

# Re-description of the female of *Kampimodromus langei* Wainstein & Arutunjan (Acari: Phytoseiidae) based on normal and abnormal specimens, with the first description of its male

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## Original research

### ABSTRACT

*Kampimodromus langei* Wainstein and Arutunjan (Acari: Phytoseiidae) is reported for the first time for the Turkish fauna. It is re-described and illustrated, based on normal and abnormal female specimens from material collected from *Quercus cerris* L. var. *cerris* (Fagaceae) trees in Samsun Province on the north coast of Turkey. In addition, the male is described for the first time in this study. Our examination of a series of female specimens of *K. langei* showed no remarkable differences compared to its original description and subsequent redescrptions. However, on both sides of a female specimen, we observed an additional dorsal seta inserted at the location of seta *SI* known from other groups of Mesostigmata closely related to phytoseiid mites. The dorsal shield of the abnormal specimen is also illustrated and its setal measurements are provided. To the best of our knowledge of phytoseiids, the extra seta has been reported only for *Typhlodromus* (*Typhlodromus*) *laurae* Wainstein. The possibility of the more rearward location of anterior dorsal setae *z6* and *s6* which is known for some phytoseiid species, as well as the presence of extra seta/e on other species of phytoseiid mites, are also briefly discussed.

**Keywords** Kampimodromini; predatory mite; fauna; new record; abnormality; extra dorsal seta

Received 16 March 2022

Accepted 14 April 2022

Published 19 April 2022

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Academic editor

Faraji, Farid

<https://doi.org/10.24349/d6cm-8rly>

ISSN 0044-586X (print)

ISSN 2107-7207 (electronic)



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## Introduction

The members of the mite genus *Kampimodromus* Nesbitt (Acari: Phytoseiidae) are considered to be Type III generalist predators living on pubescent leaves (McMurtry *et al.* 2013). Among them, *K. aberrans* (Oudemans) is an effective predator of phytophagous mites on a number of crops that include apples, grapes and hazelnuts (Kreiter *et al.* 2000; Kasap 2005; Ozman-Sullivan 2006; Duso *et al.* 2014). Natural populations of some other *Kampimodromus* species such as *K. ericinus* Ragusa di Chiara & Tsolakis, *K. keae* (Papadoulis & Emmanouel), *K. langei* Wainstein & Arutunjan and *K. ragusai* Swirski & Amitai have been reported from *Quercus* spp. trees in some European countries (Ragusa di Chiara and Tsolakis 1994; Tixier *et al.* 2008; Papadoulis *et al.* 2009; Cargnys *et al.* 2012; Doker *et al.* 2017, 2018; Faraji and Hoekstra 2021).

**How to cite this article** Saglam D. *et al.* (2022), Re-description of the female of *Kampimodromus langei* Wainstein & Arutunjan (Acari: Phytoseiidae) based on normal and abnormal specimens, with the first description of its male. *Acarologia* 62(2): 446-453. <https://doi.org/10.24349/d6cm-8rly>

In this study, we report *K. langei* for the first time for Turkish fauna. It is re-described and illustrated, based on normal and abnormal female specimens. Also, the male is described for the first time in this study.

## Material and methods

This study was conducted in 2021 in several remnant oak forests on the Kurupelit campus of Ondokuz Mayıs University in Samsun Province, Turkey. Most of the surveys were done periodically in June, July, August, September and October. Leaves of oak trees were inspected with the aid of a 10X hand magnifying lens and those with phytoseiid mites were collected. The collected leaves were wrapped in paper, placed in a labeled plastic bag and stored in an ice-box until transferred to the laboratory. They were then refrigerated until checked for mites under a stereomicroscope. All of the collected mites were stored in 70% alcohol until cleared in lactophenol and mounted on slides in Hoyer's medium. The slides were then kept in an incubator at 55 °C for one week. The mites were identified and illustrated by the second author. The permanent slides were examined under an Olympus® CX-41 microscope. Illustrations were prepared by using a U-Da drawing attachment (Camera Lucida). The taxonomic system used followed Chant and McMurtry (2007), and the setal nomenclature used followed Lindquist and Evans (1965), as adapted by Rowell *et al.* (1978). The dorsal and ventral setal pattern used was that of Chant and Yoshida-Shaul (1989, 1991, 1992). The nomenclature for solenostomes for the dorsal idiosoma follows that of Athias-Henriot (1975). Leg chaetotaxy follows that of Evans (1963). Measurements are given in micrometers and presented as the mean, followed by the range in parentheses. The examined specimens are deposited in the mite collection of the Acarology Laboratory, Cukurova University, Adana, Turkey.

## New record for Turkey

### *Kampimodromus langei* Wainstein & Arutunjan

(Figures 1, 2)

*Kampimodromus langei* Wainstein & Arutunjan, 1973: 55, Fig. 2.

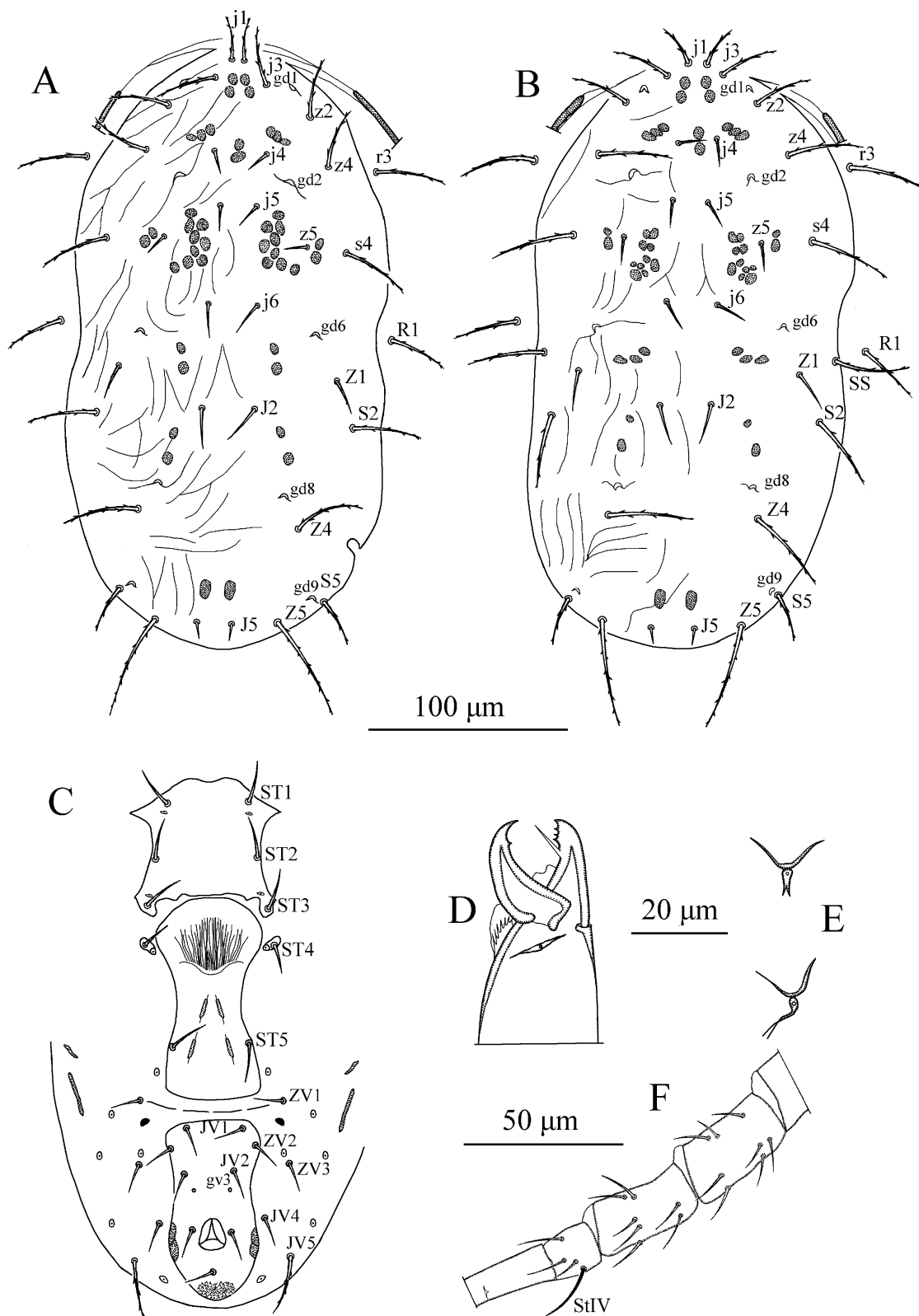
**Diagnosis** — Dorsal setal pattern 10A:8C, one female specimen with extra dorsal seta on both sides, dorsal shield striated, bearing five pairs of large solenostomes (*gd1*, *gd2*, *gd6*, *gd8* and *gd9*). Dorsal setae serrated, except *j4*, *j5*, *j6*, *J2*, *J5* and *Z1* smooth, *J2* and *Z1* with few barbs in some specimens. Peritreme extending to level of seta *z2*. Sternal shield smooth with three pairs of setae, genital shield smooth. Ventrianal shield smooth with three pairs of preanal setae and one pair of rounded pores. Calyx of spermatheca cup-shaped; atrium small, nodular, attached to calyx without neck. Fixed digit with three teeth, and movable digit with one tooth. Genu II and Genu IV each with eight setae, and tibia IV seven setae. Macroseta *StIV* present and with blunt tip. Male dorsal shield reticulated and with setae *r3* and *R1*. Male ventrianal shield striated, with three pairs of setae (*JV1*, *JV2* and *ZV2*), and one specimen had unpaired seta *JV3* on right side. Male spermatodactyl L-shaped with slightly developed toe.

## Re-description

### Female

(n=10)

**Dorsum** — (Figures 1A, B). Dorsal setal pattern 10A:8C (*r3* and *R1* off shield), one specimen with an extra dorsal seta on both sides (*SS* present, identical to location of *S1*). Dorsal shield striated, with waist at level of seta *R1*. A lateral cavity anterior to seta *S5* on right side visible on the illustrated specimen. Bearing five pairs of solenostomes (*gd1*, *gd2*, *gd6*, *gd8*



**Figure 1** *Kampimodromus langei* Wainstein & Arutunjan, 1973 female. A – Dorsal shield of a normal specimen, B – Dorsal shield of the abnormal specimen (with extra seta SS), C – Ventral idiosoma, D – Chelicera, E – Spermathecae, F – Leg IV (genu, tibia and basitarsus). Figures A, C, D, E and F are from the same specimen. Scale bars: 100 µm for Figures A, B and C; 20 µm for D and E, 50 µm for F.

and *gd9*). Muscle marks (sigillae) visible mostly on podosoma; length of dorsal shield 300 (275–310), width (at level of *s4*) 149 (145–153), width (at level of *S2*) 158 (155–160). Dorsal setae serrated, except *j4*, *j5*, *j6*, *J2*, *J5* and *Z1* smooth. Setae *J2* and *Z1* with few barbs in some specimens. Measurements of dorsal setae as follows: *j1* 19 (18–20), *j3* 27 (25–30), *j4* 12 (10–13), *j5* 11 (10–13), *j6* 13 (13–15), *J2* 20 (18–23), *J5* 5 (4–6), *z2* 27 (25–28), *z4* 29 (28–30), *z5* 11 (10–13), *Z1* 18 (15–20), *Z4* 41 (40–43), *Z5* 48 (45–50), *s4* 33 (30–35), *SS* 35 (**only one specimen**), *S2* 38 (35–40), *S5* 19 (18–20), *r3* 38 (35–40) and *R1* 27 (25–30). Peritreme extending to level of seta *z2*.

**Venter** — (Figure 1C). Ventral setal pattern 14: *JV*-3:*ZV*. Sternal shield smooth, lightly sclerotized; with irregular posterior margin, three pairs of setae (*ST1*, *ST2* and *ST3*) and two pairs of pores (*iv1* and *iv2*); length (*ST1*–*ST3*) 56 (55–58), width (*ST2*–*ST2*) 56 (55–58); metasternal setae *ST4* and one pair of pores (*iv3*) on metasternal shields. Genital shield smooth, width at level of genital setae (*ST5*) 44 (43–45). Ventrianal shield elongate, with waist at level of seta *JV2*. Three pairs of pre-anal setae (*JV1*, *JV2* and *ZV2*); and one pair of rounded pores (*gv3*) posteromedian to *JV2*, distance between pre-anal pores 22. One pair of para-anal seta (*Pa*) and unpaired post-anal seta (*Pst*). Length of ventrianal shield 91 (88–95), width at level of setae *ZV2* (widest point) 51 (50–53), at level of anus (at level of muscle marks, widest point) 46 (45–48). Setae *ZV1*, *ZV3*, *JV4* and *JV5* and six pairs of poroids on integument surrounding ventrianal shield. Setae *JV5* serrated, longer than other ventral setae, 27 (25–28) in length.

**Chelicera** — (Figure 1D). Fixed digit 23 (23–25) long with three apical teeth, and pilus dentilis; movable digit 23 (23–25) long, with one tooth.

**Spermatheca** — (Figure 1E). Calyx short, cup-shaped, flaring distally, 8 (8–10) in length. Atrium small, nodular; attached to calyx without neck. Major duct long, minor duct not visible.

**Legs** — (Figure 1F). Length of legs (base of coxae to base of claws): leg I 237 (230–240); leg II 191 (185–195); leg III 174 (168–175); leg IV 222 (215–225). Macrosetae *StIV* blunt tip 18 (18–20) in length. Chaetotaxy as follows: Leg I: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 2 3/1 2/2 2, genu 2 2/1 2/1 2, tibia 2 2/1 2/1 2. Leg II: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 2 3/1 2/1 1, genu 2 2/1 2/0 1, tibia 1 1/1 2/1 1. Leg III: coxa 0 0/1 0/1 0, trochanter 1 0/1 0/2 1, femur 1 2/1 1/0 1, genu 1 2/1 2/0 1, tibia 1 1/1 2/1 1. Leg IV: coxa 0 0/1 0/0 0, trochanter 1 0/1 0/2 1, femur 1 2/1 1/0 1, genu 1 2/1 2/0 2, tibia 1 1/1 2/0 2.

## Male

(n=9)

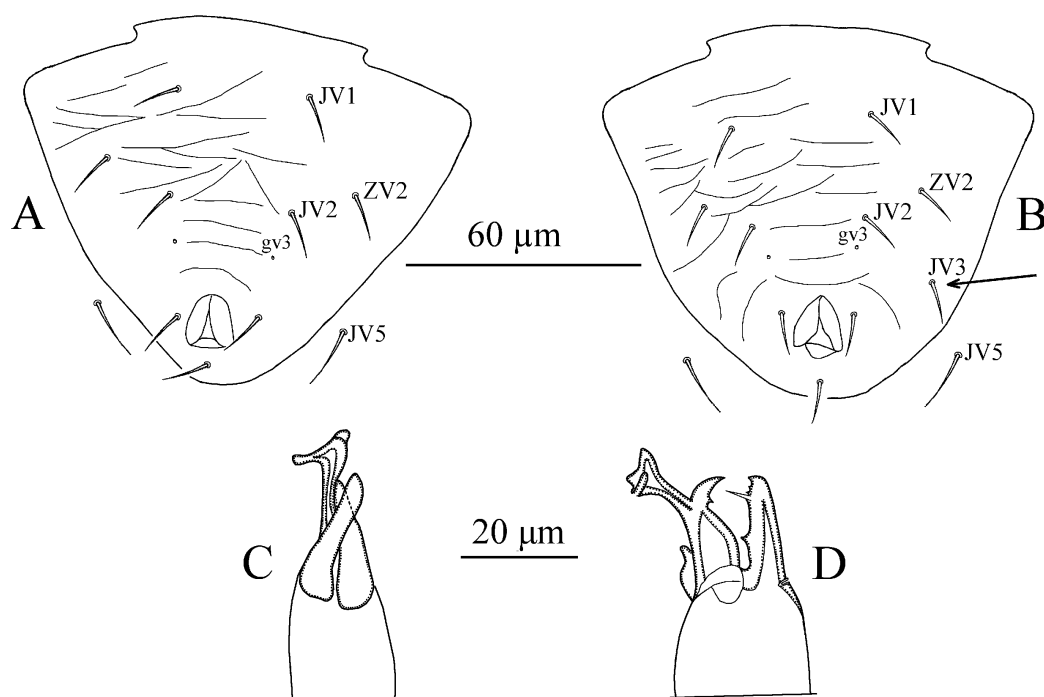
Similar to female in many aspects.

**Dorsum** — Dorsal setal pattern 10A:8C (*r3* and *R1* on shield). Dorsal shield sclerotized, reticulated, bearing five pairs of solenostomes (*gd1*, *gd2*, *gd6*, *gd8* and *gd9*); length of dorsal shield 220 (218–223), width (at level of *s4*) 116 (113–118). Serration of dorsal setae as in female. Measurements of dorsal setae as follows: *j1* 14 (13–15), *j3* 27 (25–30), *j4* 12 (10–13), *j5* 12 (10–13), *j6* 14 (13–15), *J2* 25 (23–26), *J5* 5 (4–6), *z2* 29 (28–30), *z4* 34 (33–35), *z5* 14 (13–15), *Z1* 19 (18–20), *Z4* 31 (30–33), *Z5* 33 (30–35), *s4* 41 (38–42), *S2* 32 (30–36), *S5* 11 (10–12), *r3* 31 (30–33) and *R1* 22 (20–25).

Peritreme extending to level of seta *z2*.

**Venter** — (Figure 2A, B). Sternogenital shield smooth, sclerotized, with five pairs of setae (*ST1*, *ST2*, *ST3*, *ST4* and *ST5*). Distance between bases of *ST1*–*ST5* 98 (95–100). Ventrianal shield triangular, striated, bearing three pairs of pre-anal setae (*JV1*, *JV2* and *ZV2*) (Figure 2A), (one specimen had an unpaired seta (*JV3* on left side) (Figure 2B), a pair of para-anal (*Pa*) and unpaired post-anal seta (*Pst*), and with one pair of rounded pores (*gv3*) posteromedian to *JV2*, distance between pre-anal pores 19 (18–20). Length of ventrianal shield 95 (93–98), width (at anterior corners widest point) 105 (99–110). Setae *JV5* slightly serrated, 15 (13–18) in length.

**Chelicera** — (Figure 2C, D). Fixed digit with three teeth, two apical and one well-behind pilus dentilis; movable digit with one tooth; spermatophoral process L-shaped, with toe slightly developed. The left and the right sides of the illustrated specimen, as well as some other



**Figure 2** *Kampimodromus langei* Wainstein & Arutunjan, 1973 male. A – Ventrianal shield of a normal specimen, B – Variation on ventrianal shield (with unpaired seta *JV3* marked with an arrow), C – Chelicera with spermatophoral process normal in position (left side), D – Chelicera with toe twisted (right side). Figures A, C, and D are from the same specimen. Scale bars: 60 µm for Figures A and B; 20 µm for C and D.

specimens on both sides seemed to have different shape of spermatophoral process, with toe twisted in those cases.

**Legs** — Length of legs (base of coxae to base of claws): leg I 207 (205–210); leg II 191 (188–193); leg III 149 (148–150); leg IV 210 (205–213). Basitarsus IV with short macroseta, *StIV* 16 (15–18) in length. Leg chaetotaxy as in female.

#### Material examined

Ten females and 9 males were collected from *Q. cerris* var. *cerris* in remnants of oak forest on the Kurupelit campus Ondokuz Mayıs University in Samsun Province, 41°21'58.9"N, 36°11'18.5"E: two females, 6 May 2021; one female, 27 May 2021; two males, 29 July 2021; two females, 18 August 2021; four females and six males, 28 August 2021; one female and one male, 18 September 2021.

#### World Distribution

Armenia (Wainstein and Arutunjan 1973), Russia (Meshkov 1999), Norway (Denmark and Edland 2002), Moldova (Kulikova 2011), Croatia, Italy (Cargnus *et al.* 2012), The Netherlands (Faraji and Hoekstra 2021) and Turkey (this study).

#### Remarks

*Kampimodromus langei* was described by Wainstein and Arutunjan (1973) based on the material collected from *Quercus* sp. (Fagaceae) in Stepanavan, Armenia. Our collection of this species in Turkey represents a new record for the country as previous studies of the genus *Kampimodromus* did not include *K. langei* (Ozman and Cobanoglu 2001; Cobanoglu

and Ozman 2002; Kasap and Cobanoglu 2009; Yesilayer and Cobanoglu 2011; Doker *et al.* 2017, 2018). In addition, the male *K. langei* is described for the first time in this study. Morphological characters and measurements of the current specimens are similar to those of the original description and subsequent re-descriptions (Wainstein and Arutunjan 1973; Ragusa di Chiara and Tsolakis 1994; Tixier *et al.* 2008; Cargnus *et al.* 2012; Faraji and Hoekstra 2021). However, a single female specimen showed an abnormality in having an additional dorsal seta on both sides, with all other morphological characters and measurements of the specimen being almost identical to the other specimens examined in this study, as well as the earlier descriptions. To the best of our knowledge, the extra seta inserted at the location of *S1* has previously been reported by Kolodochka (2006) for *Typhlodromus* (*Typhlodromus*) *laurae* Arutunjan, but is not known in any other Phytoseiidae species to date (Rowell *et al.* 1978; Chant and Yoshida-Shaul 1989; Chant and McMurtry 2007; Ferragut *et al.* 2010). However, it is not known whether the extra seta reported for *T. (T.) laurae* was paired or unpaired because Kolodochka (2006) illustrated only the right side of the specimen.

This extra seta could be considered seta *z6* or *s6* because both are already known for some members of the family Phytoseiidae (Chant and McMurtry 2007; Papadoulis *et al.* 2009). However, when those setae are present on other phytoseiid species their insertion is clearly anterior to seta *R1* (Kreiter *et al.* 2002; Faraji *et al.* 2008; Ferragut *et al.* 2010; Demite *et al.* 2020). However, the extra setae described in this study were located posterior to *R1*. In addition, when the podosomal setae *z6* and *s6* are present in phytoseiids their insertion is clearly anterior to solenostome *gd6* (Chant and McMurtry 2007; Papadoulis *et al.* 2009) which is not the case in the abnormal specimens reported by Kolodochka (2006) and in this study. Kolodochka (2006) named this seta, *SS*. Therefore, we have used the same notation and have described this seta as *SS*.

Instead of being called an abnormality, the presence of extra seta/e can also be considered to be a kind of variation that has been reported for some phytoseiid species such as *Amblyseius palustris* (Chant), *Euseius finlandicus* (Oudemans), *Neoseiulus agrestis* (Karg), *N. longispinosus* (Evans), *Phytoseius echinus* Wainstein & Arutunjan, *Typhlodromus* (*Anthoseius*) *caudiglans* Schuster, *T. (A.) commenticus* Livshitz & Kuznetsov, *T. (T.) pyri* Scheuten (Chant and Yoshida-Shaul 1989; Kolodochka 2006; Silva *et al.* 2020). In addition, Kolodochka (1985) reported a type specimen of *T. (T.) rarus* Wainstein without setae *j3* and one each of *S5* and *Z4* but with an unpaired seta in the region of seta *Z4*. However, unpaired and unknown setae on the dorsal shield of phytoseiid mites can also represent a new taxonomic status as Demite *et al.* (2017) recently described a new genus and a new species, *Amazoniaseius imparisetosus* Demite, Cruz & McMurtry, with two unpaired setae.

In addition, an unpaired seta (*JV3*) was also observed on the ventrianal shield of a male specimen examined in this study. We consider the presence of this unpaired seta to be a variation because it has been already reported for *A. nemorivagus* Athias-Henriot and *N. bicaudus* (Wainstein) by Papadoulis *et al.* (2009).

## Acknowledgements

This research is part of the first author's Master's thesis and was supported by the Scientific Research Foundation of Ondokuz Mayıs University in Samsun, Turkey (Project number: PYO.ZRT.1904.21.014). The authors thank Prof. Dr. Hamdi G. Kutbay of Ondokuz Mayıs University for his identification of the oak trees and Dr. Gregory T. Sullivan of The University of Queensland for comments and editing.

## References

- Athias-Henriot C. 1975. Nouvelles notes sur les Amblyseini. II. Le relevé organotaxique de la facedorsale adulte (Gamasides, protoadéniques, Phytoseiidae). *Acarologia*, 17(1): 20-29.

- Cargnus E., Girolami V., Zandigiacomo P. 2012. Re-examination of specimens of three species of *Kampimodromus* Nesbitt (Acari: Phytoseiidae) from north-eastern Italy, with first report on *Kampimodromus corylosus* Kolodochka in Italy. *Int. J. Acarol.*, 38: 583-594. <https://doi.org/10.1080/01647954.2012.710247>
- Chant D.A., McMurtry J.A. 2007. Illustrated keys and diagnoses for the genera and subgenera of the Phytoseiidae of the world (Acari: Mesostigmata). West Bloomfield: Indira Publishing House. pp. 219.
- Chant D.A., Yoshida-Shaul E. 1989. Adult dorsal setal patterns of the family Phytoseiidae (Acari: Gamasina). *Int. J. Acarol.*, 15: 219-233. <https://doi.org/10.1080/01647958908683852>
- 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., Yoshida-Shaul E. 1992. Adult idiosomal setal patterns in the family Phytoseiidae (Acari: Gamasina). *Int. J. Acarol.*, 18: 177-193. <https://doi.org/10.1080/01647959208683949>
- Cobanoglu S., Ozman S.K. 2002. Beneficial mite species of hazelnut orchard ecosystems from the Black Sea Region of Turkey. *Proceedings of the 2nd Meeting of WG 4: Prague 30-31st May 2002, Bio-control of Arthropod Pests in the Stored Products*: 91-99.
- Demite P.R., Souza R.B., Cavalcante A.C.C. 2020. A new species of *Phytoseius* Ribaga (Acari: Mesostigmata: Phytoseiidae) from the Amazon Forest, Brazil, with a redefinition of the *purseglovei* species group Chant & Yoshida-Shaul. *Syst. Appl. Acarol.*, 25: 1350-1358. <https://doi.org/10.11158/saa.25.7.14>
- Demite P.R., Cruz W.P. da, McMurtry J.A., Moraes G.J. de 2017. *Amazoniaseius imparisetosus* n.sp., n.g.: an unusual new phytoseiid mite (Acari: Phytoseiidae) from the Amazon forest. *Zootaxa*, 4236: 302-310. <https://doi.org/10.11646/zootaxa.4236.2.5>
- Denmark H.A., Edland T. 2002. The subfamily Amblyseinae Muma (Acari: Phytoseiidae) in Norway. *Int. J. Acarol.*, 28: 195-220. <https://doi.org/10.1080/01647950208684296>
- Doker I., Kazak C., Karaca M.M., Karut K. 2017. Two new records of the genus *Kampimodromus* Nesbitt (Acari: Phytoseiidae) for Turkey with a revised key to the World species. *Acarologia*, 57: 355-363. <https://doi.org/10.1051/acarologia/20164160>
- Doker I., Karut K., Karaca M.M., Cargnus E., Kazak C. 2018. Internal Transcribed Spacer (ITS) sequences of some *Kampimodromus* (Acari: Phytoseiidae) species: Is *Kampimodromus ragusai* a valid species or a synonym of *Kampimodromus aberrans*? *Syst. Appl. Acarol.*, 23: 2237-2243. <https://doi.org/10.11158/saa.23.11.15>
- Duso C., Ahmad S., Tirello P., Pozzebon A., Klaric V., Baldessari M., Malagnini V., Angeli G. 2014. The impact of insecticides applied in apple orchards on the predatory mite *Kampimodromus aberrans* (Acari: Phytoseiidae). *Exp. Appl. Acarol.*, 62: 391-414. <https://doi.org/10.1007/s10493-013-9741-3>
- Evans, G.O. 1963. Observations on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata). *Bull. Br. Mus. Nat. Hist. Zool.*, 10: 275-303. <https://doi.org/10.5962/bhl.part.20528>
- Faraji F., Hoekstra P.H. 2021. Some new species records of the predatory mite family Phytoseiidae (Acari: Mesostigmata) from The Netherlands. *Soil Org.*, 93: 35-57. <https://doi.org/10.25674/so93iss1pp35>
- Faraji F., Sakenin-Chelav H., Kamali K., McMurtry J.A. 2008. Four new species records of Phytoseiidae (Acari: Mesostigmata) for Iran, and description of variability in the spermatheca of *Typhlodromus bakeri*. *Syst. Appl. Acarol.*, 13: 123-132. <https://doi.org/10.11158/saa.13.2.5>
- Ferragut F., Pérez Moreno I., Iraola V., Escudero A. 2010. Ácaros depredadores em las plantas cultivadas. Familia Phytoseiidae. Madrid: Ediciones Agrotécnicas. pp. 202.
- Kasap I. 2005. Life-history traits of the predaceous mite *Kampimodromus aberrans* (Oudemans) (Acarina: Phytoseiidae) on four different types of food. *Biol. Control*, 35: 40-45. <https://doi.org/10.1016/j.biocontrol.2005.05.014>
- Kasap I., Çobanoğlu S. 2009. Phytoseiid mites of Hakkâri province, with *Typhlodromus* (*Anthoseius*) *tamaricis* Kolodochka, 1982 (Acari: Phytoseiidae), a new record for the predatory mite fauna of Turkey. *Turk. Zool. Derg.*, 33: 301-308. <https://doi.org/10.3906/zoo-0805-9>
- Kolodochka L.A. 1985. A redescription of *Typhlodromus rarus* (Parasitiformes, Phytoseiidae). *Vestn. Zool.*, 6: 16-22. [in Russian].
- Kolodochka L.A. 2006. Phytoseiid mites of the Palaearctic Region (Parasitiformes, Phytoseiidae): faunistic, taxonomy, ecomorphology, evolution. *Vestn. Zool., Suppl.*, 21: 1-250. [in Russian].
- Kreiter S., Ueckermann E.A., Quilici S. 2002. Seven new phytoseiid species, with a new generic assignement and a key to the species of La Reunion Island (Acari: Mesostigmata). *Acarologia*, 42: 335-350.
- Kreiter S., Tixier M.S., Auger P., Muckensturm N., Sentenac G., Doublet B., Weber M. 2000. Phytoseiid mites of vineyards in France (Acari: Phytoseiidae). *Acarologia*, 41: 77-96.
- Kulikova, L. 2011. Mites of fruit plantations of the Republic of Moldova. Muzeul Olteniei Craiova. Oltenia. Studii și comunicări. Științele Naturii, 27: 55-62.
- Lindquist E.E., Evans G.O. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). *Mem. Ent. Soc. Can.*, 47: 1-64. <https://doi.org/10.4039/entm9747fv>
- McMurtry J.A., Moraes, G.J. de, Famah Sourassou N. 2013. Revision of the lifestyles 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>
- Meshkov Yu.I. 1999. Contribution to phytoseiid fauna (Parasitiformes, Phytoseiidae) of Moscow District. *Zool. Zhurnal*, 78: 426-431 [in Russian].
- Ozman-Sullivan S.K. 2006. Life history of *Kampimodromus aberrans* as a predator of *Phytoptus avellanae* (Acari: Phytoseiidae, Phytoptidae). *Exp. Appl. Acarol.*, 38: 15-23. <https://doi.org/10.1007/s10493-005-5786-2>

- Ozman S.K., Çobanoğlu S. 2001. Current status of hazelnut mites in Turkey. *Acta Hortic.*, 56: 479-487. <https://doi.org/10.17660/ActaHortic.2001.556.70>
- Papadoulis G.Th., Emmanouel N.G., Kapaxidi, E.V. 2009. Phytoseiidae of Greece and Cyprus (Acari: Mesostigmata). West Bloomfield: Indira Publishing House. pp. 200.
- Ragusa di Chiara S., Tsolakis H. 1994. Revision of the genus *Kampimodromus* Nesbitt, 1951 (Parasitiformes, Phytoseiidae), with a description of a new species. *Acarologia*, 35: 305-322.
- Rowell H.L., Chant D.A., Hansell R.I.C. 1978. The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae (Acarina: Mesostigmata). *Can. Entomol.*, 110: 859-876. <https://doi.org/10.4039/Ent110859-8>
- Silva D.E., Nascimento J.M. do, Meira A. de A., Corrêa L.L.C., Johann L., Rodrigues R., Ferla N.J. 2020. Intraspecific variation of *Typhlodromus* (*Typhlodromus*) *pyri* Scheuten in vineyards of Northwest Portugal. *Int. J. Acarol.*, 46: 60-62. <https://doi.org/10.1080/01647954.2019.1695934>
- Tixier M.-S., Kreiter S., Croft B.A., Cheval B. 2008. *Kampimodromus aberrans* (Acari: Phytoseiidae) from the USA: morphological and molecular assessment of its density. *Bull. Entomol. Res.*, 98: 125-134. <https://doi.org/10.1017/S0007485307005457>
- Wainstein B.A., Arutunjan E.S. 1973. New species of predatory mites of the family Phytoseiidae (Parasitiformes) in Armenian SSR. *Doklady Akademii Nauk Armyanskoy SSR*, 56: 55-58. [in Russian].
- Yesilayer A., Çobanoğlu S. 2011. The distribution of predatory mite species (Acari: Phytoseiidae) on ornamental plants and parks of Istanbul, Turkey. *Türk. Entomol. Bült.*, 1: 135-143.