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Article

Phyllocoptes khazariensis sp. nov. (Acari: Eriophyiodea) from *Cupressus sempervirens* (Cupressaceae) in Iran

Forough Ranjbar-Varandi[1], Karim Haddad Irani-Nejad[1] and Parisa Lotfollahi[2*]

1. Department of Plant Protection, Faculty of Agriculture, University of Tabriz, Tabriz, Iran; E-mails: Forough.ranjbar.varandi@gmail.com, khaddad@tabrizu.ac.ir
2. Department of Plant Protection, Faculty of Agriculture, Azarbaijan Shahid Madani University, Tabriz, Iran; E-mail: prslotfollahy@yahoo.com

* Corresponding author

ABSTRACT
The new eriophyid species, *Phyllocoptes khazariensis* **sp. nov.** was found on *Cupressus sempervirens* L. (Cupressaceae) during a survey on eriophyoid mite fauna of Sari county, Mazandaran province, north of Iran, in summer 2017. This is the first *Phyllocoptes* species found on plants of the genus *Cupressus* and herein described and illustrated.

KEYWORDS: Eriophyidae, Mazandaran, new species, Phyllocoptinae, Phyllocoptini.

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INTRODUCTION

Some of the diagnostic characters of the genus *Phyllocoptes* Nalepa, 1887 (Acari: Eriophyoidea: Eriophyidae) are as follows: Body fusiform; gnathosoma rather small, projecting obliquely downwards; opisthosoma evenly rounded dorsally and with setae *c2*, *d*, *e* and *f* present; coxal setae *1b*, *1a* and *2a* present; legs with all usual segments and setae, empodium simple; prodorsal shield with anterior lobe over gnathosoma; tubercles of setae *sc* usually placed ahead of rear shield margin, setae *sc* directed forward or up and central, if tubercles and setae are near rear shield margin, then *sc* directed forward; in some species *sc* placed on rear shield margin, but tubercle with longitudinal or oblique basal axes and *sc* directed up, central or convergent to rear; female genitalia with a moderate distance from coxae, coverflap with one row of longitudinal striae; and apodeme of normal length in ventral view (Amrine *et al.* 2003).

Until now, 11 *Phyllocoptes* species have been reported from Iran: *Phyllocoptes graniti* Keifer, *P. pruni* Soliman & Abou-Awad, *P. gracilis* (Nalepa), *P. adalius* Keifer, *P. abaenus* Keifer, *P. balasi* Farkas, *P. trilobos* Honarmand, Sadeghi & de Lillo, *P. bilobospinosus* Chetverikov, *P. birreae* Honarmand, Sadeghi & de Lillo, *P. hamedi* Jafari & Khanjani and *P. pteridii* Petanović (Sepasgozarian 1975; Hajizadeh & Hosseini 2004; Lotfollahi *et al*. 2014; Xue *et al*. 2016; Gol *et al.* 2018; Honarmand *et al*. 2019, 2020, 2022; Mehri-Heyran *et al.* 2020; Jafari and Khanjani 2021; Jafari

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et al. 2022; Ranjbar-Varandi *et al.* 2022). In this paper, one new species, *Phyllocoptes khazariensis* **sp. nov.**, is described and illustrated based on the specimens found on the host plant *Cupressus sempervirens* L. (Cupressaceae). This plant species is an evergreen tree that grows in Europe, Turkey, Iran, Syria, Jordan, Lebanon and North Africa (Assadi 1988–2013). Forest areas in the north up to an altitude of 1300 meters are the main habitats of this species in Iran (Frey and Robust 1986). Currently just one eriophyoid species, *Trisetacus juniperinus* (Nalepa, 1911) was found on the plants of the family Cupressaceae in Iran, including *Juniperus communis* L. (Shibani-Fahandi *et al.* 2011) and *C. sempervirens* (Shibani-Fahandi *et al.* 2011).

MATERIAL AND METHODS

Eriophyoid mites were recovered from the plant material of *Cupressus sempervirens* L. (Cupressaceae) by means of the modified washing method developed by Monfreda *et al.* (2007). The slide mounting was done according to Mehri-Heyran *et al.* (2020).

All morphological measurements were taken by means of a phase contrast microscope Olympus BX41, 1000× magnification (oil immersion) according to Amrine and Manson (1996) as modified by de Lillo *et al.* (2010) and are given in micrometers. Counting of dorsal, ventral and coxigenital semiannuli follows Lotfollahi *et al*. (2020). Measurements and means are rounded off to the nearest integer when required except for the characters with very short length. Measurements refer to the length of the morphological trait unless otherwise specified. In the female description, the holotype measurements are followed by range values, in parentheses, of the studied population (*i.e.* holotype and paratypes) and for male only the range values are given. The mean values of the paratypes are reported in a few cases in which the measurements of the holotype could not be taken, due to the slide mounting position of the specimens and were marked by an asterisk (*) in the description.

Line drawings were hand-drawn by the first author through a *camera lucida* according to de Lillo *et al*. (2010) and the abbreviations labeling schematic drawings in figures follow mainly Amrine *et al.* (2003).

The genus classification follows Amrine *et al.* (2003) and comparisons were also made with new genera of Eriophyoidea described since that publication. Host plant names and their synonymies are in accordance with "*The World Flora Online*" (2022).

Type materials are deposited in the Acarology Laboratory, Department of Plant Protection, Faculty of Agriculture, University of Tabriz (Iran), and in the Acarology Laboratory, Department of Plant Protection, Faculty of Agriculture, Azarbaijan Shahid Madani University, Tabriz (Iran).

RESULTS

Family Eriophyidae Nalepa
Subfamily Phyllocoptinae Nalepa
Tribe Phyllocoptini Nalepa

Phyllocoptes khazariensis sp. nov.

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Description

Female (Fig. 1; measured specimens = 10) – Body fusiform, 160 (155–182, excluding gnathosoma), 62 (56–64) wide. **Gnathosoma** projecting obliquely downwards, chelicerae 31 (26–33), palp 29 (27–29), palp coxal setae *ep* 3.5* (3–3.5), dorsal palp genual setae *d* 7 (4.5–7.5), unbranched. **Prodorsal shield** 46 (45–47) including frontal lobe, 56 (54–58) wide, sub-triangular; with a broad-based double layer frontal lobe, 16 (12–17), over gnathosomal base; with anterior lobes

and folded lateral lobes. Shield smooth. Tubercles of scapular setae *sc* 3.5 (2.5–4.5) ahead of rear shield margin, 19 (19–21) apart, setae *sc* 4 (3.5–4.5), directed medially. **Legs** with all usual segments and setae. Leg I 26 (26–28), femur 8.5 (8.5–9.5), genu 3.5 (3–5), tibia 7 (7–8), tarsus 6.5 (5.5–7.5), tarsal solenidion *ω* 7 (6–7) distally rounded, empodium simple, 9 (8–9), 6-rayed; femoral setae *bv* 13 (9.5-14), genual setae *l″* 21 (20–22), paraxial tibial setae *l′* 3 (3–3.5), paraxial fastigial tarsal setae *ft*' 21 (20–24), antaxial fastigial tarsal setae *ft″* 21 (21–23), paraxial unguinal tarsal setae *u′* 4* (4–4.5). Leg II 25 (25–27), femur 9.5 (9–10), genu 3.5 (3–3.5), tibia 6 (6–7), tarsus 5.5 (5.5–6.5), tarsal solenidion *ω* 9 (8–9) distally rounded, empodium simple, 8.5 (8–10), 5 (5–6)-rayed; femoral setae *bv* 12 (12-13), genual setae *l″* 4 (3–4), paraxial fastigial tarsal setae *ft′* 7 (5.5–8), antaxial fastigial tarsal setae *ft*" 22 (no variation), paraxial unguinal tarsal setae *u′* 4 (3–4). **Coxisternal region:** prosternal apodeme 6.5 (5.5–8), anterior setae on coxisternum I *1b* 12 (10–13), 15 (13–15) apart; proximal setae on coxisternum I *1a* 23 (18–26), 10 (9–10) apart; proximal setae on coxisternum II *2a* 42 (30–42), 26 (23–27) apart; 11 (11–13) microtuberculate semiannuli between coxae and genital coverflap plus 3 (3–4) transversal rows of granules at the base of the coverflap. Infracapitular plate and coxal plate I smooth but coxal plate II with dense coarse granules. **External genitalia** 16 (16–19), 36 (33–36) wide, coverflap ornamented with 15 (13–15) oblique striae; setae *3a* 16* (15–17), 18 (16–18) apart. **Internal genitalia:** spermathecae ovoid, oriented posterolateral; spermathecal tubes relatively short about a third of spermathecae diameter, with tiny cone-shaped spermathecal process situated at the back end of spermathecal tube; transverse genital apodeme trapezoidal, distally folded. **Opisthosoma** with 62 (62–67) dorsal semiannuli and 65 (63–71) ventral semiannuli. **Microtubercles** are triangular on dorsal semiannuli; fine triangular on posterior margin of ventral semiannuli; spiny on the rear margin of the last 4 (no variation) dorsal semiannuli and elongated and linear on the last 6 (no variation) ventral semiannuli. Setae *c2* 29 (26–31) on ventral semiannulus 11 (11–14), setae *d* 52 (48–52) on ventral semiannulus 26 (26–30); setae *e* 40* (39–41) on ventral semiannulus 44 (42–49); setae *f* 16 (14–16) on ventral semiannulus 61 (59–67); 4 (no variation) annuli posterior to setae *f*. Setae *h2* 18 (18–21), *h1* 3 (2.5–3.5).

Male (Fig. 1-GM; measured specimens = 3) – Similar in shape and prodorsal shield arrangement to female. Body smaller than female, 142–159, 53–56 wide; palp genual setae *d* 6–8, unbranched; prodorsal shield 41–42 including frontal lobe, 52–54 wide; setae *sc* 3.5–4, 17–18 apart. Opisthosoma with 52–57 dorsal semiannuli and 50–57 ventral semiannuli, 11–17 semiannuli between coxae and genitalia, with microtubercles similar to that of female. Setae: *1b* 7–9, *1a* 15–25, *2a* 24–37, *c2* 24–27, *d* 26–34, *e* 19-35, *f* 14–16, *h1* 3–3.5, *h2* 16–21. Male genitalia 20–22 wide, setae *3a* 18–22, 15–16 apart.

Type host plant

Cupressus sempervirens L. (Cupressaceae), the Mediterranean cypress (also known as Italian cypress, Tuscan cypress, Persian cypress, or pencil pine).

Type locality

Amreh village, Sari county, Mazandaran province, Iran (36° 24' 26.0" N, 53° 08' 25.5" E), 457 m above sea level, coll. F. Ranjbar-Varandi, 10 August 2017.

Type material

Holotype: single female on a microscope slide (8-2-1-2-1). Paratypes: 11 females and 11 males mounted individually on separate microscope slides (8-2-1-2-2–23).

Other material

Two females from Mianrood village (36° 31' 04.3" N, 53° 03' 11.4" E, 252 m above sea level) on 6 August 2017, Sari county, Mazandaran province, Iran, from the same host plant, coll. F. Ranjbar-Varandi.

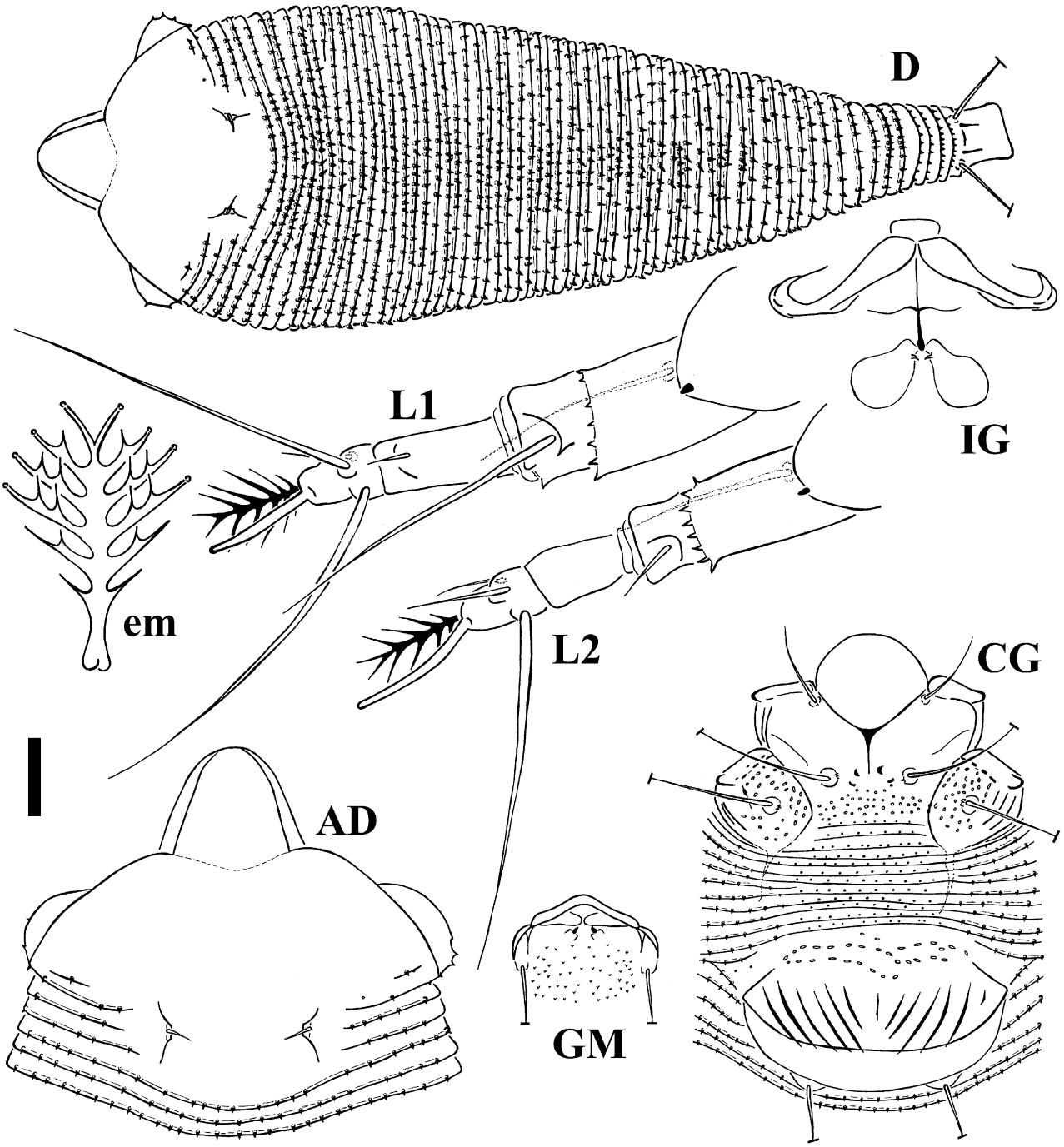

Figure 1. Schematic drawings of *Phyllocoptes khazariensis* **sp. nov.** – **D.** Dorsal view; **AD.** Prodorsal shield; **CG.** Female coxigenital region; **em.** Empodium; **GM.** Male genital region; **IG.** Internal female genitalia; **L1**. Leg I; **L2.** Leg II; **Scale bar:** 15 µm for D; 10 µm for AD, CG, IG, GM; 5 µm for L1, L2; 2.5 µm for em.

Relation to the host plant

Vagrant on leaves; no plant deformations were observed.

Etymology

This species is named after Khazar, the Persian name of Caspian Sea in the north of the region where it was collected.

Differential diagnosis

Among the four *Phyllocoptes* species found on the plants of Cupressaceae, the new species is closer to *P. libocedri* (Keifer, 1939) and *P. arceuthi* Keifer, 1953.

Phyllocoptes libocedri was described as a vagrant species on twig tips of *Calocedrus decurrens* (Torr.) Florin (originally listed as originally listed as *Libocedrus decurrens* Torr.) in Paradise, Butte Co., California, USA. This species has smooth prodorsal shield except slight lines on frontal lobe that is similar to the new species with completely smooth prodorsal shield. Both species have similar dorsal semiannuli number (65 in *P. libocedri* and 62–67 in the new species) and similar number of empodium rays of the anterior leg (6) and the similar length for setae *f* (17.5 in *P. libocedri* and 14–16 in the new species). However, the two species are different in the number of ventral semiannuli (63–71 in the new species *versus* 70–75 in *P. libocedri*), length of setae *sc* (3.5–4.5 in the new species *versus* 6.5 in *P. libocedri*), *c2* (26–31 in the new species *versus* 20 in *P. libocedri*), *d* (48–52 in the new species *versus* 40 in *P. libocedri*), *e* (39–41 in the new species *versus* 22 in *P. libocedri*) and *3a* (15–17 in the new species *versus* 12.5 in *P. libocedri*). In addition, female genital coverflap of *P. libocedri* is ornamented with diagonal striae (3 pairs in Keifer's drawing), but in the new species coverflap is ornamented with 13–15 oblique striae. According to Keifer's drawings, both coxae of *P. libocedri* are ornamented with few short lines and dashes, but the coxal plate I in the new species is smooth and coxal plate II is ornamented with dense coarse granules.

Phyllocoptes arceuthi was described as a vagrant species on twigs of *Juniperus occidentalis* Hook. in Midway between Camp Sacramento and Twin Bridges, El Dorado Co., California, USA. The new species is similar to that in the number of the ventral semiannuli (63–71 in new species and 70–80 in *P. arceuthi*), empodium rays (6), presence of lateral lobes on prodorsal shield, ornamentation of the female coverflap (oblique striae plus transversal rows of granules at the base), length of setae *c2* (26–31 in the new species and 25 in *P. arceuthi*) and *3a* (15–17 in new species and 17 in *P. arceuthi*). However, the prodorsal shield pattern of the new species is smooth, but *P. arceuthi* has median, admedian and first submedian lines. Also the two species differ in the length of setae *sc* (3.5–4.5 in the new species *versus* 15 in *P. arceuthi*), *d* (48–52 in new species and 30 in *P. arceuthi*), *e* (39–41 in new species and 25 in *P. arceuthi*) and *f* (14–16 in the new species *versus* 20 in *P. arceuthi*), and in the number of dorsal semiannuli (62–67 in the new species *versus* 70–80 in *P. arceuthi*).

Remarks

To date, four *Phyllocoptes* species have been found on the plant species of the family Cupressaceae including three species of *P. arceuthi* Keifer, 1953, *P. rufoclivus* Keifer, 1969, and *P. virgae* Keifer, 1969, on *Juniperus* spp. and one species, *P. libocedri* (Keifer, 1939) on plant species of the genus *Calocedrus* (Amrine and de Lillo unpublished databases). *Phyllocoptes khazariensis* **sp. nov.** is the first *Phyllocoptes* species found on plant species of the genus *Cupressus.*

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گونهٔ جدید *Phyllocoptes khazariensis* sp. nov. (Acari: Eriophyiodea) از روی *Cupressus sempervirens* (Cupressaceae) در ایران

فروغ رنجبر ورندی[1]، کریم حداد ایرانی‌نژاد[1] و پریسا لطف‌الهی[2*]

۱. گروه گیاهپزشکی، دانشکدهٔ کشاورزی، دانشگاه تبریز، تبریز، ایران؛ رایانامه‌ها: Forough.ranjbar.varandi@gmail.com؛ khaddad@tabrizu.ac.ir

۲.گروه گیاهپزشکی، دانشکدهٔ کشاورزی، دانشگاه شهید مدنی آذربایجان، تبریز، ایران؛ رایانامه: prslotfollahy@yahoo.com

* نویسندهٔ مسئول

چکیده

در بررسی کنه‌های اریوفیوئید شهرستان ساری استان مازنداران در شمال ایران طی تابستان سال ۲۰۱۷، گونه اریوفیوئید جدید *Phyllocoptes khazariensis* **sp. nov.** روی *Cupressus sempervirens* L. (Cupressaceae) یافت شد. این نخستین گونهٔ جنس *Phyllocoptes* از روی گیاهان جنس *Cupressus* است که در اینجا توصیف و ترسیم شد.

واژگان کلیدی: Eriophyidae، مازندران، گونهٔ جدید، Phyllocoptinae، Phyllocoptini.

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