, b – CytB mtDNA and c – 12S rRNA markers.

Venter. Sternal shield with three pairs of setae and two pairs of poroid; one pair of sternal setae (*st4*) on small metasternal platelets; posterior margin straight. Distances between *st1–st3* 65–72, *st2–st2* 47–52, *st5–st5* 47. Two pairs of metapodal plates, the largest one 25 long and 4 wide, the smallest one 10 long and 2 wide. Ventrianal shield with four pairs of pre-anal setae *JV1*, *JV2*, *JV3*, *ZV2* and a pair of small circular pre-anal pores (*gv3*) present, immediately posterior-mediad to *JV3*. Integument surrounding ventrianal shield with 3 pairs of setae *ZV1*, *ZV3* and *JV5*; ventrianal shield 107 long, 50–55 wide at level of anterior corners, and 65 wide at level of anus. *JV5* 55–57 long.

Legs. Legs IV with one long setae on the basitarsus 35. Genu II with nine setae (2–2/1, 2/1–2), Genu III with seven setae (1–2/1, 2/0–1).

Chelicera. Fixed digit 22 long; and movable digit 20 long. Dentition not visible because chelicerae closed.

Spermatheca. Spermatheca with elongated and tubular cervix 37 long and 3 wide, with a small atrium inserted at the base of the cervix.

Remarks. The measurements of the Georgian specimens are close to those reported in the re-description of *G. longipilus* provided by Chant and Yoshida-Shaul (1984) (Table 3). Some differences are however observed in some seta lengths, which are slightly shorter in the specimens examined in this study.

Galendromus longipilus is morphologically very close to *Galendromus occidentalis* (Nesbitt). However, because of the peritreme length and because *j6* is longer than the distance between *j6* and *J2*, we conclude that the specimens herein examined belong to *G. longipilus*. No material preserved in 100% ethanol was available for DNA analysis; therefore, we could not strengthen the identification with molecular markers at this time.

This is the first report of *G. longipilus* from Georgia. This occurrence is however consistent with the reported distribution of this species from Turkey and Europe.

Typhlodromus (*Anthoseius*) *recki* (Wainstein)

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

Specimens examined. At Telavi (5 kms West from Telavi) (41.9283° N, 45.4241° E): 3 ♀♀ and 1 ♂ on *Salvia verticillata* L. (Lamiaceae).

Previous records. Algeria, Armenia, Austria, Azerbaijan, Caucasus Region, Cyprus, France, Georgia, Greece, Hungary, Iran, Israel, Italy, Kazakhstan, Lebanon, Moldova, Morocco, Portugal, Russia, Slovenia, Spain (Ferragut 2018), Syria, Tunisia, Turkey, Ukraine.

Remarks. This species was known from Georgia, reported by Wainstein (1958) on *Salvia nemorosa* L. (Lamiaceae), and is commonly found in the West Palearctic region, especially on plants of the family Lamiaceae (Tixier *et al.* 2020a).

Two DNA sequences (one of the CytB and of the COI fragment) were obtained. CytB genetic distance between the Georgian specimen and the 54 specimens collected in South of France and Italy was 5.7% (4.7% – 14%) (Tixier *et al.* 2020b). Genetic distances among the COI sequences, ranged from 2 to 2.2% between the Georgian specimen and the four reported in Genbank (MT828361–364, from France and Italy). This differentiation can be due to population isolation or result from adaptation to climatic conditions (Tixier *et al.* 2020b; Queiroz *et al.* 2021).

Typhlodromus (*Anthoseius*) *halinae* (Wainstein & Kolodochka)

Anthoseius (*Amblydromellus*) *halinae* Wainstein & Kolodochka (1974): 629.
Anthoseius halinae, Rivnay & Swirski (1980): 177.

Amblydromella halinae, Moraes *et al.* (1986): 163.
Amblydromella (*Amblydromella*) *halinae*, Kolodochka (1998): 52.
Amblydromella (*Aphanoseia*) *halinae*, Denmark & Welbourn (2002): 308.

Specimens examined. At Terjola (Chognari) (42.2305° N, 42.7781° E): 3 ♀♀ on *Rubus* sp. (Rosaceae).

Previous records. Iran, Italy, Moldova, Norway, Russia, Slovakia, Ukraine.

Measurements of female. One specimen: voucher molecular specimen in the "best" state, the two other specimens are also voucher specimens and not all the characters can be measured.

Dorsum. Dorsal shield 310 long and 140 wide, reticulated throughout, five solenostomes not well visible (*gd2*, *gd4*, *gd6, gd8* and *gd9*), 18 pairs of dorsal setae and two pairs of sub-lateral setae: *j1* 23, *j3* 20, *j4* 15, *j5* 13, *j6* 18, *J2* 20, *J5* 5, *z2* 20, *z3* 25, *z4* 20, *z5* 13, *Z4* 25, *Z5* 43, *s4* 25, *s6* 25, *S2* 30, *S4* 25, *S5* 20, *r3* 23 and *R1* 23 in length. All setae smooth.

Peritreme. Extending forwards between the bases of the setae *j3* and *j1*.

Venter. Sternal shield with three pairs of setae and two pairs of poroids; one pair of sternal setae (*st4*) on small metasternal platelets; posterior margin straight. Distances between *st1–st3* 50, *st2–st2* 55, *st5–st5* 53. Two pairs of metapodal plates, the largest one 25 long and 3 wide, the smallest one 13 long and 2 wide. Ventrianal shield with four pairs of pre-anal setae *JV1*, *JV2*, *JV3*, *ZV2* and a pair of small circular pre-anal pores (*gv3*) present (horizontally aligned with *JV3* and vertically aligned with *JV2*). Integument surrounding ventrianal shield with three

Table 3 Measurements of morphological features of *Galendromus longipilus*, *Typhlodromus* (*Anthoseius*) *kerkirae*, *T.* (*A.*) *halinae* (specimens collected in Georgia and data retrieved from original description and re-descriptions) and *T.* (*A.*) *salviae* and *T.* (*A.*) *rhenanus* (original description and re-descriptions).

	Galendromus longipilus (n=2)	*G. longipilus* (in Chant & Yoshida-Shaul 1984)	*Typhlodromus* (*A.*) *kerkirae* (n=1)	*T.* (*A.*) *kerkirae* (in Tixier et al. 2019)	*Typhlodromus* (*A.*) *halinae* (n=1)	*T.* (*A.*) *halinae* original description	*T.* (*A.*) *salviae* (original	*T.* (*A.*) *rhenanus* (in Kolodochka 1978)
DSL	340	-	315	347	310		344	325
DSW	155	-	135	171	140		180	170
j1	25	29	20	20	23	20	22	19
j3	65-67	74	22	22	20	22	22	25
j4	52-55	63	15	13	15	14	14	15
j5	60-62	72	15	15	13	17	15	20
j6	65-70	78	18	15	18	20	18	20
J2	75	82	23	20	20	20	20	25
J5	8	8	8	11	5	8	11	8
z2	67	78	20	17	20	17	18	19
z3	62.5	71	25	25	25	25	23	not mentioned
z4	67-70	80	20	20	20	20	22	22
z5	62	68	18	16	13	17	16	20
Z4	70-75	79	32	30	25	28	31	36
Z5	60-65	75	52	53	43	47	50	50
s4	65-70	78	25	27	25	28	27	34
s6	80-82	86	30	28	25	28	28	33
S2	75-77	86	30	30	30	28	31	35
S4	absent	absent	30	30	25	28	31	32
S5	62-70	77	27	25	20	22	not mentioned	23
r3	55-57	62	18	25	23	25	25	27
R1	absent	-	18	23	23	22	23	25
JV5	55-57	59	33	-	33	-	41	48
ST1-ST1	35-37	-	not visible	-	48	-	-	-
ST2-ST2	47-52	-	not visible	-	55	-	-	-
ST3-ST3	65-70	-	not visible	-	65	-	-	-
ST4-ST4	70-75	-	not visible	-	80	-	-	-
ST5-ST5	47	56	63	-	53	-	-	-
ST1-ST3	65-72	-	not visible	-	50	-	-	-
VAS length	107	109	98	110	88	-	-	-
VAS width1	50-55	45	75	89	88	-	-	-
VAS width2	65	68	63	81	75	-	-	-
SGEIV	absent	absent	absent	absent	18	-	-	-
STiIV	absent	absent	absent	absent	20	-	-	-
STIV	35	-	27	28	23	28	27	29
MP1 length	25	28	not visible	-	25	-	-	-
MP1 width	4	4	not visible	-	3	-	-	-
MP2 length	10	-	not visible	-	13	-	-	-
FD	22	21	28	27	25	-	-	-
MD	20	-	23	26	23	-	-	-
Spermatheca length	37	-	13	-	18	-	-	-

pairs of setae *ZV1*, *ZV3* and *JV5*; ventrianal shield 88 long, 88 wide at level of anterior corners, and 75 wide at level of anus. *JV5* 33 long.

Legs. Legs IV with one macroseta on the basitarsus (23), and setae (not macrosetae) on the genu (18), tarsus (20). Genu II with seven setae (2–2/0, 2/0–1), Genu III with seven setae (1–2/0, 2/1–1).

Chelicera. Fixed digit 25 long; and movable digit 23 long. Dentition not visible because chelicerae closed.

Spermatheca. Spermatheca with cervix 15–18 long (on the two sides) and 10 wide, with an atrium inserted in the cervix.

Remarks. The specimen studied is morphologically close to *Typhlodromus* (*Anthoseius*) *rhenanus* (Oudemans), even if some differences are observed in spermatheca shape (Table 3). Molecular comparisons with specimens from our own database show high CytB distances between the sequences herein obtained and those referring to *T.* (*A.*) *rhenanus* (19.6% – 20.3%). Similar high distances have been previously observed at the intraspecific level (i.e. Tixier *et al.* 2017, 2019). However, for the COI fragment, 22% divergence was observed between *T.* (*A.*) *rhenanus* and our specimens. Such large divergences indicate that these specimens do not belong to *T.* (*A.*) *rhenanus*, but to a morphologically similar species.

They are also close to *T.* (*A.*) *georgicus* Wainstein, but difference in spermatheca shape and *S5* length (30 for *T.* (*A.*) *georgicus* and 20 for the presently examined specimen) (Hajizadeh and Mortazavi 2015) seem to show that the specimen observed do not belong to this latter species. It is difficult to assign a single specimen to a species. Tixier (2013) tried to provide some decision rules and proposed based on statistical analysis, that a difference of 11 microns between two specimens would be sufficient to conclude that these specimens might belong to different species. We see that in the present case the difference between the specimen examined and *T.* (*A.*) *georgicus* (10 microns) would be just included in this interspecific variation. However, because of this slight difference, we can have still some doubts. Considering other species, especially *Typhlodromus* (*Anthoseius*) *halinae,* it seems that the specimen observed is much closer to this latter species than to *T.* (*A.*) *georgicus*. However, the specimens were also morphologically very close to *Typhlodromus* (*Anthoseius*) *salviae* (Kolodochka) but unfortunately we did not find in the description of this latter species, information on the differentiation with *T.* (*A.*) *halinae* (Table 3).

Even if some doubts exist between an identification assigned to *T.* (*A.*) *halinae* or to *T.* (*A.*) *georgicus*, because of closer morphological traits with the former species, we considered that the specimen herein collected belong to *T.* (*A.*) *halinae*. Molecular sequences would help in assisting the diagnosis of these morphological close species in the future, as well as in clarifying the fact that some authors stated that differentiation between some *Typhlodromus* (*Anthoseius*) species is only possible based on male observation (Kolodochka 1978). This would be the first report of *T.* (*A.*) *halinae* from Georgia. Because of its current distribution in Eastern Europe and Middle East, the report of the species in Georgia is not surprising.

Typhlodromus (*Anthoseius*) *kerkirae* Swirski & Ragusa

Typhlodromus kerkirae Swirski & Ragusa 1976: 101.
Anthoseius kerkirae, Rivnay & Swirski 1980: 177.
Typhlodromus kerkyrae [sic], Papaioannou-Souliotis 1981: 41.
Amblydromella kerkirae, Moraes *et al.* 1986: 165.
Amblydromella (*Aphanoseia*) *kerkirae*, Denmark & Welbourn 2002: 308.

Specimens examined. At Telavi (5 kms from West Telavi) (41.9283° N, 45.4241° E): 1 ♀ on *Salvia verticillata* L. (Lamiaceae) and 2 ♀♀ on *Rubus* sp. (Rosaceae), at Tbilisi (240 David Aghmashenebeli Alley) (41.8068° N, 44.7668° E): 1 ♀ on *Eryngium caeruleum* L. (Apiaceae).

Previous records. Croatia, France, Greece, Iran, Italy, Spain, Turkey.

Measurements of female (1 specimen: voucher molecular specimen in "best" state)

Dorsum. Dorsal shield 315 long and 135 wide, reticulated throughout, with six solenostomes (*gd2*, *gd4*, *gd6*, *gd8* and *gd9*), 18 pairs of dorsal setae and two pairs of sub-lateral setae: *j1* 20, *j3* 22, *j4* 15, *j5* 15, *j6* 18, *J2* 23, *J5* 8, *z2* 20, *z3* 25, *z4* 20, *z5* 18, *Z4* 32, *Z5* 52, *s4* 25, *s6* 30, *S2* 30, *S4* 30, *S5* 27, *r3* 18 and *R1* 18 in length. All setae smooth except *Z5* lightly barbed.

Peritreme. Eextending nearly reaching the bases of the setae *j1*.

Venter. Sternal shield with three pairs of setae and two pairs of poroids; one pair of sternal setae (*st 4*) on small metasternal platelets; posterior margin straight. Distances between *st1–st3* not visible, *st2–st2* not visible, *st5–st5* 63. Metapodal shields not visible due to mountings (DNA voucher specimen). Ventrianal shield with four pairs of pre-anal setae *JV1*, *JV2*, *JV3*, *ZV2* and a pair of small circular pre-anal pores (*gv3*) present, at level of setae *JV3*, posterior or slightly postero-paraxial to setae *JV2*. Integument surrounding ventrianal shield with four pairs of setae *ZV1*, *ZV3*, *JV4* and *JV5*; ventrianal shield 98 long, 75 wide at level of anterior corners, and 63 wide at level of anus. *JV5* 33 long.

Legs. Legs IV with one macrosetae on the basitarsus 27. Genu II with seven setae (2–2/0, 2/0–1), chaetotaxy of the Genu III not clearly visible (leg folded).

Chelicera. Fixed digit 28 long; and movable digit 23 long. Dentition not visible because chelicerae closed.

Spermatheca. Spermatheca with campanulate calyx 13 long and 8 wide, with an atrium incorporated at the basis of the cervix.

Remarks. The morphological features reported above are in line with those reported by Tixier *et al.* (2019) for *T.* (*A.*) *kerkirae* (Table 3). Four DNA sequences were obtained for CytB, one for 12S and two for the COI fragments. The Genbank database only includes CytB sequences for *T.* (*A.*) *kerkirae* (accession number: MK014094), which have 15.4% – 16.1% divergence with sequences from our specimens from Georgia. In contrast, the mean distance between the four Georgian specimens is 0.25%. Although the genetic distance between the French and Georgian specimens is high, it is lower than the intraspecific variation already observed for species of the sub-family Typhlodrominae and the genus *Typhlodromus* (*Anthoseius*) (i.e. 21.7% for *T.* (*A.*) *rhenanoides* in Tixier *et al.* 2019). The COI and 12S rRNA sequences newly included in the Genbank database will serve as references for further molecular identification of this species.

Phytoseius finitimus Ribaga

Phytoseius finitimus Ribaga 1904: 178.
Phytoseius (*Dubininellus*) *finitimus,* Wainstein 1959: 1365.
Phytoseius (*Pennaseius*) *finitimus*, Pritchard & Baker 1962: 223.
Pennaseius finitimus, Schuster & Pritchard 1963: 279.
Phytoseius (*Phytoseius*) *finitimus*, Denmark 1966: 16.
Phytoseius dubinini Beglyarov 1958: 116 (synonymy according to Pritchard & Baker 1962).

Specimens examined. At Bolnisi (Kveshi) (41.4401° N, 44.4463° E): 9 ♀♀ and 5 ♂♂ on *Rubus* sp. (Rosaceae), at Bolnisi (Parizi) (41.4709° N, 44.7361° E): 9 ♀♀ and 5 ♂♂ on *Rubus* sp. (Rosaceae), at Gardabani (Vaziani) (41.7004° N, 45.0543° E): 9 ♀♀ and 4 ♂♂ on *Rubus* sp. (Rosaceae), at Gurjaani (Chalaubani) (41.6291° N, 45.7946° E): 11 ♀♀ and 3 ♂♂ on *Rubus* sp. (Rosaceae), at Kharagauli (Rd S1 2.5km East of Tsakva) (42.0965° N, 43.4532° E): 13 ♀♀, 2 ♂♂ and 1 immature on *Rubus* sp. (Rosaceae), at Kobuleti (Daba Chakvi) (41.7180° N, 41.7384° E): 1 ♀ on *Citrus* sp. (Rutaceae), at Kvareli (Eniseli) (41.9988° N, 45.6702° E): 2 ♀♀ on *Ulmus minor* (Ulmaceae), at Lanchkhuti (Grigoleti) (42.0192° N, 41.7629° E): 8 ♀♀ and 3 ♂♂ on *Rubus* sp. (Rosaceae), at Lanchkhuti (Maltakva Univ. Research Center) (42.0528° N, 41.7273° E): 9 ♀♀ and 1 ♂ on *Rubus* sp. (Rosaceae), at Sagarejo (Tokhliauri) (41.7299° N, 45.4236° E): 11 ♀♀ and 3 ♂♂ on *Rubus* sp. (Rosaceae), at Senaki (Sakharbedio) (42.2858° N, 42.0381° E): 9 ♀♀, 1 ♂ and 1 immature on *Rubus* sp. (Rosaceae) and 1 ♀ on *Corylus avellana* (Betulaceae), at Telavi (5 kms West from Telavi) (41.9283° N, 45.4241° E): 3 ♀♀ on *Rubus* sp.

(Rosaceae), at Terjola (Chognari) (42.2305° N, 42.7781° E): 1 ♀ on *Rubus* sp. (Rosaceae), at Tetri Tskaro (Koda) (41.5953° N, 44.7767° E): 12 ♀♀, and 3 ♂♂ on *Rubus* sp. (Rosaceae).

Previous records. Algeria, Azores, Egypt, France, Greece, Iran, Israel, Italy, Montenegro, Morocco, Portugal, Slovenia, Spain, Syria, Tunisia, Turkey, USA.

Remarks. According to the world database of Demite *et al.* (2021), *P. finitimus* is not reported from Georgia. However, *Phytoseius plumifer* (Canestrini and Fanzago) has been reported several times from this country. Because of its long history of misidentification with *P. finitimus* (Duso and Fontana 2002), we can wonder about the specimens reported under the name of *P. plumifer* from Georgia.

Phytoseius finitimus was the most frequent species retrieved herein (41% of the specimens collected).

CytB (29), COI (28) and 12S (18) sequences were obtained and compared to those of Tixier *et al.* (2017) for specimens collected on *Viburnum tinus* (Adoxaceae), *Vitis vinifera* (Vitaceae) from Italy and *Actinidia deliciosa* (Actinidiacae) from France. The supplementary table S4 shows the genetic distances obtained. Low intraspecific variation was observed for the Georgian specimens. The Georgian specimens are molecularly closer to those from *A. deliciosa* and *V. vinifera* than to those from *V. tinus*, whatever the samples considered (locations and plants). It is worth to note that for the three molecular fragments, a high genetic distance is observed between a specimen collected from *Rubus* sp. at Bolnisi-Kveshi and all the others (Supplementary Table S4).

Conclusion

Eleven species of Phytoseiidae were identified during this survey, and among them seven are new for the Georgia Fauna. Results show that despite the reduced number of host plant species sampled, new occurrences were revealed, emphasizing knowledge gaps on Phytoseiidae distribution. Main features resulting from the survey include (i) the occurrence of common East European species, already retrieved from this country and neighbouring countries, and (ii) the unexpected occurrence of some species, which could be explained by exotic introductions (accidental or for biological control purposes). The fact that *E. stipulatus* and *P. finitimus* were observed for the first time in Georgia, while they were the two most abundant species retrieved, is quite unexpected. Fauna modification due for instance to climate change (especially for *E. stipulatus* as this species is mainly reported from the Mediterranean coast climate) and/or misidentifications (especially for *P. finitimus* because of repeated misidentification with *P. plumifer*) are hypotheses that can be put forward to explain these results. The study also illustrates the utility of integrative taxonomy for diagnosis purposes. The observation of the lowest intraspecific distance never detected for the 12S rRNA marker and the validity of the genus *Transeius* are the main taxonomic issues pinpointed.

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References

Abbasova E. D. 1972. Phytoseiid mites (Parasitiformes: Phytoseiidae) of Azerbaijan. Avtoreferat Dissertatsii na Soiskanie Uchenoy Stepeni Kandidata Biologicheskikh Nauk. Akadrmiya Nauk Azerbaydzhanskoy SSR, Institut Zoologii, Baku, Azerbaijan, 34 pp.

Amitai S., Swirski E. 1981. A new species of *Amblyseius* (Acarina: Phytoseiidae) from the Far East. Isr. J. Entomol., 15: 59-66.

Arutunjan E.S. 1970. Phytoseiid mites (Phytoseiidae) on agricultural crops in the Armenian SSR. Akademii Nauk Armyanskoi SSR, Otdelenie Biologicheskikh Nauk, Dissertatsii na Soiskanie Uchenoi Stepeni Candidata Biologrcheskikh Nauk, Zooliya, 97, 31 pp.
Athias-Henriot C. 1958. Phytoseiidae et Aceosejidae (Acarina: Gamasina) d'Algérie. II. Phytoseiidae. Clé des genres *Amblyseius* Berlese (Suite) et *Seiulus* Berlese. Bull. Soc. Hist. Nat. Afrique du Nord, 49: 23-43.
Athias-Henriot C. 1959. Acariens planticoles d'Algérie. I. 5e contribution au genre *Amblyseius* Berlese (Phytoseiidae). II. Première liste d'Actinochitinosi (Cheyletidae, Caligonellidae, Hemisarcoptidae). Bull. Acad. Roy. Belgique, Sciences (Ser. 5), 45: 130-153.
Athias-Henriot C. 1960. Nouveaux *Amblyseius* d'Algérie (Parasitiformes, Phytoseiidae). Acarologia, 2: 288-299.
Athias-Henriot C. 1975. Nouvelles notes sur les Amblyseiini. II. Le relevé organotaxique de la face dorsale adulte (Gamasides protoadéniques, Phytoseiidae). Acarologia, 17(1): 20-29.
Athias-Henriot C. 1977. Nouvelles notes sur les Amblyseiini. III. Sur le genre *Cydnodromus*: Redéfinition, composition (Parasitiformes, Phytoseiidae). Entomophaga, 22: 61-73. https://doi.org/10.1007/BF02372991
Barbosa Lima D., Rezende-Puker D., Santos de Mendonça R., Tixier M.-S., Guedes Correia Gondim Junior M., Wagner da Silva Melo J., Chiaradia Oliveira D., Navia D. 2018. Molecular and morphological characterization of the predatory mite *Amblyseius largoensis* (Acari: Phytoseiidae). Surprising similarity between an Asian and American populations. Exp. Appl. Acarol., 76: 287-310. https://doi.org/10.1007/s10493-018-0308-1
Beglyarov G.A. 1958. Species of Phytoseiidae (Parasititormes: Gamasoidea) predatory upon tetranychid mites in orchards of the Krasnodar region. Trudy Vsesoiuznogo Institut Zashchity Rastenii, Leningrad, Russia, 10: 98-124.
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. 1959. Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of thirty-eight new species. Can. Entomol., 61(12): 1-166. https://doi.org/10.4039/entm9112fv
Chant D.A., Yoshida-Shaul E. 1984. A world review of the occidentalis species group in the genus *Typhlodromus* Scheuten (Acarina: Phytoseiidae). Can. J. Zool., 62: 1860-1871. https://doi.org/10.1139/z84-272
Chant D.A., Yoshida Shaul E. 1990. The identities of *Amblyseius andersoni* (Chant) and *A. potentillae* (Garman) in the family Phytoseiidae (Acari: Gamasina). Int. J. Acarol., 16(1): 5-12. https://doi.org/10.1080/01647959008683857
Chant D.A., Yoshida-Shaul E. 1991. Adult ventral setal patterns in the family Phytoseiidae (Acari: Gamasina). Int. J. Acarol., 17: 187-199. https://doi.org/10.1080/01647959108683906
Chant D.A., McMurtry J.A. 2004. A review of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part III. The tribe Amblyseiini Wainstein, subtribe Amblyseina 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 sub-genera of the Phytoseiidae of the World. Indira Publishing House, 220 pp.
Cunliffe F., Baker E.W. 1953. A guide to the predatory phytoseiid mites of the United States. Pinellas Biology Laboratory, Inc., 1, 28 pp.
De Leon D. 1959. Two new genera of Phytoseiid mites with notes on *Proprioseius meridionalis* Chant (Acarina: Phytoseiidae). Entomol. News, 70: 257-262.
Demite P.R., Moraes G.J. de, McMurtry J.A., Denmark H.A., Castilho R.C. 2021. Phytoseiidae Database. Available from: www.lea.esalq.usp.br/phytoseiidae (accessed 20/XII/2020)
Denmark H.A. 1966. Revision of the genus *Phytoseius* Ribaga, 1904 (Acarina: Phytoseiidae). Fla. Dep. Agric. Bul., 6: 1-105.
Denmark H.A., Welbourn W.C. 2002. Revision of the genera *Amblydromella* Muma and *Anthoseius* De Leon (Acari: Phytoseiidae). Int. J. Acarol., 28(4): 291-316. https://doi.org/10.1080/01647950208684308
Dos Santos V., Tixier M.-S. 2017. Molecular markers for analysing phylogenetic relationships within the mite family Phytoseiidae (Acari: Mesostigmata). Cladistics 28(5): 1-16. https://doi.org/10.1111/cla.12166
Duso C., Fontana P. 2002. On the identity of *Phytoseius plumifer* (Canestrini & Fanzago, 1876) (Acari: Phytoseiidae). Acarologia, 42 (2) : 127-136.
Ehara S., Amano H. 1998. A revision of the mite family Phytoseiidae in Japan (Acari: Gamasina), with remarks on its biology. Species Divers., 3(1): 25-73. https://doi.org/10.12782/specdiv.3.25
Ehara S., Okada Y., Kato H. 1994. Contribution to the knowledge of the mite family Phytoseiidae in Japan (Acari: Gamasina). J. Fac. Educ. Tottori University Nat. Sc., 42(2): 119-160.
Faraji F., Cobanoglu S., Cakmak I. 2011. A checklist and a key for the Phytoseiidae species of turkey with two new species records (Acari: Mesostigmata). Int. J. Acarol., 37 (suppl. 1): 221-243. https://doi.org/10.1080/01647954.2011.558851
Ferragut, F., Escudero, A. 1997. Taxonomy and distribution of predatory mites belonging to the genus *Euseius* Wainstein 1962, in Spain (Acari, Phytoseiidae). Bol. San. Veg. Plagas, 23(2): 227-235.
Ferragut F. 2018. New records of phytoseiid mites of the subfamilies Typhlodrominae and Phytoseiinae (Acari: Phytoseiidae) from Spain, with description of a new species and re-description of four species of *Typhlodromus* Scheuten. Syst. Appl. Acarol., 23(5): 883-910. https://doi.org/10.11158/saa.23.5.8
Gomelauri L.A. 1968. Three new species of mites of the family Phytoseiidae in southern Georgia [in Russian]. Bulletin of the Academy of Sciences of the Georgian SSR, Zoology and Parasitology, 52(2): 515-520.

Hajizadeh J., Mortazavi S. 2015. The genus Euseius Wainstein (Acari: Phytoseiidae) in Iran, with a revised key to Iranian phytoseiid mites. Int. J. Acarol., 41 (1) : 53-66. https://doi.org/10.1080/01647954.2014.985712
Jeyaprakash A., Hoy M.A. 2002. Mitochondrial 12S rRNA sequences used to design a molecular ladder assay to identify six commercially available phytoseiids (Acari: Phytoseiidae). Biol. Control, 25: 136-142. https://doi.org/10.1016/S1049-9644(02)00056-7
Ji J., Lin T., Zhang Y., Lin J., Li L., Chen X. 2013. A comparison between *Amblyseius* (*Typhlodromips*) *swirskii* and *Amblyseius eharai* with *Panonychus citri* (Acari: Tetranychidae) as prey: developmental duration, life table and predation. Syst. Appl. Acarol., 18(2): 123-129. https://doi.org/10.11158/saa.18.2.4
Kanouh, M., Tixier, M.-S., Guichou, S., Cheval, B. & Kreiter, S. 2010. Two synonymy cases within the genus *Neoseiulella* (Acari: Phytoseiidae): is the molecular evidence so evident? Biol. J. Linn. Soc., 101: 323-344. https://doi.org/10.1111/j.1095-8312.2010.01516.x
Karg W. 1971. Acari (Acarina), Milben, Unterordnung Anactinochaeta (Parasitiformes): Die freilebenden Gamasina (Gamasides), Raubmilben. Die Tierwelt Deutschlands und der angrenzenden Meeresteile, 59. Teil, VEB Gustav Fischer Verlag, Jena, 475 pp.
Karg W. 1991. Die Raubmilbenarten der Phytoseiidae Berlese (Acarina) Mitteleuropas sowie angrenzender Gebiete. Zool. Jahrb. Syst., 118(1): 1-64.
Knapp M., Van Houten, Y., Van Baala E., Groot T. 2018. Use of predatory mites in commercial biocontrol: current status and future prospects. Acarologia 58(Suppl): 72-82. https://doi.org/10.24349/acarologia/20184275
Kazak C., Yildiz S., Sekeroglu E. 2002. Biological characteristics and life tables of *Neoseiulus umbraticus* Chant (Acari, Phytoseiidae) at three constant temperatures. J. Pest Sci., 75: 118-121. https://doi.org/10.1046/j.1472-8206.2002.02034.x
Kolodochka L.A. 1978. Manual for the identification of plant-inhabiting phytoseiid mites. Akademii Nauk Ukrainian SSR, Instituta Zoologii, Naukova Dumka , Kiev, 79 pp.
Kolodochka L.A. 2006. Phytoseiid mites of the Palaearctic Region (Parasitiformes, Phytoseiidae): faunistic, taxonomy, ecomorphology, evolution. Vest. Zool., suppl. 21, 250pp.
Kreiter S., Douin M., Tixier M.-S. 2021. New records of phytoseiid mites (Acari: Mesostigmata) from Madeira Island. Acarologia 61 (2): 217-240. https://doi.org/10.24349/acarologia/20214428
Kreiter S., Payet R.-M., Douin M., Fontaine O., Fillatre J., Lebellec F. 2020. Phytoseiidae of La Réunion Island (Acari: Mesostigmata): three new species and two males described, new synonymies, and new records. Acarologia, 60(1) : 111-195. https://doi.org/10.24349/acarologia/20204361
Kreiter S., Dos Santos Vicente V., Tixier M.-S., Fontaine O. 2016. An unexpected occurrence of *Amblyseius swirskii* Athias-Henriot in La Réunion Island (Acari: Phytoseiidae). Acarologia, 56(2): 175-181. https://doi.org/10.1051/acarologia/20162254
Kulikova L. 2011. Mites of fruit plantations of the Republic of Moldova. Muzeul Olteniei Craiova. Oltenia. Studii şi comunicări. Ştiinţele Naturii, 27(1): 55-62.
Kumar S., Stecher G., Li M., Knyaz C., Tamura K. 2018. MEGA X: Molecular Evolutionary Genetics Analysis across computing platforms. Mol. Biol. Evol., 35: 1547-1549. https://doi.org/10.1093/molbev/msy096
Lindquist E., Evans G.W. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina Acarina: Mesostigmata. Mem. Entomol. Soc. Canada, 47, 1-64. https://doi.org/10.4039/entm9747fv
McGregor E.A. 1954. Two new mites in the genus *Typhlodromus* (Acarina: Phytoseiidae). South. Calif. Acad. Sc. Bul., 53: 89-92.
McMurtry JA, Croft BA 1997. Life-styles of phytoseiid mites and their roles in biological control. Ann. Rev. Entomol., 42: 291-321. https://doi.org/10.1146/annurev.ento.42.1.291
McMurtry J.A., Moraes G.J.de 1984. Some phytoseiid mites from the South Pacific, with descriptions of new species and a definition of the *Amblyseius largoensis* species group. Int. J. Acarol., 10: 27-37. https://doi.org/10.1080/01647958408683347
McMurtry J.A., Moraes G.J. de, Sourasso N.F. 2013. Revision of the life styles of phytoseiid mites (Acari: Phytoseiidae) and implications for biological control strategies. Syst. Appl. Acarol., 18: 297-320. https://doi.org/10.11158/saa.18.4.1
Moraes G.J. de, McMurtry J.A., Denmark H.A. 1986. A catalog of the mite family Phytoseiidae. References to taxonomy, synonymy, distribution and habitat. EMBRAPA - DDT, Brasilia, Brazil, 353 pp.
Muma M.H. 1961. Subfamiles, genera, and species of Phytoseiidae (Acarina: Mesostigmata). Fla. St. Mus. Bull., 5(7): 267-302.
Okassa M., Kreiter S., Guichou S., Tixier M.-S. 2011. Molecular and morphological boundaries of the predator *Neoseiulus californicus* McGregor (Acari: Phytoseiidae). Biol. J. Linn. Soc., 104: 393-406. https://doi.org/10.1111/j.1095-8312.2011.01717.x
Oudemans A.C. 1915. Acarologische Aanteekeningen. LVI. Entomol. Berichten, 4: 180-188. https://doi.org/10.5962/bhl.part.1128
Oudemans A.C. 1929. Acarologische Aanteekeningen. C. Entomol. Berichten, 8: 28-36.
Oudemans A.C. 1930. Acarologische Aanteekeningen. CI. Entomol. Berichten, 8: 48-53.
Papaioannou-Souliotis P. 1981. Predacious mites (Phytoseiidae) observed on various plants in Greece. Annales de l'Institut Phytopathologique Benaki, 13: 36-58.
Park Y., Joon-Ho Lee J.H. 2020. Temperature-dependent development and oviposition models and life history characteristics of *Amblyseius eharai* (Amitai et Swirski) (Acari: Phytoseiidae) preying on *Tetranychus urticae* (Koch) (Acari: Tetranychidae). J. Asia-Pac. Entomol., 23 (4): 869-878. https://doi.org/10.1016/j.aspen.2020.07.021

Pritchard A.E., Baker E.W. 1962. Mites of the family Phytoseiidae from Central Africa, with remarks on the genera of the world. Hilgardia, 33(7): 205-309. https://doi.org/10.3733/hilg.v33n07p205
Queiroz M.C., Douin M., Marques de Souza S., Sato E., Tixier M.-S. 2021. Molecular variations of the Cytochrome b DNA and protein sequences in *Phytoseiulus macropilis* Banks (Acari: Phytoseiidae) and *P. persimilis* (Athias-Henriot) (Acari: Phytoseiidae) reflect population structuration. Exp. Appl. Acarol., 84(4):687-701. https://doi.org/10.1007/s10493-021-00648-w
Rahmani H., Kamali K., Faraji F. 2010. Predatory mite fauna of Phytoseiidae of northwest Iran (Acari: Mesostigmata). Turk. J. Zool., 34: 497-508. https://doi:10.3906/zoo-0902-23
Ribaga, C. 1904 (1902) Gamasidi planticoli. Riv. Patol. Veg., 10, 175-178.
Rivnay T., Swirski E. 1980. Four new species of phytoseiid mites (Acarina: Mesostigmata) from Israel. Phytoparasitica, 8: 173-187. https://doi.org/10.1007/BF03158314
Rowell H.J., Chant D.A., Hansell R.I.C. 1978. The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae. Can. Entomol., 110: 859-876. https://doi.org/10.4039/Ent110859-8
Samsoniya T.I. 1972. Species composition of predatory mites (Parasitiformes: Phytoseiidae) on stonefruit plants in eastern Georgia. Bull. Acad. Sci. of Georgian SSR, 65(1): 193-196.
Samsoniya T.I. 1977. Zonal-vertical distribution of Phytoseiidae in eastern Georgia on pip fruit culture. Bull. Acad. Sci. of Georgian SSR, 87(1): 181-183.
Schuster R.O., Pritchard A.E. 1963. Phytoseiid mites of California. Hilgardia, 34: 191-285. https://doi.org/10.3733/hilg.v34n07p191
Sengonca C., Drescher K. 2001. Laboratory studies on the suitability of *Thrips tabaci* Lindeman (Thysanoptera, Thripidae) as prey for the development, longevity, reproduction and predation of four predatory mite species of the genus *Amblyseius* (Acari, Phytoseiidae). Z. PflKrankh. PflSchutz., 108: 66-76.
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
Tamura K., Stecher G., Peterson D., Filipski A., Kumar S. 2013. MEGA6: Molecular Evolutionary Genetics Analysis using Maximum Likelihood, Evolutionary Distance, and Maximum Parsimony Methods. Mol. Biol. Evol., 30: 2725-2729. https://doi.org/10.1093/molbev/mst197
Tixier M.-S. 2018. Predatory mites (Acari: Phytoseiidae) in agro-ecosystems and conservation biological control: a review and explorative approach for forecasting plant-predatory mite interactions and mite dispersal. Frontiers in Ecology & Evolution, 6: 192. https://doi.org/10.3389/fevo.2018.00192
Tixier M.-S., Allam L., Douin M., Kreiter S. 2016. Phytoseiidae (Acari: Mesostigmata) of Morocco: new records, descriptions of five new species, re-descriptions of two species, and key for identification. Zootaxa, 4067(5): 501-551. https://doi.org/10.11646/zootaxa.4067.5.1
Tixier M.-S., Guichou S., Kreiter S. 2008a. Morphological variation in the biological control agent *Neoseiulus californicus* (McGregor) (Acari: Phytoseiidae): consequences for diagnostic reliability and synonymies. Invert. Syst., 22: 453-469. https://doi.org/10.1071/IS07052
Tixier M.-S., Kreiter S. 2009. Arthropods in biodiversity hotspots: the case of the Phytoseiidae (Acari: Mesos-tigmata) Biodivers. Conserv., 18: 507-527. https://doi.org/10.1007/s10531-008-9517-y
Tixier M.-S., Principato D., Douin M., Kreiter S. 2019. Mites of the genus *Typhlodromus* (Acari: Phytoseiidae) from Southern France: combined morphological and molecular approaches for species identification. Zootaxa, 4604(2): 242-280. https://doi.org/10.11646/zootaxa.4604.2.2
Tixier M.-S., Ferrero M., Okassa M., Guichou S., Kreiter S. 2010a. On the specific identity of specimens of *Phytoseiulus longipes* Evans (Mesostigmata: Phytoseiidae) showing different feeding behaviours: morphological and molecular analyses. Bull. Entomol. Res., 100: 569-579. https://doi.org/10.1017/S0007485309990617
Tixier M.-S., Okassa M., Liguori M.L., Poinso A., Salerno B., Kreiter S. 2010b. Voucher specimens for DNA sequences of Phytoseiid mites (Acari: Mesostigmata). Acarologia, 50: 487-494. https://doi.org/10.1051/acarologia/20101984
Tixier M.-S., Dos Santos V., Douin M., Duso C., Kreiter S. 2017. Great molecular variation questions the status of the species *Phytoseius finitimus* (Acari: Phytoseiidae) and the barcoding decision diagnosis. Acarologia, 57(3): 493-515. https://doi.org/10.24349/acarologia/20174168
Tixier M.-S., Kreiter S., Moraes G.J. 2008b. Biogeographic distribution of the mites of the family Phytoseiidae (Acari: Mesostigmata). Biol. J. Linn. Soc., 93: 845-856. https://doi.org/10.1111/j.1095-8312.2007.00937.x
Tixier M.-S., Kreiter S., Douin M., Moraes G.J. 2012a. Rates of description of Phytoseiidae (Acari: Mesostigmata): space, time and body size variations. Biodiv. Conserv.,*21: 993-1013. https://doi.org/10.1007/s10531-012-0235-0
Tixier M.-S., Okassa M., Kreiter S. 2012b. An integrative morphological and molecular diagnostics for *Typhlodromus pyri* (Acari: Phytoseiidae). Zool. Scr., 41: 68-78. https://doi.org/10.1111/j.1463-6409.2011.00504.x
Tixier M.-S., Perez Martinez S., Douin M. 2020a. Markers for life traits: the example of variations in morphology, molecular and amino acid sequences within the species *Typhlodromus* (*Anthoseius*) *recki* Wainstein (Acari: Mesostigmata: Phytoseiidae). Biol. J. Linn. Soc. 103, online first. https://doi.org/10.1093/biolinnean/blaa103
Tixier M.-S., Douin M., Oliva R., Gonzalez L., Pount B., Kreiter S. 2020. Distribution and biological features of the species *Typhlodromus* (*Anthoseius*) *recki* (Acari: Phytoseiidae) on *Tetranychus urticae*, *T. evansi* (Acari: Tetranychidae) and *Aculops lycopersici* (Acari: Eriophyidae). Acarologia, 60(4): 684-697. https://doi.org/10.24349/acarologia/20204396
Tsolakis H., Tixier M.-S., Kreiter S., Ragusa S. 2012. The genus concept within the family Phytoseiidae (Acari: Parasitiformes). Historical review and phylogenetic analyses of the genus *Neoseiulus* Hughes. Zool. J. Linn. Soc., 165: 253-273. https://doi.org/10.1111/j.1096-3642.2011.00809.x

Ueckermann E.A., Loots G.C. 1988. The African species of the subgenera *Anthoseius* De Leon and *Amblyseius* Berlese (Acari: Phytoseiidae). Entomol. Mem., Dep. Agric. Water Supply, Rep. South Africa 73, 168 pp.
Wainstein B.A. 1959. New subgenus and species of the genus *Phytoseius* Ribaga, 1902 (Phytoseiidae: Parasitiformes). Zool. Zhur., 38: 1361-1365.
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., Vartapetov S.G. 1973. Predatory mites of the family Phytoseiidae (Parasitiformes) of Adzharskaya ASSR. Akademiya Nauk Armyanskoy SSR, Biologicheskiy Zhurnal Armenii, 26(2): 102-105.
Wainstein B.A. 1958. New species of mites of the genus *Typhlodromus* (Parasitiformes: Phytoseiidae) from Georgia. Soobshcheniya Akademii Nauk Gruzinskoy SSR, 21(2): 201-207.
Yoshida-Shaul E., Chant D.A. 1995. A review of the species of Phytoseiidae (Acari: Gamasina) described by A. C. Oudemans. Acarologia, 36(1): 3-19.