

Orijinal araştırma (Original article)

Re-descriptions of *Neoseiulus reductus* (Wainstein) and *Typhlodromus (Anthoseius) caucasicus* (Abbasova) (Acarı: Phytoseiidae) from Turkey

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Türkiye'den *Neoseiulus reductus* (Wainstein) ve *Typhlodromus (Anthoseius) caucasicus*'un (Abbasova) (Acarı: Phytoseiidae) yeniden tanımları

Öz: *Typhlodromus (Anthoseius) caucasicus* (Abbasova) ve *Neoseiulus reductus* (Wainstein) (Acarı: Phytoseiidae), Tokat Gökal platosundaki çilek bitkilerinden (1450m yüksekte) toplanan örneklerde göre yeniden tanımlanmış ve çizimleri verilmiştir. *Typhlodromus (A.) caucasicus*, Türkiye akar faunası için yeni kayıt niteliğindedir. Ek olarak, bu çalışmada *N. reductus* bireyleri üzerinde yapılan incelemeler, orijinal ve bazı yeniden tanımların aksine bu türün dorsal plakasının ağısı yapıda olduğunu göstermektedir. Ayrıca, bu türün Türkiye'den daha önce yapılan bazı çalışmalarda *N. cucumeris* (Oudemans) olarak bildirilmiş olabileceği düşünülmektedir. Peritremelerin göreceli uzunluğu ve pre-anal solenotomların şekli, *N. reductus* ve *N. cucumeris* arasındaki farklar arasındadır. Bu çalışmada sunulan yeniden tanımlamalar, *N. reductus* ve *T. (A.) caucasicus*'un doğru teşhis edilebilmeleri açısından önemlidir.

Anahtar kelimeler: Fauna, yeni kayıt, çilek, biyolojik mücadele, morfoloji

Abstract: Two predatory mite species, *Typhlodromus (Anthoseius) caucasicus* (Abbasova) and *Neoseiulus reductus* (Wainstein) (Acarı: Phytoseiidae) are re-described and illustrated, based on specimens collected from strawberry plants on Gökal Plateau at 1450 meters above sea level in Tokat Province, Turkey. *Typhlodromus (A.) caucasicus* is a new record for the Turkish mite fauna. In addition, our examination revealed that *N. reductus* has a reticulated dorsal shield, as opposed to a smooth dorsal shield in its original description and in some re-descriptions. Apparently, the reticulation on the dorsal shield was not taken into consideration in some of the previous descriptions. Furthermore, this species may have been reported as *N. cucumeris* (Oudemans) in some previous studies from Turkey. The relative length of peritremes and the shape of pre-anal solenotomes are among the differences between *N. reductus* and *N. cucumeris*. The re-descriptions provided in this study are important for the further diagnosis of *N. reductus* and *T. (A.) caucasicus*.

Keywords: fauna, new record, strawberry, biological control, morphology

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Introduction

Predatory mites belonging to the family Phytoseiidae (Acari: Parasitiformes: Mesostigmata) are of great importance for the biological control of spider mites, thrips and whiteflies (Papadoulis et al., 2009; McMurtry et al., 2013). More than 2500 species (including synonyms) of phytoseiid mites belonging to three subfamilies and 94 genera are currently known globally (Demite et al., 2020). In Turkey, recent faunistic studies that focused on native phytoseiid species reported the presence of about 110 species belonging to 21 genera (Cobanoglu, 2002; Yanar & Ecevit, 2005; Kasap & Cobanoğlu, 2009; Faraji et al., 2011; Akyazi et al., 2016; Doker et al., 2017; 2019; Cobanoglu et al., 2018; Doker, 2018; Cakir et al., 2020; Ersin et al., 2020). In this study, *Typhlodromus (Anthoseius) caucasicus* (Abbasova) and *Neoseiulus reductus* (Wainstein) are re-described and illustrated, based on specimens collected from strawberry plants on Gökal Plateau in Tokat Province, Turkey.

Material and methods

Leaf samples were collected from strawberry plants in Gökal Plateau at 1450 meters above sea level in Tokat Province, Turkey. Mites were extracted by using a Berlese-Tullgren funnel and stored in 70% ethyl alcohol. The mites were mounted in Hoyer's medium on microscope slides. Examinations were conducted by using an Olympus® CX-41 microscope. Illustrations were prepared by using a U-Da drawing attachment (Camera Lucida). The taxonomic system used follows Chant & McMurtry (2007). The setal nomenclature used follows Lindquist and Evans (1965), as adapted by Rowell et al. (1978). The dorsal and ventral setal pattern is that of Chant & Yoshida-Shaul (1989; 1991; 1992). Measurements are given in micrometers. The identification of species and illustrations were done by the third author. The examined specimens are deposited in the mite collection of the Acarology Laboratory, Cukurova University, Adana, Turkey.

Results and discussion

Re-descriptions

***Neoseiulus reductus* (Wainstein)**
(Figure 1–5)

Amblyseius (Amblyseius) reductus Wainstein 1962: 235.

Female (n=2).

Dorsum (Figure 1). Dorsal setal pattern 10A:9B (*r3* and *R1* off shield). Dorsal shield, sclerotized, oval with a slight waist at level of *Z1*, reticulated. Bearing five pairs of solenostomes (*gd1*, *gd2*, *gd6*, *gd8* and *gd9*). Muscle-marks (sigilla) visible on podosoma, length of dorsal shield 300–310, width 163–168 at level of *s4*, width 178–180 at level of *S2*. All dorsal setae smooth, except *Z4* and *Z5*, which are slightly serrated. Measurements of dorsal setae as follows: *j1* 25–28, *j3* 35–38, *j4* 23–25, *j5*

18–20, j_6 23, J_2 25, J_5 10, z_2 33–35, z_4 35–38, z_5 20, Z_1 25–28, Z_4 48–50, Z_5 60, s_4 45–50, S_2 40–43, S_4 33–35, S_5 30, r_3 25–30, and R_1 23–25.

Peritreme. Extending to level of between setae j_3 – z_2 .

Venter (Figure 2). Ventral setal pattern 14:JV–3:ZV. Sternal shield smooth, slightly sclerotized with three pairs of setae (ST_1 , ST_2 , ST_3), two pairs of poroids (pst_1 and pst_2). Distance (ST_1 – ST_3) 63, width (ST_2 – ST_2) 60. Metasternal setae ST_4 and a pair of pores (pst_3) on metasternal shields. Genital shield smooth; width at level of genital setae (ST_5) 58. Ventrianal shield reticulated, bearing three pairs of pre-anal setae (JV_1 , JV_2 , and ZV_2), a pair of para-anal (Pa) and a post-anal setae (Pst), and with a pair of crescentic solenostomes (gv_3) posteromedian to JV_2 ; distance gv_3 – gv_3 18. Length of ventrianal shield 110–113, width at level of ZV_2 75–80, width at level of anus 65–70. Setae JV_4 , JV_5 , ZV_1 , ZV_3 , and five pairs of poroids on integument surrounding ventrianal shield. Setae JV_5 smooth, much longer than other ventral setae, 38–40 in length.

Chelicera (Figure 3). Fixed digit 25 long with four teeth with *pilus dentilis*; movable digit 28 long with one tooth.

Spermatheca (Figure 4). Calyx saccular, elongated, flaring distally, 18–20 in length; atrium nodular not enlarged, joined to calyx by a very short neck; major duct as wide as atrium; minor duct visible.

Legs (Figure 5). Length of legs (base of coxae to base of claws) as follows: leg I 310–315, leg II 240–245, leg III 230–240, leg IV 305–310. Genua II, III, and IV eight, seven and seven setae, respectively. Leg IV with three sharp pointed macrosetae. Measurements of macrosetae as follows: $SgeIV$ 25, $StiIV$ 25 and $StIV$ 40–43.

Male. Not collected in this study.

Material examined. Two females, Erbaa district, Gökal Plateau (1450 m above sea level), Tokat Province, collected from cultivated strawberry plants infested with two-spotted spidermite, *Tetranychus urticae* Koch (Acari: Tetranychidae), July 28, 2017.

World Distribution. Denmark, Finland, France, Georgia, Germany, Hungary, Iran, Italy, Kazakhstan, Latvia, Moldova, Poland, Russia, Serbia, Slovakia, Slovenia, Ukraine (Demite et al., 2020), Turkey (Inak et al., 2020), and this study.

Remarks

Neoseiulus reductus was reported recently by Inak et al. (2020), based on specimens collected from an unknown host in Bolu Province, Turkey. Our examinations of the current specimens show some differences when compared to the re-description by Inak et al. (2020). For example, our specimens have a reticulated dorsal shield and three macrosetae on leg IV as opposed to a smooth dorsal shield and only one macroseta on leg IV in Inak et al. (2020). The three macrosetae are clearly illustrated by Kolodochka (1978) whereas the reticulated dorsal shield was only simply illustrated by Beglyarov (1981) and is not included in the other re-descriptions (Wainstein, 1962; Arutunjan, 1977; Kolodochka, 1978; Miedema, 1987; Inak et al., 2020). This species is very close to *N. cucumeris* (Oudemans) which is also known from the Turkish fauna (Ozman & Cobanoglu, 2001; Akyazi & Ecevit, 2003).

Neoseiulus reductus and Typhlodromus (Anthoseius) caucasicus in Turkey

However, *N. cucumeris* has small rounded preanal solenostomes and long peritremes (extending to the level of *j1–j3*), as opposed to crescentic preanal solenostomes and shorter peritremes extending to the level of *j3–z2*) in *N. reductus* (Kolodochka, 1978; Papadoulis et al., 2009). Based on the abovementioned evidences, we assumed that *N. reductus* might have been reported as *N. cucumeris* in Turkey. For example, Akyol (2019) reported *N. cucumeris* based on a single specimen collected from an apple tree in Ordu Province, a location very close to where our *N. reductus* specimens were collected. Akyol (2019) provided a photo of the ventrianal shield in which crescentic solenostomes are clearly visible (page 152, Fig. 4.105). For all the reasons mentioned above, this species is re-described and illustrated for further diagnosis.

Typhlodromus (Anthoseius) caucasicus

(Figure 6–10)

Mumaseius caucasicus Abbasova, 1970: 47.

Female (n=1).

Dorsum (Figure 6). Dorsal setal pattern 12A:8A (*r3* and *R1* off shield). Dorsal shield oval with waist at level of *R1*, sclerotized, strongly sculptured and bearing five pairs of large solenostomes (*gd2*, *gd4*, *gd6*, *gd8* and *gd9*). Length of dorsal shield 360, width 188 at level of *s4*, width 208 at level of *S2*. All dorsal setae smooth except *Z5* which are slightly serrated. Dorsal setae *j1*, *j6*, *J2*, *s4*, *s6*, *S2*, *S4*, *S5*, *Z4*, *Z5*, and *r3* arising on very small tubercles. Measurements of dorsal setae as follows: *j1* 22, *j3* 23, *j4* 15, *j5* 15, *j6* 18, *J2* 22, *J5* 13, *z2* 18, *z3* 23, *z4* 23, *z5* 20, *Z4* 30, *Z5* 50, *s4* 23, *s6* 25, *S2* 28, *S4* 30, *S5* 28, *r3* 25, and *R1* 23.

Peritreme. Extending to level of setae *j1*.

Venter (Figure 7). Ventral setal pattern 15:JV–3:ZV. Sternal shield smooth, slightly sclerotized with two pairs of setae (*ST1* and *ST2*), two pairs of poroids (*pst1* and *pst2*). Distance (*ST1–ST2*) 33, width (*ST2–ST2*) 63. Setae *ST3* are free on integument, metasternal setae *ST4* and a pair of pores (*pst3*) on metasternal shields. Genital shield smooth; width at level of genital setae (*ST5*) 65. Ventrianal shield smooth, bearing four pairs of pre-anal setae (*JV1*, *JV2*, *JV3* and *ZV2*), a pair of para-anal (*Pa*) and post-anal setae (*Pst*), and with a pair of rounded solenostomes (*gv3*) posteromedian to *JV2*; distance *gv3–gv3* 13. Length of ventrianal shield 113, width at level of *ZV2* 90, width at level of anus 80. Setae *JV4*, *JV5*, *ZV1*, *ZV3*, and five pairs of poroids on integument surrounding ventrianal shield. Setae *JV5* smooth, arising on tubercles, much longer than other ventral setae, 33 in length.

Chelicera (Figure 8). Fixed digit 28 long with three teeth with *pilus dentilis*; movable digit 25 long with two teeth.

Spermatheca (Figure 9). Calyx saccular, flaring distally, 18 in length; atrium nodular not enlarged, directly attached to the calyx without neck; major as wide as atrium; minor duct not visible.

Legs (Figure 10). Length of legs (base of coxae to base of claws) as follows: leg I 328, leg II 288, leg III 268, leg IV 370. Genua II, III, and IV each with seven setae. Leg IV with one macroseta arising on very small tubercles *StIV* 30 in length. Genu

and tibia IV also have some setae arising on tubercles but they are not distinctly different from other setae on the same segment.

Male. Not collected in this study.

Material examined. A female specimen, Erbaa district, Gökal Plateau (1450 m above sea level), Tokat Province, collected from cultivated strawberry plants infested with *T. urticae*, July 9, 2018.

World Distribution. Azerbaijan, Georgia, Italy, Norway, Sweden, Ukraine (Demite et al., 2020) and Turkey (this study).

Remarks

This is the first report of *T. (A.) caucasicus* from Turkey. Morphological characters and measurements of the Turkish specimen are very close to those of the original description and re-descriptions (Abbasova, 1970; Arutunjan, 1977; Evans & Edland, 1988; Tixier et al., 2019). Tixier et al. (2019) collected and illustrated this species in France and depicted the dorsal shield as reticulated. However, our examination of this Turkish specimen showed a strongly sculptured pattern on the dorsal shield, as illustrated in the original description.

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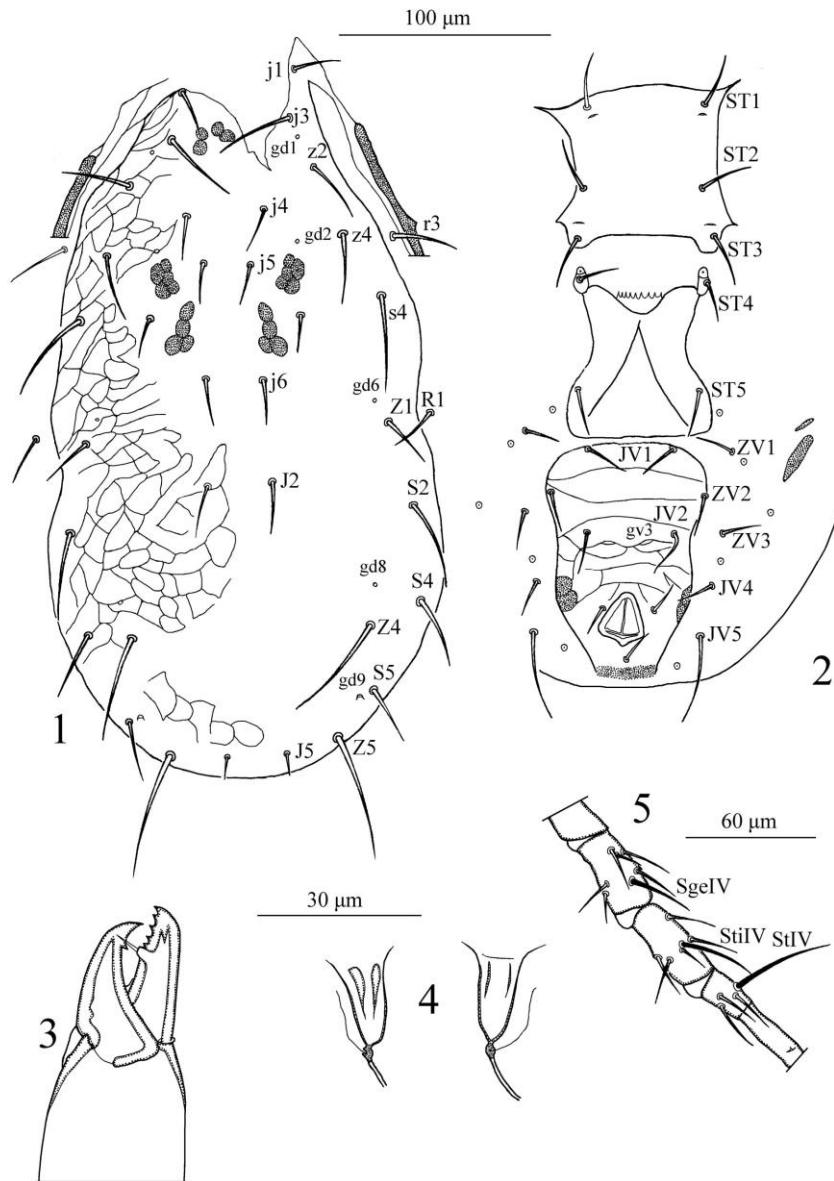


Figure 1–5. *Neoseiulus reductus* (Wainstein), female: 1. Dorsal shield; 2. Ventral idiosoma; 3. Chelicera; 4. Spermatheca; 5. Leg IV. Scale bars = 100 µm for 1, 2; 30 µm for 3, 4; 60 µm for 5.

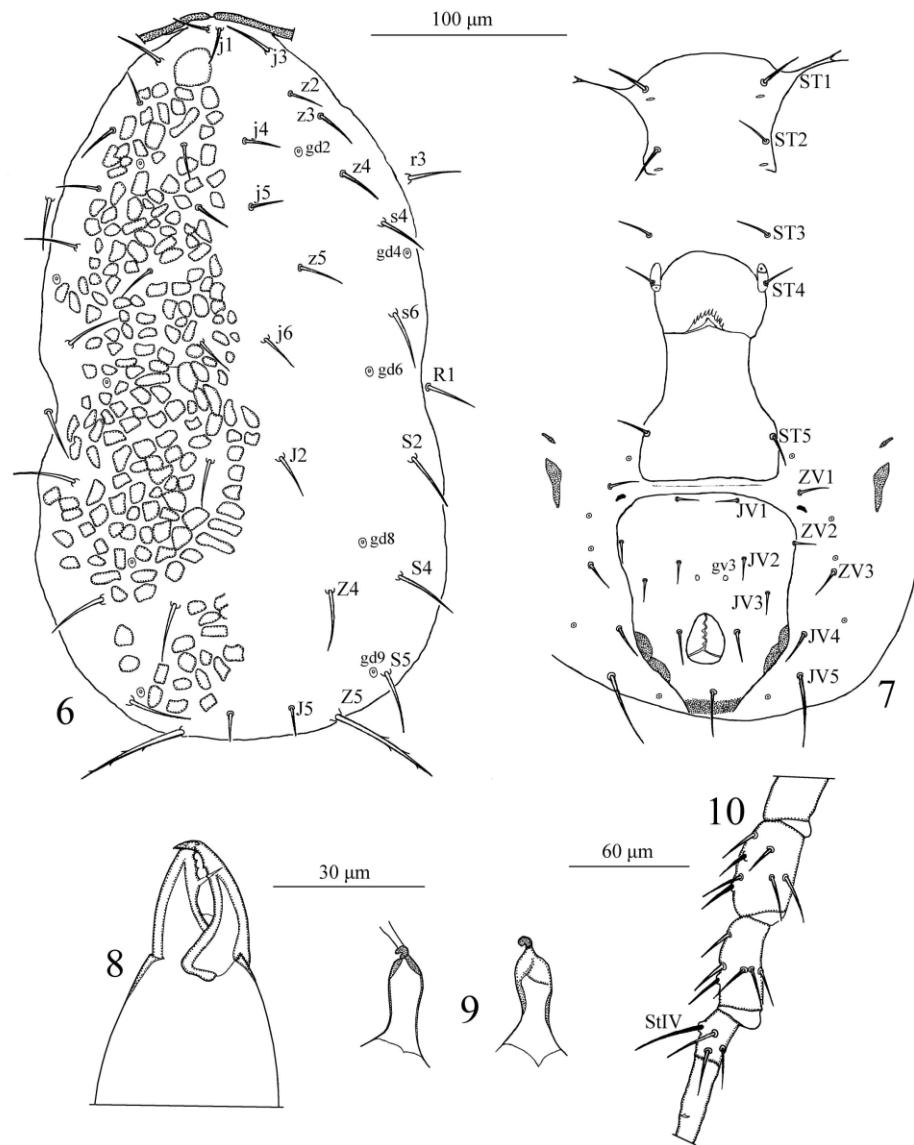


Figure 6–10. *Typhlodromus (Anthoseius) caucasicus* (Abbasova), female: 6. Dorsal shield; 7. Ventral idiosoma; 8. Chelicera; 9. Spermatheca; 10. Leg IV. Scale bars = 100 µm for 6, 7; 30 µm for 8, 9; 60 µm for 10.