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RAPHIGNATHUS AZARSHAHRIENSIS N. SP. (ACARI: TROMBIDIFORMES: RAPHIGNATHIDAE) FROM NORTHWEST IRAN

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ABSTRACT — A new species of the genus *Raphignathus* Duges (Acari: Raphignathidae), *Raphignathus azarshahriensis* **n. sp.** is described and illustrated from Azarshahr, Northwest Iran. A key to all known species of *Raphignathus* in Iran is also given.

KEYWORDS — Acari; Raphignathidae; *Raphignathus* Duges; Iran; new species

INTRODUCTION

Members of the family Raphighnathidae are predacious and can be found underneath tree bark, in moss, in pigeon nests, in lichens, in leaf litter, in soil and on a wide range of plants (Zaher and Gomma 1979; Fan and Yin 2000; Khanjani and Ueckermann 2003). The genus *Raphignathus* Dugès was the first described in this family; the distribution of more than 62 species is cosmopolitan. Ten of these species are known from Iran, namely, *R. collegiatus* Atyeo, Baker and Crossley, 1961; *R. gracilis* Rack, 1962; *R. giselae* Meyer and Ueckermann, 1989; *R. zhaoi* Hu, Jing and Liang, 1995; *R. aciculatus* Fan, 2000; *R. hecmatanaensis* Khanjani and Ueckermann, 2003; *R. protaspus* Khanjani and Ueckermann, 2003; *R. saboorii* Ghorbani and Bagheri, 2011; *R. atyoi* Meyer and Ueckermann, 1989; *R. larestanensis* Bagheri *et al.*, 2012 (Khanjani and Ueckermann 2003; Ghorbani *et al.* 2011; Dehghan Dolati *et al.* 2011; Bagheri *et al.* 2012). In this paper a new species, *R. azarshahriensis* **n. sp.** is described and figured.

MATERIALS AND METHODS

Mites were extracted from soil of black cherry, walnut and almond orchards using a Berlese funnel. Collected specimens were cleared in Nesbitt's fluid and mounted in Hoyer's Medium (Walter *et al.* 2009). The gnathosomal length is measured from the proximal base of the chelicerae to the tip of the palptibial claw, and the length of idiosoma from the suture between gnathosoma and idiosoma to the posterior margin of idiosoma, the width of idiosoma at the broadest part. The setae were measured from their insertion base to the tip. Distances between setae were measured between the insertions. Dorsal setal designation followed Kethley (1990) and and leg setal are noted according to

Grandjean (1944). All measurements are given in micrometers (μm).

RESULTS

Genus *Raphignathus* Dugès, 1834

Type species — *Raphignathus ruberrimus* Dugès, 1834.

Diagnosis — Small mites with soft-sclerotized body, red or yellow colored when they are live; subcapitulum with two pairs of subcapitular setae (*m*, *n*) and two pairs of adoral setae (or_1, or_2); palptibia claw small; cheliceral bases fused; peritremes arising from midbasal part of stylophore and extending along anterior margin of idiosoma; idiosoma oval; propodosoma with three shields, one median and two lateral; one pair of eyes on lateral shields present; one pair of small shields may be present between median and lateral propodosomal shields; Opisthosoma with a large shield bearing 3-6 pairs of setae; Dorsum with 11-12 pairs of setae; two pairs of aggenital setae and three or four pairs of genital setae present; anal opening clearly separated from genital aperture and with three pairs of setae; number of solonidia on tarsi in male and female often is similar but in male dorsal body shields are fused and solonidia of tarsi enlarged (Fan and Yin 2000; Khanjani and Ueckermann 2003; Ghorbani *et al.* 2011; Bagheri *et al.* 2012).

Genus *Raphignathus* Dugès: Key to the Iranian species

1. Interscutal membrane dorsomedially with less than 3 (1 or 2) pairs of setae 2
— Interscutal membrane dorsomedially with 3 pairs of setaee ..... *R. larestanaensis*

2. Interscutal membrane with 1 pair of setae 7
— Interscutal membrane with 2 pairs of setae 3

3. Genital shields with 4 pairs of setae ... *R. saboorii*
— Genital shields with 3 pairs of setae 4

4. Palpfemur with 3 pairs of setae 5
— Palpfemur with 2 pairs of setae 6

5. Femur IV with 3 setae ..... *R. aciculatus*
— Femur IV with 2 setae ..... *R. atyeoi*

6. Endopodal shields associated only with coxae III-IV 7
— Endopodal shields associated with coxae I-IV..... *R. hecmatanaensis*

7. Small shields between median and lateral prodorsal shield absent, dorsal setae e_1 reaching anterior margin of opisthosomal shield, median propodosomal shield reaching to peritremes anteriorly ..... *R. gracilis*
— Small shields between median and lateral prodorsal shield present, dorsal setae e_1 not reaching anterior margin of opisthosomal shield, median propodosomal shield not reaching to peritremes anteriorly ..... *R. giselae*

8. Tibia I with 7 setae (5+φ, $\varphi\rho$) 9
— Tibia I with 6 setae (5+$\varphi\rho$) 10

9. Two small shields on interscutal integument is very small; setae $e_1$close to anterior margin of opistosomal shield ..... *R. collegiatus*
— Two small shields on interscutal integument is much longer; setae $e_1$well behind anterior margin of opistosomal shield ..... *R. azarshahriensis*

10. Tarsus IV with 14 setae ..... *R. zhaoi*
— Tarsus IV with 13 setae..... *R. protaspus*

Raphignathus azarshahriensis n. sp. (Figures 1-2)

Female (n = 4) — Measurements of holotype (measurements of paratypes in parentheses); Length of body (including gnathosoma) 660 (582 – 690); Length of body (excluding gnathosoma) 410 (372 – 440) and width 245 (215 – 276).

Dorsum (Figure 1a) — Body oval; prodorsum with one median and two lateral shields; one pair

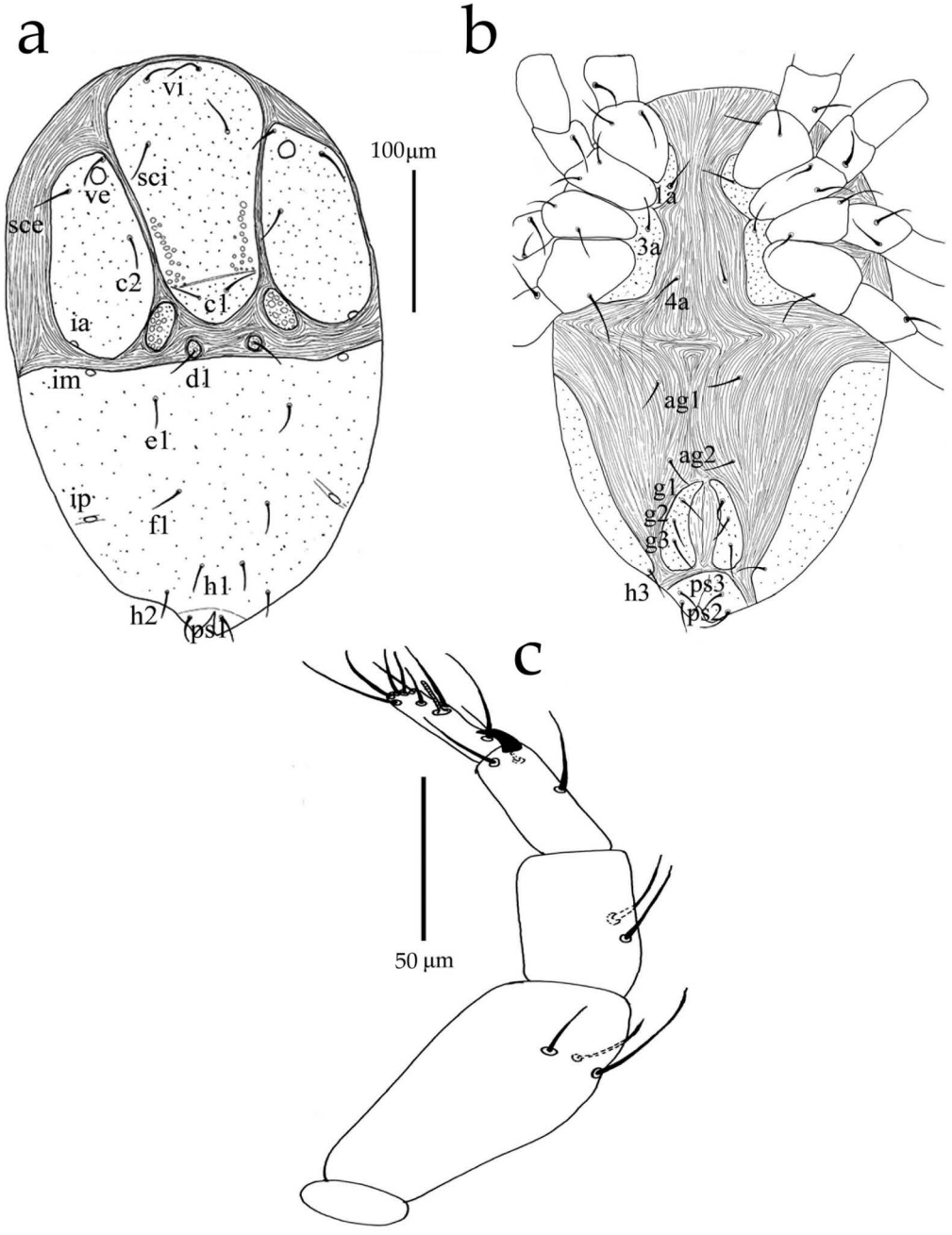


FIGURE 1: *Raphignathus azarshahriensis* **n. sp.** (Female): a – Dorsal view; b – Ventral view; c – Palp.

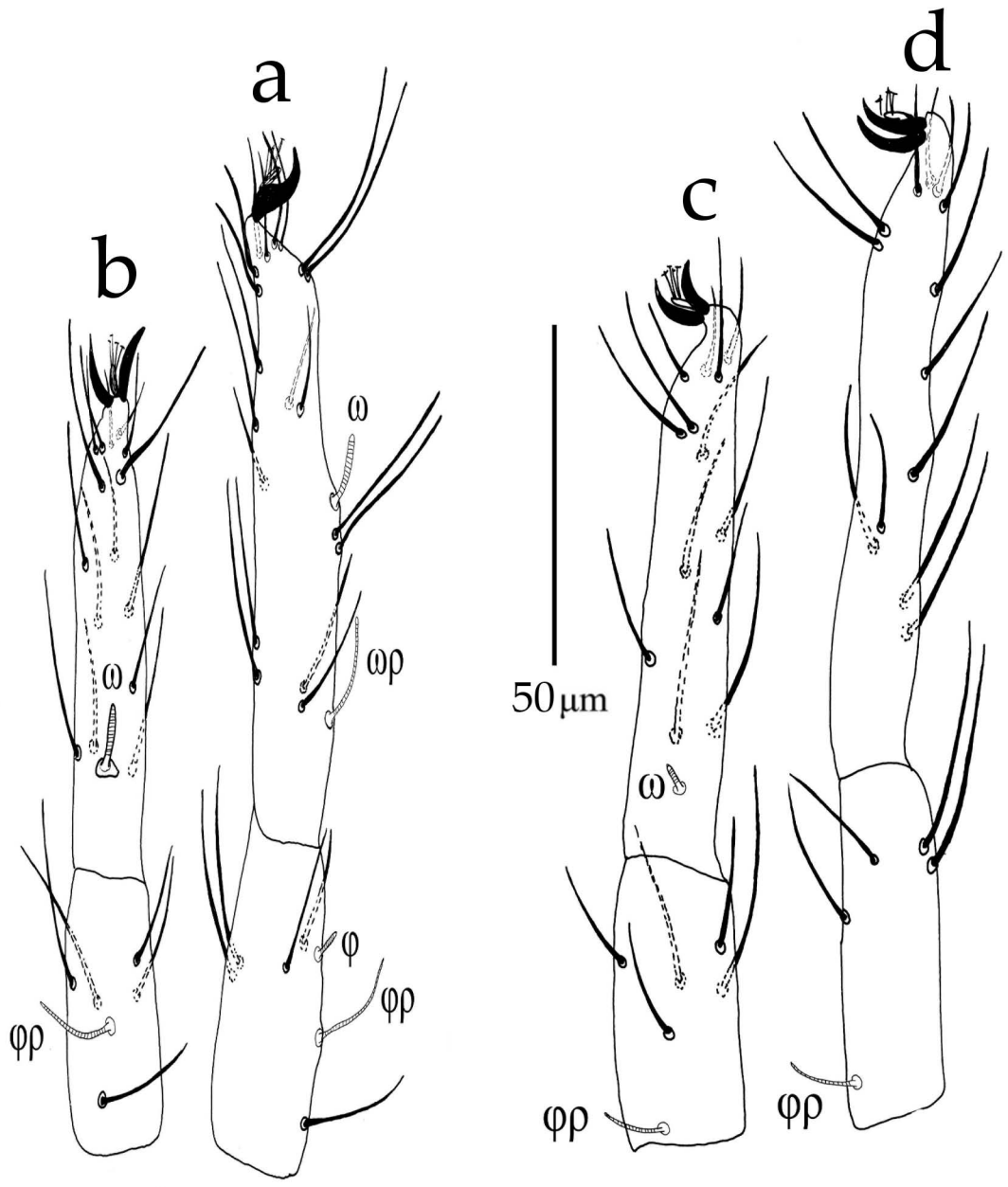


FIGURE 2: *Raphignathus azarshahriensis* **n. sp.** (Female): a – Tarsus and tibia I; b – Tarsus and tibia II; c – Tarsus and tibia III; d – Tarsus and tibia IV.

of small shields behind median shield present; median prodorsomal shield with three pairs of setae (*vi*, *sci* and c_1); each lateral shield with three pairs of setae (*ve*, *sce* and c_2), one pair of eyes and one pair of cupules (*in*); interscutal membrane with one pair of setae (*d*) situated on small platelets. Opisthosomal shield is large and with five pairs of setae (e_1, f_1, h_1, h_2 and h_3) and two pairs of cupules (*im* and *ip*); setae e_1 well behind anterior margin of opistosomal shield; all dorsal setae setiform. Lengths of dorsal setae as follows: *vi* 27 (25 – 27); *ve* 32 (26 – 33); *sci* 30 (27 – 31); *sce* 29 (27 – 30); c_1 25 (21 – 26); c_2 27 (26 – 28); d_1 27 (20 – 27); e_1 24 (23 – 27); f_1 26 (21 – 26); h_1 20 (17 – 20); h_2 20 (18 – 21); h_3 22 (21 – 23); distances between setae as fallow: *vi-vi* 35 (26 – 37); *ve-ve* 116 (109 – 124); *sci-sci* 55 (50 – 59); *sce-sce* 180 (175 – 183); *sci-vi* 46 (42 – 47); *ve-sce* 33 (31 – 35); *ve*-c_2 51 (46 – 62); *sce*-c_2 50 (46 – 56); c_1-c_1 16 (14 – 17); d_1-d_1 40 (37 – 41); e_1-e_1 92 (82 – 103); d_1-e_1 50 (42 – 57); f_1-f_1 60 (60 – 66); e_1-f_1 72 (64 – 70); h_1-h_1 27 (26 – 30); h_1-h_2 35 (32 – 36); h_2-h_2 70 (67 – 77); h_3-h_3 95 (80 – 92).

Venter (Figure 1b) — Endopodal shields between the coxae I-II and III-IV are present; setae *1a* and *3a* on endopodal shields; setae *4a* on membrane posterior to coxae IV; three pairs of genital (g_1-g_3) and two pairs of aggenital setae (ag_1- ag_2); the anal plates bear three pairs of pseudanal setae (ps_1-ps_3). Lengths of anogenital area setae as follows: ag_1 30 (28 – 35); ag_2 27 (23 – 27); g_1 25 (23 – 27); g_2 24 (21 – 23); g_3 25 (21 – 24); ps_1 20 (18 – 20); ps_2 21 (20 – 22); ps_3 21 (20 – 22).

Gnathosoma (Figure 1c) — Length of gnathosoma 250 (210 – 240). Subcapitulum with two pairs of subcapitular setae (*m*: 39 and *n*: 40) and two pairs of adoral setae (or_1: 23 and or_2: 25); stylophore conical and striated; palpal chaetotaxy: tarsus with four terminal eupathidia, one long solenidion and four tactile setae; tibia with one developed claw and three tactile setae; genua and femur with two and three tactile setae, respectively.

Legs (Figure 2) — Length of legs (from base of coxae to tip of tarsi) as follows: leg I: 390 (360 – 403), leg II: 320 (305 – 328), leg III: 325 (317 – 330) and leg IV: 390 (380 – 418); Chaetotaxy of leg segments (excluding *1a*, *3a* and *4a*) as follows: coxae 2-2-2-1; trochanters 1-1-2-1; femora 6-6-4-4; genuae 5(+k)-5(+k)-4-4; tibiae 5(+φ, φρ)-5(+φρ)-5(+φρ)-4(+φρ); tarsi 19(+ω I, ω II)-15(+ω)-13(+ω)-13.

Male and immature stages — Unknown.

Etymology — The new species name "*azarshahriensis*" refers to the type locality, Azarshahr, Iran.

Type material — Holotype female and seven female paratypes of *Raphignathus azarshahriensis* **n. sp.** were collected from soil of black cherry, walnut and almond orchards, September 17, 2011, Pirchopan village, Azarshahr, East Azerbaijan province, Iran, by Mansoureh Ahaniazad. The holotype and one paratype female will be deposited in the Arachnida Collection of Plant Protection Research Institute, Pretoria, South Africa and six paratypes were deposited in the Acarological Collection, Department of Plant Protection, Faculty of Agriculture, University of Maragheh, Iran.

Discussion and Remarks

Study on about 50 known species of the genus *Raphignathus* shows that eight groups of characters are used to distinguish each species from others:

1. the number of setae on palpfemur,
2. the legs chaetotaxy,
3. the number of setae on interscutal membrane,
4. the size of opisthosomal shield,
5. the presence or absence of endopodal shields,
6. the presence or absence of small shields behind median prodorsal shield,
7. the number of setae on median prodorsal shield,
8. the number of genital setae.

Therefore each of these 50 species differs by the combination of these eight characters, and none of these combinations is specific to the Iranian species. Some of the species present in the Iranian fauna were originally described from South Africa, China and USA, (*R. giselae*, *R. gracilis*, *R. zhaoi* and *R. collegiatus* respectively). The presence in Iran of these species with wide distribution forbids to define

characteristics of the Iranian species against other countries.

Anyway the new species is very close in body shape and in leg chaetotaxy to *R. protaspus* (Khanjani and Ueckermann, 2003), yet described from Iran. The number of tibial solenidia on the first pair of legs is the main character that discriminates these two species: two distinct solenidia in the new species (φ and φρ) *vs* an unique solenidion in *R. protaspus* (φρ). The new species (582 – 690 μm) is also somewhat longer than *R. protaspus* (491 – 516 μm).

The new species could be confused with *R. collegiatus* Atyeo, Baker and Crossley, described from U.S.A., by having 3 pairs of genital setae, 2 pairs of setae on interscutal membrance, 4 setae on femur IV and in having the same chaetotaxy. But *R. collegiatus* and the new species can be separated as follows:

1. the setae e_1 are well behind anterior margin of opisthosomal shield in the new species,
2. the cupule *im* is on opistosomal shield in new species but on integument in *R. collegiatus*,
3. the small shields posterolateral to median prodorsal shields and endopodal shields associated with coxae I-IV are much larger in the new species.

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