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Phytoseiid mites (Acari, Mesostigmata) from the rest areas of Hungarian highways

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Abstract. The mesostigmatid mite family Phytoseiidae was surveyed in rest areas of Hungarian highways by examination of leaves collected from arboreal plants. All together 15 species, ca. 20 % of the Hungarian Phytoseiid fauna were recorded. Seven species were collected from the ring highway around Budapest (M0), ten species were found alongside the north-western highway (M1), six-six species were recorded from the north-eastern and south-eastern highways (M3 and M5), and five species from the area of south-western highway (M7), finally two species were found on the newly built southern highway (M6). *Euseius finlandicus* (Oudemans, 1915) was present in most of the sampling sites, while other common species were *Phytoseius macropilis* (Banks, 1909); *Kampimodromus aberrans* (Oudemans, 1930); *Neoseiulella aceri* (Collyer, 1957) and *Typhlodromus* (*Typhlodromus*) *tiliae* Oudemans, 1929. *Typhloseiulus peculiaris* (Kolodochka, 1980) was shown at the first time from Hungary in the framework of our study, thus a short description and new illustrations are given to this species.

Keywords. Acari, Phytoseiidae, highways, first record, Hungary.

INTRODUCTION

The fast moving species of the family Phytoseiidae are well known as natural enemies of mite and insect pests from the agricultural and natural areas (McMurtry & Croft 1997, Tsolakis *et al*. 2012). Due to their economical importance, they are among the most intensively studied groups of the mites; more than 2280 species being discovered and described so far (Chant & McMurtry 2007, Tixier *et al*. 2012).

Highway margins are specific habitats, which can be situated in agricultural zones or in forested areas, in plains or in mountainous areas as well. Therefore, the fauna of the planted rest stations may reflect natural, agricultural or urban influences, while they can be colonized by mountainous or lowland elements as well. Due to the intensive transport activity, highways have important role in the dispersion of numerous animal groups. Therefore, the fauna of rest stations of highways consists of several invasive species as well, which mainly arrived from the neighbouring countries.

Investigations on the role of the Hungarian highway margins in altering the autochthonous fauna and migration of the animals, as well as in conservation of biodiversity in certain animal taxa were started in 2001 (Kozár 2009, Kozár *et al*. 2012). The present work is a part of a multitaxa survey of Hungarian highway margins.

MATERIAL AND METHODS

Leaves of arboreal plants were collected in 2012 and 2013, two times in a year in 28 rest areas along six Hungarian highways (Fig. 1). The collected leaves were stored in plastic bags for 1–3 days before microscopic examination. Mites were removed with a small brush from the leaves under stereomicroscope and they were examined

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on slides in a gelatine-lactic acid mixture. Specimens were then mounted on slide in Hoyer medium and deposited in the Soil Zoology collection of the Hungarian Natural History Museum. For the identification, Karg's (1993) book was used accompanied with several other important papers (e.g. Cargnus *et al*. 2012, Faraji *et al*. 2007); the distributions and systematic status are given after Moraes *et al.* (2004) catalogue. Setal nomenclature used follows that of Lindquist & Evans (1965), as adapted by Rowell *et al*. (1978). We use the following sequence in designating the origin of the samples: highway code (M0–M7), name of rest station, host plant.

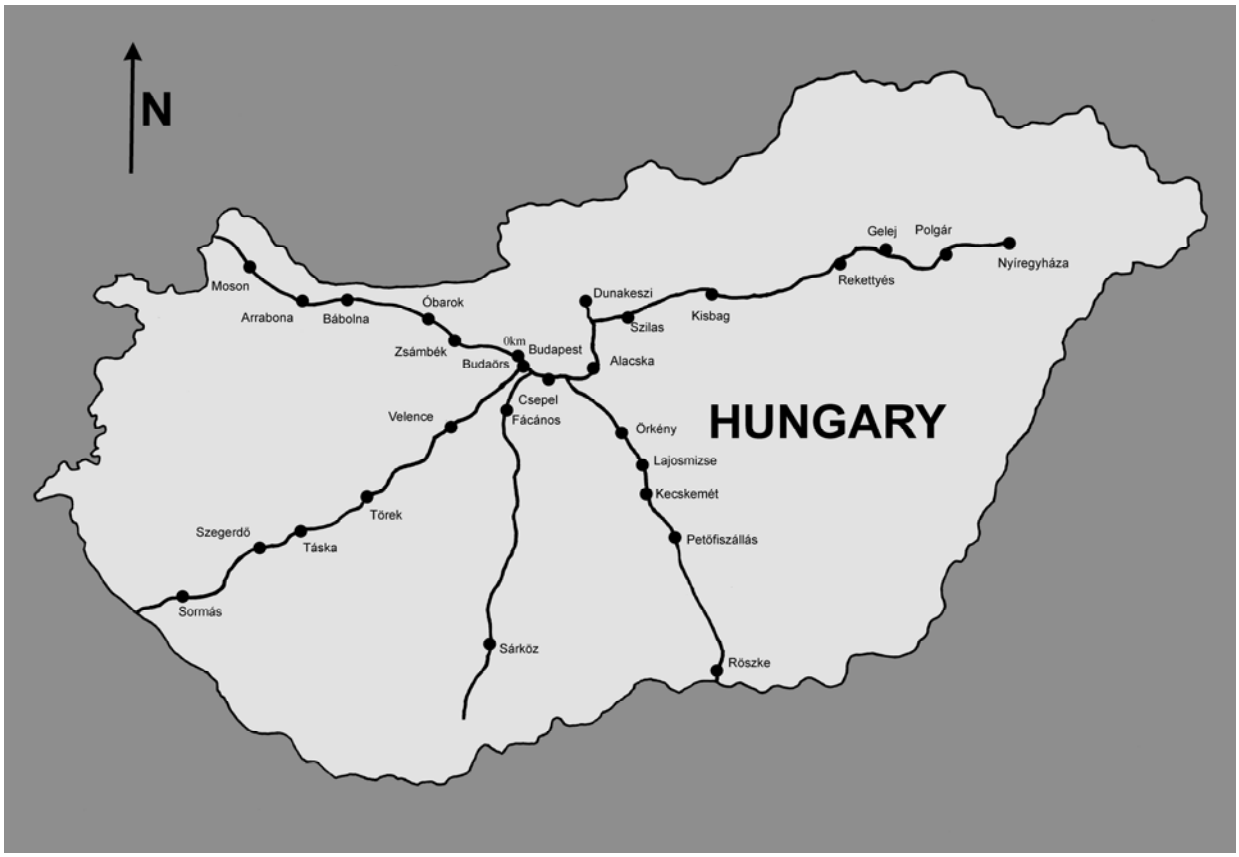


Figure 1. Phytoseiid collection sites along the Hungarian highways.

RESULTS

Family Phytoseiidae Berlese, 1916

Subfamily Amblyseiinae Muma, 1961

Amblyseius andersoni (Chant, 1957)

Material examined. M0, Dunakeszi, maple

Remark. Holarctic species (Moraes *et al*. 2004).

Euseius finlandicus (Oudemans, 1915)

Material examined. M0, Annahegy, unknown plant; M0, Csepel, ash; M0, Csepel, hackberry; M0, Dunakeszi, maple; M0, 0km, SOS, oak; M0, 0km, SOS, maple; M1, Arrabona, linden; M1, Bábolna, hornbeam; M1, Bábolna, cornel; M1 Zsámbék, linden; M3, Kisbag, hornbeam; M3, Nyíregyháza, oak; M3, Polgár, maple; M3, Polgár, mulberry; M3, Rekettyés, linden; M3, M3, Rekettyés, oak; Rekettyés, unknown plant; M3, Szilas, ash; M5, Kecskemét, linden; M5, Kecskemét, birch;

M5, Kecskemét, elm; M5, Örkény, unknown plant; M5, Örkény, hornbeam; M5, Petőfiszállás, bird cherry; M6, Fácános, hornbeam; M7, Budaörs, bird cherry; M7, Szegerdő, hornbeam; M7, Török, maple; M7, Velence, mulberry; M7, Velence, linden.

Remarks. This is a very common species. *E. finlandicus* possesses a Holarctic distribution, but it can be found in Nicaragua, Mexico and Indonesia as well (Moraes *et al*. 2004).

***Kampimodromus aberrans* (Oudemans, 1930)**

Material examined. M0, 0km, SOS, maple; M0, Annahegy, maple; M1, Zsámbék, apple; M3, Kisbag, linden; M5, Lajosmizse, linden; M5, Röszke, linden; M7, Táska, maple.

Remarks. This is a common species in Europe but it has sporadic reports from North-Africa and North-America as well (Moraes *et al*. 2004).

***Kampimodromus corylosus* Kolodochka, 2003**

Material examined. M0, SOS, 0km, hazelnut; M5, Kecskemét, hazelnut; M5, Örkény, hazelnut; M7, Sormás, hazelnut.

Remarks. Quite rare species perhaps with Mediterranean distributional pattern (Cargnus *et al*. 2012). It was reported first time from Hungary just recently (Ripka & Szabó 2010).

Subfamily Phytoseiinae Berlese, 1916

***Phytoseius juvenis* Wainstein & Arutunjan, 1970**

Material examined. M1, Arrabona, willow.

Remarks. This species occurs from France to Armenia and Kazakhstan (Moraes *et al*. 2004).

***Phytoseius macropilis* (Banks, 1909)**

Material examined. M1, Moson, ash; M1, Zsámbék, maple; M3, Gelej, hazelnut; M3, Kisbag, hornbeam; M3, Rekettyés, linden; M5, Röszke, linden.

Remarks. Cosmopolitan species, it is common and widely distributed all over in Europe (Moraes *et al*. 2004).

Subfamily Typhlodrominae

***Neoseiulella aceri* (Collyer, 1957)**

Material examined. M0, Alacska, linden; M0, Annahegy, unknown plant; M1, Arrabona, linden; M1, Arrabona, maple; M3, Kisbag, maple; M3, Rekettyés, dewberry.

Remark. This species is listed from Europe and North-America (Moraes *et al*. 2004).

***Neoseiulella formosa* (Wainstein, 1958)**

Material examined. M1, Bábolna, hazelnut; M3, Kisbag, linden.

Remarks. N. formosa is distributed mainly in Eastern Europe (Armenia, Georgia, Moldova, Ukraine and Hungary (Moraes *et al*. 2004).

***Paraseiulus triporus* (Chant & Yoshida-Shaul, 1982)**

Material examined. M0, Annahegy, unknown plant.

Remarks. P. triporus was recorded from North-America and Europe (Moraes *et al*. 2004).

***Typhlodromus (Anthoseius) intercalaris* Livshitz & Kuznetsov, 1972**

Material examined. M1, Óbarok, elm.

Remarks. This species is known from France, Greece, Italy, Hungary and Iran (Moraes *et al*. 2004, Ripka 2006, Faraji *et al*. 2007).

***Typhlodromus (Anthoseius) recki* Wainstein, 1958**

Material examined. M1, Óbarok, elm; M3, Kisbag, hornbeam; M6, Fácános, maple; M6, Sárköz, hazelnut.

Remarks. T. (A.) recki was recorded from Europe and the Middle-East (Moraes *et al*. 2004).

***Typhlodromus (Typhlodromus) corticis* Herbert, 1958**

Material examined. M5, Petőfiszállás, maple.

Remarks. This is a very rare but widely distributed species, which is reported from Canada, China, Italy, Russia (Moraes *et al*. 2004) and Hungary (Ripka 2006).

***Typhlodromus (Typhlodromus) pyri* Scheuten, 1857**

Material examined. M7, Táska, linden.

Remarks. This species occurs in Europe, Middle-East, North-America, Australia, and New Zealand (Moraes *et al*. 2004).

***Typhlodromus* (*Typhlodromus*) *tiliae* Oudemans, 1929**

Material examined. M0, Alacska, linden; M1, Óbarok, hornbeam; M5, Örkény, hornbeam; M7, Budaörs, unknown plant.

Remarks. Widely distributed species; reported from Europe, Asia, and North-America (Moraes *et al*. 2004).

***Typhloseiulus peculiaris* (Kolodochka, 1980)**

Material examined. M1, Óbarok, oak.

Remarks. T. peculiaris was foundso far only in Moldova, Iran (Faraji *et al*. 2007) and Greece (Papadoulis & Emmanouel 1993; Papadoulis *et al.* 2009). This is the first Hungarian record.

Description of *Typhloseiulus peculiaris* (Kolodochka, 1980) from Hungary

***Typhloseiulus peculiaris* (Kolodochka, 1980)**

Seiulus peculiaris Kolodochka, 1980: 41

Typhlodromus peculiaris (Kolodochka, 1980): Chant & Yoshida-Shaul 1983: 1150.

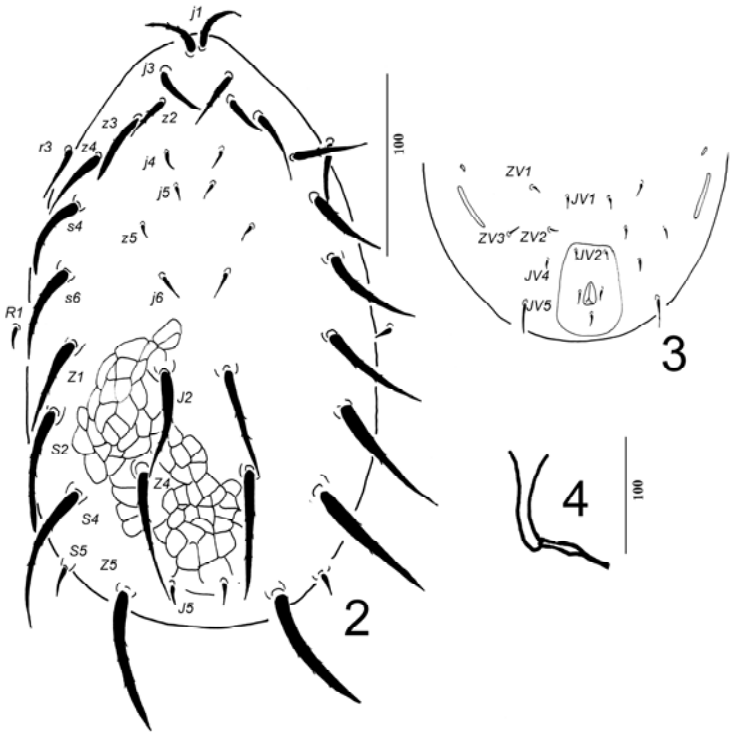
Typhloseiulus peculiaris (Kolodochka, 1980): Chant & McMurtry 1994: 246. Faraji *et al*. 2007: 231–233.

Material examined. Two females, Hungary, Óbarok rest station in highway M1, from leaves of oak, 08.V.2013. leg. B. Kiss. Three females, Hungary, Óbarok rest station in highway M1, from leaves of oak, 20.IX.2013. leg. A. Karap & B. Kiss.

Short description. Dorsal shield covered by reticulate sculptural pattern. Dorsal setae j4 (14–15), j5 (8–10), z5 (8–10), j6 (18–20), S5 (19–20), J5 (8–10) and R1 (13–15) short, smooth and needle-like. Other setae on dorsal body long, robust and finely pilose, except setae r3 (39–40), which smooth and shorter (Fig. 2). Length of other dorsal setae as follows: j1 and j3 38–40, z2 33–35, z3 50–52, z4 50–52, s4 58–60, s6 65–67, Z1 68–70, S2 83–85, S4 102–105, Z5 101–103. Apical part of peritremes reaching to setae j1. Ventrianal shield oblong, bearing setae JV2 and one pair of adanal setae and one postanal seta. JV5 setae longer than other ventral setae (Fig. 3). Spermatheca with long and narrow calyx (Fig. 4).

Notes to the Hungarian specimens. The specimens found are similar to the Iranian one in the shape of the spermatheca (Faraji *et al*. 2007), but the mentioned light ornamentation on sternal and ventrianal shields are missing in the Hungarian specimens.

Remarks. *Typhloseiulus simplex* (Chant, 1956) is the only *Typhloseiulus* Chant & McMurtry, 1994 species reported from Hungary before our study (Ripka 2006, Ripka *et al*. 2013). The two species differ from each other in the following characters: setae J2 are more than four times longer than setae j6, and setae J2 reach to the basis of setae Z4 in the species *T. peculiaris*, in contrast, the setae J2 are only twice longer than setae j6 and setae J2 do not reach to the basis of setae Z4 in *T. simplex*.



Figures 2–4. *Typhloseiulus peculiaris* (Kolodochka, 1980). 2 = dorsal shield, 3 = ventrianal region, 4 = spermatheca.

DISCUSSION

15 phytoseiid species were recorded from the rest stations of the Hungarian highways, which represent *ca*. 20% of the phytoseiid species so far reported from Hungary (Ripka 2006). Seven species were collected from the area of the ring highway around Budapest (M0), ten species from north-western highway (M1), 6–6 species from the north-eastern and the south-eastern highway (M3 and M5), five species from the south-western highway (M7) and two species from the newly constructed central southern highway (M6). The highway M1 and the sections of M3 and M7 close to Budapest are the oldest highways in Hungary, the plantations of their rest stations started several decades ago. In contrary, the highways M0 and M6 are newly built and several parts of the highways M3, M5 and M7 (primarily the parts far from Budapest) are established in the last decade, therefore higher and older trees can only be found in rest stations close to Budapest. On the contrary, we found small and young trees along the newly built sections. In conesquence, the lowest number (2 species) of phytoseiids was observed along the M6 highway which is the most recently built.

The most common species in the area of the Hungarian highways is *E. finlandicus*; it was collected on several different host plants. This species is very frequent in Hungary both in natural and agricultural environments as well.

The species *K. aberrans, N. aceri, Ph. macropilis, T. (A.) recki* and *T. (T.) tiliae* were found in several rest stations of the highways. The other species were found only one-two rest stations. The species *K. corylosus* was found only on leaves of hazelnut trees or bushes in four different places. It seems this species has a preference for the hazelnut trees. *K. corylosus* has only recently been reported from Hungary (Ripka & Szabó 2010), but probably occurs everywhere together with its host plant. Due to the difficulty in identification of *K. corylosus*, numerous earlier Hungarian data of *K. aberrans* can be misidentification of *K. corylosus*.

The newly recorded species *T. peculiaris* and the rare *T. (A.) intercalaris* were collected near Óbarok (highway M1) where the rest station is surrounded by forested area. Kozár (2009) mentioned that the same sampling place was among the most species reach localities of Hungarian highways for scale insects also. *T. peculiaris* was observed on leaves of oak, similarly to the Iranian specimen, which was found on the same tree species (Faraji *et al*. 2007).

Most of the species found possess Holarctic, Palearctic or European distribution patterns. Only four species *K. corylosus, T. peculiaris, T (A.) intercalaris* and *T. (A.) recki*, are perhaps of Mediterranean distribution, colonized the Carpathian Basin from the nearby glacial refuges (Italy and Balkan Peninsula) or using an alternative colonization way from the Northern part of the Black Sea.

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