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## The new distribution of *Amblyseius herbicolus* in Turkey (Parasitiformes, Phytoseiidae) with a key of *Amblyseius* species found in Turkey

Rana AKYAZI<sup>1\*</sup>, Edward A. UECKERMANN<sup>2,3</sup> and Mete SOYSAL<sup>1</sup>

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<sup>1</sup> Department of Plant Protection, Faculty of Agriculture, University of Ordu, 52200 Ordu, Turkey. [metesoysal06@gmail.com](mailto:metesoysal06@gmail.com), [ranainak@hotmail.com](mailto:ranainak@hotmail.com) (\*Corresponding author)

<sup>2</sup> ARC-PPRI, Private Bag X134, Queenswood, Pretoria 0121, South Africa.

<sup>3</sup> School of Biological Sciences/Zoology, North-West University, Potchefstroom Campus 2520, South Africa. [UeckermannE@arc.agric.za](mailto:UeckermannE@arc.agric.za)

**ABSTRACT** — *Amblyseius herbicolus* Chant, 1959 (Mesostigmata: Phytoseiidae) is reported for the first time in Ordu province (Sea side, Black Sea Region), Turkey. The specimens were collected from persimmon trees (*Diospyros kaki* Thunb., *Diospyros lotus* L.) infested with tenuipalpid and tydeid mites in Altınordu and Perşembe, Ordu Province, Turkey.

**KEYWORDS** — *Amblyseius herbicolus*; Predatory mite; Phytoseiidae; Ordu; Turkey

### INTRODUCTION

Phytoseiid mites are generally considered to be important biological control agents of pest mites on many crops world-wide. According to the second version of the world phytoseiid catalog, there were 2243 phytoseiid species (Moraes *et al.* 2004). However, 2692 phytoseiid species were listed by a most recent catalog (Prasad 2012). In September 2012, the first version of an electronic database for phytoseiid mites of the world was released listing 2735 species till November 2015 (Demite *et al.* 2014, 2015). Amblyseiinae is the largest subfamily with 1748 species and 65 genera. The type genus of this subfamily, *Amblyseius* contains 400 species (Demite *et al.* 2014, 2015). Prior to this study, Faraji *et al.* (2011) reported a total of 62 phytoseiid species for the Turkish fauna. Six of these species belong to the genus *Amblyseius* Berlese, 1914. Döker *et al.* (2014) added one more species of this genus to the Turkish fauna.

This paper reports *A. herbicolus* as a new record of phytoseiid mites belonging to the genus *Amblyseius* from Turkey. Additionally, measurements (in  $\mu\text{m}$ ) of the Turkish specimens (only the range), the information regarding collection details, habitats, hosts and world distribution are also presented in this paper.

### MATERIAL AND METHOD

Leaf samples were collected from the Ordu province in the Black sea region of Turkey. Details of geographical coordinates were recorded using a GPS mobile device. The localities where *A. herbicolus* was found were marked on the map of Ordu using the Google Earth Tool. The samples taken from different regions were placed in plastic bags, labeled, and brought to the laboratory. Specimens were preserved in vials containing 70 % ethanol,

cleared in Lacto-phenol and mounted in Hoyer on microscope slides and dried in an oven at 50°C.

## RESULTS

New record for the Turkish mite fauna

**Family Phytoseiidae Berlese**  
**Subfamily Amblyseiinae Muma**  
**Genus *Amblyseius* Berlese**  
***Amblyseius herbicolus* Chant**

*Amblyseius herbicolus* Chant, 1959: 84.

Senior synonyms:

*Amblyseius amitae* Bhattacharyya (Denmark and Muma, 1989)

*Amblyseius deleoni* Muma and Denmark (Daneshvar and Denmark, 1982)

*Amblyseius deleoni* Muma and Denmark (Denmark and Muma, 1989)

*Amblyseius giganticus* Gupta (Gupta, 1986)

*Amblyseius impactus* Chaudhri, 1968 (Daneshvar and Denmark, 1982)

Previously known as: (Moraes *et al.*, 2004; Prasad, 2012)

*Typhlodromus (Amblyseius) herbicolus* (original designation) (Chant, 1959)

*Amblyseius (Amblyseius) herbicolus* (Muma, 1961)

*Typhlodromus herbicolus* (Hirschmann, 1962)

Material examined — Ordu: Central, 40°58'14.84"N, 37°59'13.31"E, 85m above sea level, 27 June 2012, 1♀; 04 July 2012, 4♀; 01 August 2012, 2♀; 04 July 2012, 1♀; 11 July 2012 1♀, on *Diospyros kaki* Thunb. (Ebenaceae).

Ordu: Perşembe, 41° 3'6.12"N, 37°46'22.86"E, 4m above sea level, 05 September 2012, 1 ♀, on *Diospyros kaki* Thunb. (Ebenaceae).

Ordu: Perşembe, 41° 1'27.30"N, 37°47'8.70"E, 13m above sea level, 05 September 2012, 1 ♀, on *Diospyros lotus* L. (Ebenaceae).

### Description

Female (n = 3)

Dorsum (Figure 1) — Dorsal setal pattern 10A:9B (r3 and R1 off shield). Dorsal shield oval

smooth, with scattered muscle-marks (sigilla), bearing 6 pairs of small solenostomes, length of dorsal shield (j1-J5) 313 – 352, width (distance between bases of s4) 196 – 221; dorsal setae smooth, except for setae Z4 and Z5 which are faintly serrate, measurements of setae as follows: j1 33 – 38, j3 32 – 39, j4 8 – 9, j5 7 – 8, j6 6 – 7, J2 8 – 9, J5 9 – 10, z2 9 – 12, z4 8 – 12, z5 6 – 7, Z1 9 – 12, Z4 91 – 99, Z5 220 – 251, s4 86 – 96, S2 10 – 12, S4 9 – 11, S5 9 – 10, r3 10 – 16, R1 8 – 9, JV5 50 – 55. Peritreme extending anterior to setae j1.

Venter (Figure 2A) — Ventral setal pattern 14: JV-3: ZV. Sternal shield smooth, with 3 pairs of setae (ST1, ST2, and ST3) and 2 pairs of solenostomes (pst1 and pst2); length (ST1-ST3) 64 – 69, width (distance between setae ST2) 70 – 73; metasternal setae ST4 and a pair of solenostomes (pst3) on metasternal shields. Genital shield smooth; width at level of genital setae (ST5-ST5) 58 – 64. Ventrianal shield vase-shaped, with 3 pairs of preanal setae (JV1, JV2, and ZV2), anal setae (a1, a2, and a3), one pair of small solenostomes closely associated with setae JV2 and situated directly posterior to it. Length of ventrianal shield 102 – 117, width (ZV2-ZV2) 44 – 48, width at level of anal opening 61 – 69. Setae JV4, JV5, ZV1, ZV3, and 4 pairs of solenostomes on integument surrounding ventrianal shield. Seta JV5 smooth, 51 – 60 in length.

Chelicerae (Figure 2B) — Fixed digit 29-36 long with 12 teeth and pilus dentilis; movable digit 31 – 33 long with 4 teeth.

Legs (Figure 2C) — Length of legs (base of coxae to base of ambulacrum) as follows: leg I 380 – 409; leg II 301 – 315; leg III 300 – 335; leg IV 368 – 424. GeII, GeIII, and GeIV with 7, 7, and 7 setae, respectively. Leg IV with 3 macrosetae, SgeIV 98 – 128, StiIV 75 – 89 and StIV 63 – 70. Leg III also with 3 macrosetae, SgeIII 41 – 46, StiIII 33 – 40 and StIII 30 – 32. Legs II and I with one macroseta each, Sge II 34 – 39 and Sge I 40 – 48.

Spermatheca (Figure 3) — Calyx fundibular, 24-32 long, atrium wafer-like and nodular major duct long, minor duct not visible.

Male: Unknown.

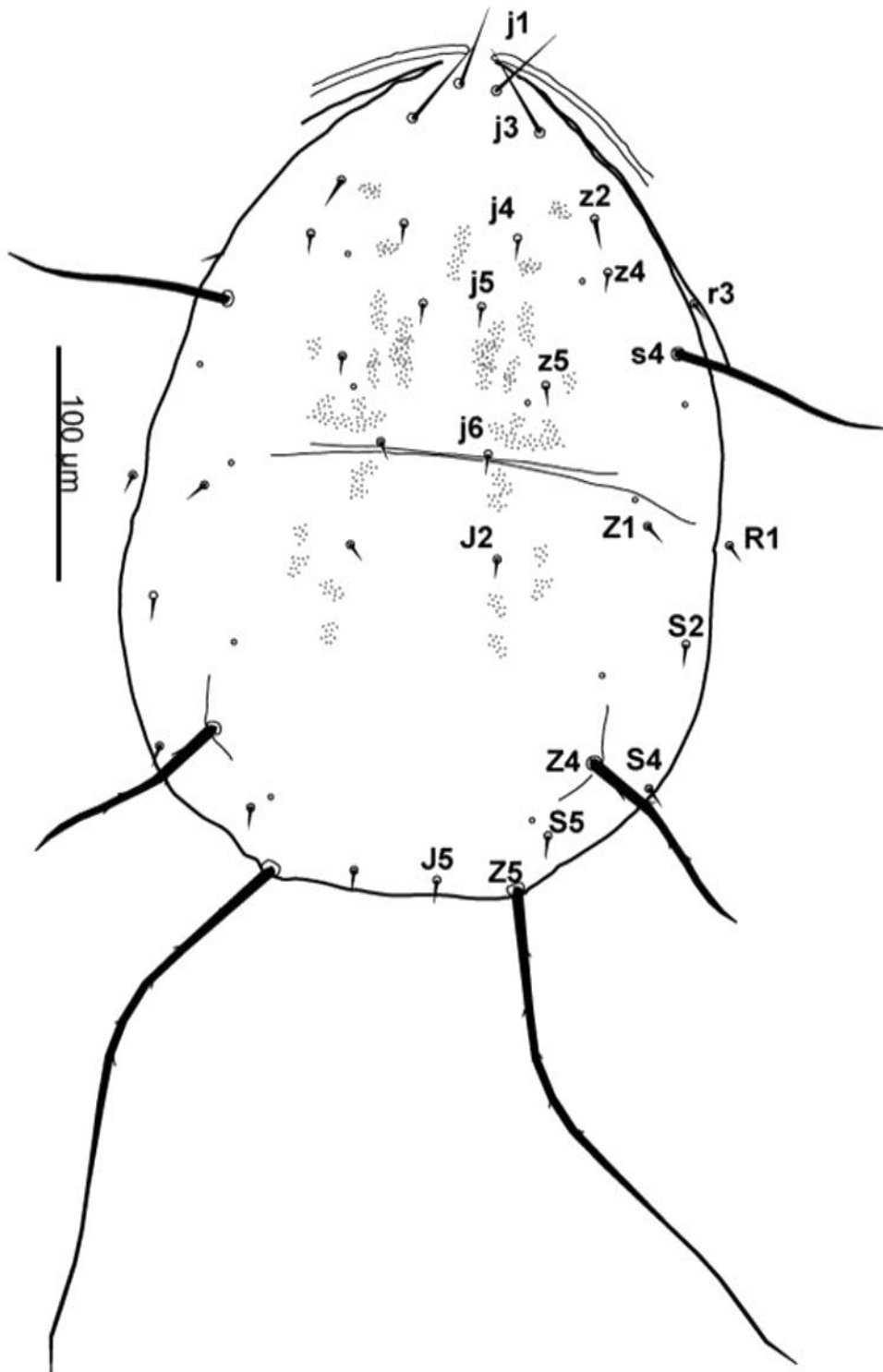


FIGURE 1: *Amblyseius herbicolus* Chant, Female: Dorsal view

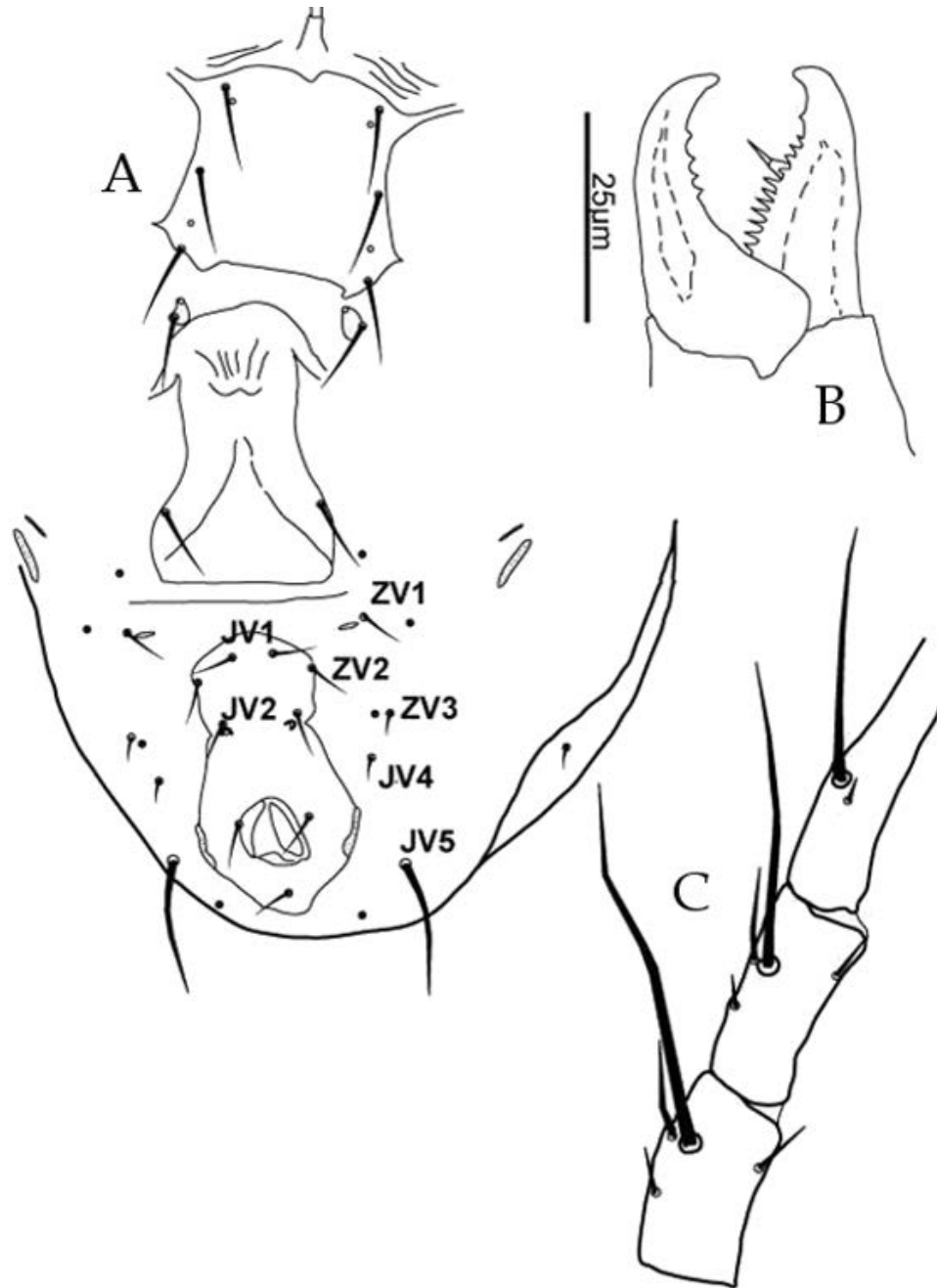


FIGURE 2: *Amblyseius herbicolus* Chant, Female: A – Venter; B – Chelicerae; C – Leg IV

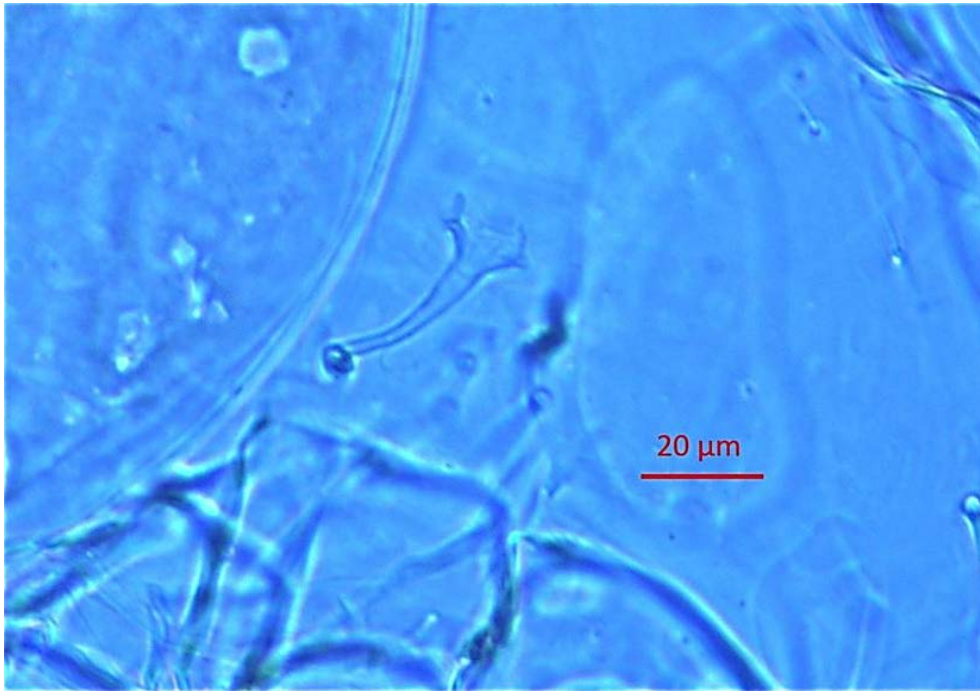


FIGURE 3: Funnel shaped spermatheca in *Amblyseius herbicolus*



FIGURE 4: Tube-shaped spermatheca in *Amblyseius largoensis*

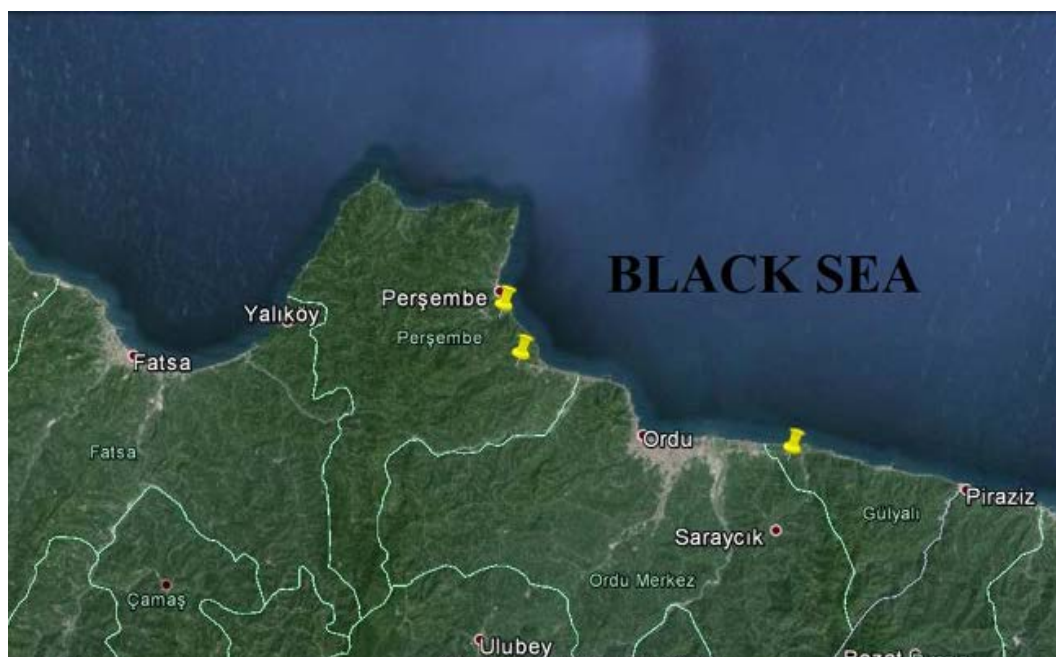


FIGURE 5: Localities in Ordu province (Black Sea Region), Turkey where *Amblyseius herbiocolus* were collected.

**Remarks**

The Turkish specimens actually perfectly fit the re-description of Denmark and Muma (1989). It is only setae s4 which is 4 microns shorter than that in the re-description and setae Z4 which are 10 micron shorter.

This species close resembles *A. largoensis* (Muma) in general appearance. However, it differs from the latter in having the calyx of the spermatheca fundibular instead of tubular, the atrium wafer-like nodular oppose to only nodular (Collyer 1982, Denmark and Muma 1989) (Figure 4), the preanal solenostomes of the ventrianal shield are posterior to setae JV2 and closely associated with these setae, whereas posteromedially to JV2 in *A. largoensis*; the movable cheliceral digit bears 4 teeth but 3 in *A. largoensis*. *A. herbiocolus* can further be distinguished from *A. largoensis* in that seta Z5 is 220 – 225 long opposed to about 206 in *A. largoensis*. All these features are present in the Turkish specimens of *A. herbiocolus*.

**Distribution**

This species is mainly reported from Southern Hemisphere (Africa, South America, South Asia

and Australasian region. It was reported from the following countries: Argentina, Australia (Queensland), Benin, Brazil, Amapa, Bahia, Minas Gerais, Parana Pernambuco, Rio Grande Do Norte, Rio Grande Do Sul, Roraima, Sao Paulo, Burundi, Canary Islands, China (Fujian; Wuling Mountain Region), Colombia, Costa Rica, Dominican Republic, Dr Congo, El Salvador, Ghana, Guadeloupe, Guatemala, Hawaii, Honduras, India, Arunachal Pradesh, Kerala, Tripura, West Bengal, Iran, Kenya, Les Saintes, Malawi, Malaysia, Martinique, New Caledonia, Papua New Guinea, Peru, Philippines, Portugal, Puerto Rico, Reunion islands, Rwanda, Senegal, Singapore, South Africa, Spain, Taiwan, Thailand, USA, Venezuela, West Indies (Demite *et al.* 2015).

**Key to species of the genus *Amblyseius* Berlese in Turkey based on adult females (based on Döker *et al.*, 2014)**

- 1. Ventrianal shield vase-shaped ..... 2
- Ventrianal shield not vase-shaped ..... 3
  
- 2. Calyx of spermatheca tubular ..... *A. largoensis* (Muma)

— Calyx of spermatheca fundibular . . . *A. herbicolus*  
Chant

3. Seta Z5 longer than width of dorsal shield;  
spermatheca with calyx annulated, flared dis-  
tally. . . . . *A. obtusus* (Koch)  
— Seta Z5 shorter than width of dorsal shield; sper-  
matheca with calyx not annulated . . . . . 4

4. Ventrianal shield with large elliptical (cres-  
centshaped) preanal solenostomes. . . . . 5  
— Ventrianal shield with small round preanal  
solenostomes . . . . . 7

5. Dorsal shield reticulated . . . . . *A. bryophilus* Karg  
— Dorsal shield smooth. . . . . 6

6. Seta Z5 102 – 116  $\mu\text{m}$  long; atrium of spermatheca  
relatively long; StiIV at most reaching the insertion  
of StiIV . . . . . *A. swirskii* Athias-Henriot  
— Seta Z5 longer than 150  $\mu\text{m}$ ; atrium of spermathe-  
ca short and c-shaped; StiIV passing well behind  
the insertion of StiIV . . . . . *A. andersoni* (Chant)

7. Seta Z4 almost reaching insertion of seta S4. . . . .  
. . . . . *A. armeniacus* Arutunjan and Ohandjanian  
— Seta Z4 short, less than 1/3 of distance between  
setae Z4 and S . . . . . *A. kadhajai* Gomelauri

## DISCUSSION

*Amblyseius herbicolus* has a world-wide distribution but was not detected during previous surveys carried out in Turkey. During surveys carried out in 2012 in Ordu province, Turkey, *Amblyseius herbicolus* was reported from three localities in Ordu province (Figure 5). It possibly entered the country via Iran, the only neighboring country it was reported from. Surveys in the regions bordering Iran or even Iraq, Armenia, Georgia and Syria may also resulted in new records.

Prior to this study, seven species belonging to the genus *Amblyseius* were recorded for the Turkish fauna. These species are *A. largoensis* (Muma), *A.*

*obtusus* (Koch), *A. swirskii* Athias-Henriot, *A. andersoni* (Chant), *A. armeniacus* Arutunjan and Ohandjanian, *A. kadhajai* Gomelauri (Faraji *et al.* 2011) and *A. bryophilus* Karg. (Döker *et al.* 2014). So, this paper presents the first record of *A. herbicolus* in Turkey.

*Amblyseius herbicolus* was found in association with: *Acaphylla theae* (Watt, 1898) *Calacarus carinatus* (Green 1890), *Phyllocoptura oleivora* (Ashmead 1879), *Tegolophus australis* Keifer 1964 (Prostigmata: Eriophyidae), *Brevipalpus obovatus* Donnadieu 1875, *Brevipalpus phoenicis* (Geijskes 1939) (Prostigmata: Tenuipalpidae), *Eotetranychus sexmaculatus* (Riley, 1890), *Panonychus citri* (McGregor 1916), *Tetranychus desertorum* Banks 1900, *Tetranychus kanzawai* Kishida 1927, *Tetranychus urticae* Koch 1836 (Prostigmata: Tetranychidae), *Tropacarus mumai* Cunliffe 1964 (Astigmata: Acaridae) (Tixier 2013) and *Polyphagotarsonemus latus* (Banks 1904) (Prostigmata: Tarsonemidae) (Rodriguez-Cruz *et al.*, 2013). In this study, the species was collected from persimmon trees, *D. kaki*, *D. lotus*, hosting tenuipalpid and tydeid mites.

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