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Paragigagnathus iraniensis n. sp. (Acari: Phytoseiidae) from Western Iran

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ABSTRACT — A new species belonging to the family Phytoseiidae, *Paragigagnathus iraniensis* n. sp., is described and illustrated from specimens collected on almond trees, *Prunus dulcis* (Mill.) D.A. Webb (Rosaceae), infested with two spotted spider mites (Tetranychidae) in Hamedan region, Iran. An identification key to all known species of the genus *Paragigagnathus* is provided.

KEYWORDS — Mesostigmata; Neoseiulini; Amblysiinae; almond; Hamedan

INTRODUCTION

The genus *Paragigagnathus* (Mesostigmata: Phytoseiidae) was described by Amitai and Grinberg (1971) with type species *P. tamaricis*, from *Tamarix* sp. (Tamaricaceae), Israel. This genus is one of the ten genera belonging to the tribe Neoseiulini, subfamily Amblysiinae (Chant and McMurtry 2007). To date ten valid species are described [from different hosts such as almond (2 species), mostly *Tamarix* spp (7 species) and *Acacia* sp. (2 species) in Africa, Middle East, South and Central Asia, Southeast Europe, namely: *P. amantis* (Chaudhri, Akbar and Rasool 1979); *P. bidentatus* (Kuznetsov, 1994); *P. cataractus* (Ueckermann and Loots 1988b); *P. desertorum* (Amitai and Swirski 1978); *P. insuetus* (Livshitz and Kuznetsov 1972); *P. madinaensis* Alatawi, Kamran and Basahih 2015; *P. moles-tus* (Kolodochka 1989); *P. namibiaensis* (Ueckermann

and Loots 1988a); *P. strunkovae* (Wainstein 1973); *P. tamaricis* Amitai and Grinberg 1971 [= *Paragigagnathus tawfiki* (Yousef 1974) in Chant and McMurtry (2003)]. The species of this genus were placed in two species groups based on setae ST3 set on or off sternal shield, *desertorum* and *strunkovae* groups, respectively (Chant and McMurtry 2003). Kolodochka (1994a, b) reviewed and re-described seven species of this genus. *Paragigagnathus amantis* was excluded because of its poor description by Chant and McMurtry (2003) and Hajizadeh *et al.* (2010) but referred to as an uncertain species by Chant & McMurtry 2007. However, in the phytoseiid world catalog and database it is listed as a valid species (Moraes *et al.* 2004; Demite *et al.* 2016). In order to clarify the taxonomic status of this species, Honey *et al.* (2015) provided adequate characters and confirmed it as a valid species belonging to *desertorum* species group. In this study an 11th

species of *Paragigagnathus* belonging to *desertorum* species group from Hamedan Province, Iran is described and illustrated. Furthermore, an updated identification key and comparison of characters of all known species of the genus is presented.

MATERIALS AND METHODS

The specimens were collected from leaves of almond trees, *Prunus dulcis* (Mill.) D.A. Webb (Rosaceae), infested with two spotted spider mite (Tetranychidae), using a stereomicroscope. The mites were then directly mounted on microscope slides in Hoyer's medium. The slides were dried in an oven at about 50 °C and examined under an Olympus BX51 microscope (Differential Interference Contrast). A camera Lucida apparatus was used for the drawings. The classification system used follows that of Chant and McMurtry (2007). The setal notations follow Rowell *et al.* (1978), dorsal setal pattern Chant and Yoshida-Shaul (1989), idiosomal setal pattern (Chant and McMurtry 2003) and adenotaxy Athias-Henriot (1975). All measurements are presented in micrometers (µm) and the measurements of the holotype are followed by ranges of the paratypes in parentheses. Also an identification key to all *Paragigagnathus* species mites (female) are given.

Family Phytoseiidae Berlese, 1916: 33

Subfamily Amblyseiinae Muma, 1961: 273

Tribe Neoseiulini Chant and McMurtry, 2003

Genus *Paragigagnathus* Amitai & Grinberg, 1971:

327

Type species: *Paragigagnathus tamaricis* Amitai and Grinberg, 1971: 327

Diagnosis: As defined by Chant & McMurtry 2003.

Paragigagnathus iraniensis n. sp.

(Figure 1)

Female (Fig. 1) (n=8)

Idiosoma oval. Idiosomal setal pattern: 10A:9B/JV-3: ZV. All idiosomal and leg setae smooth except *J5*.

Dorsum (Figs. 1A-B) — Dorsal shield heavily sclerotized and reticulated, 370 (365 – 371) long, 240 (240 – 245) wide at level of setae *R1*, with 17 pairs of smooth setae [ex. *J5* (figs. 1, 2)] and six pairs solenostomes (*gd1*, *gd2*, *gd5*, *gd6*, *gd8*, *gd9*). Length of setae: *j1* 18 (17 – 19), *j3* 26 (24 – 26), *j4* 17 (16 – 18), *j5* 15 (15 – 16), *j6* 19 (18 – 20), *J2* 23 (23 – 24), *J5* 15 (15 – 16), *z2* 25 (24 – 26), *z4* 26 (25 – 27), *z5* 18 (18 – 19), *Z1* 23 (23 – 24), *Z4* 30 (30 – 32), *Z5* 41 (40 – 41), *s4* 34 (33 – 35), *S2* 39 (39 – 40), *S4* 40 (39 – 41), *S5* 41 (40 – 41), *r3* 24 (23 – 25), *R1* 20 (20 – 21).

Chelicerae (Fig. 1C) — Chelicera 150 (147 – 151) in length; Fixed digit with three teeth, pilus dentilis not distinct, movable digit 20 (19 – 21) long and with a tooth (Fig. 1C).

Tectum (Fig. 1D) — The anterior margin of the tectum convex and pointed antromedially and 25 (23 – 26) wide (Fig. 1D).

Venter (Fig. 1E) — Venter of idiosoma with eight pairs of opisthogastric setae. Sternal shield smooth, anterior margin convex and posterior margin indistinct with two pairs of setae sub equal in lengths [*ST1* 20 (19 – 21), *ST2* 18 (18 – 19)], two pairs of lyri-fissures (*iv1-2*) posterior to setae *ST1* and *ST2*, respectively. Distance between setae: *ST1-1* 42 (40 – 42); *ST1-2* 38 (38 – 39); *ST2-2* 47 (46 – 48). Setae *ST3* set on soft integument and 20 (19 – 21) in length; forth sternal setae (*ST4*) 20 (20 – 22) long and set on small metasternal shields, each with one small lyri-fissure (Fig. 5). Genital shield truncate and 110 (100 – 112) long, 50 (48 – 50) wide at level setae *ST5*, *ST5* 20 (19 – 21) long. Two pairs of elongate metapodal shields, primary shield almost twice as long as secondary shield [47 (46 – 48), 20 (20 – 21)]. Ventrianal shield smooth and anterior margin notched, 110 (110 – 111) long, constricted at level of setae *JV2* and broadest at level of setae *Pa* [46 (45 – 47), 58 (58 – 60) wide, respectively]. Pre-anal region with two pairs of pre-anal setae *ZV2* and *JV2* and one pair of pores [distance between pores 9 (9-10)]; Anal opening surrounded with 3 setae (*Pa* and *Pst*). Opisthogastric cuticle bearing five pairs of smooth setae (*ZV1*, *ZV3*, *JV1*, *JV4*, *JV5*) and five pairs of lyri-fissures on small platelets. Length of opisthogastric setae: *ZV1* 15 (14 – 15), *ZV2* 15 (14 – 15), *ZV3* 13 (12 – 13), *JV1* 14 (13 – 14), *JV2* 12 (11 – 13), *JV4* 10 (10 – 11), *JV5*

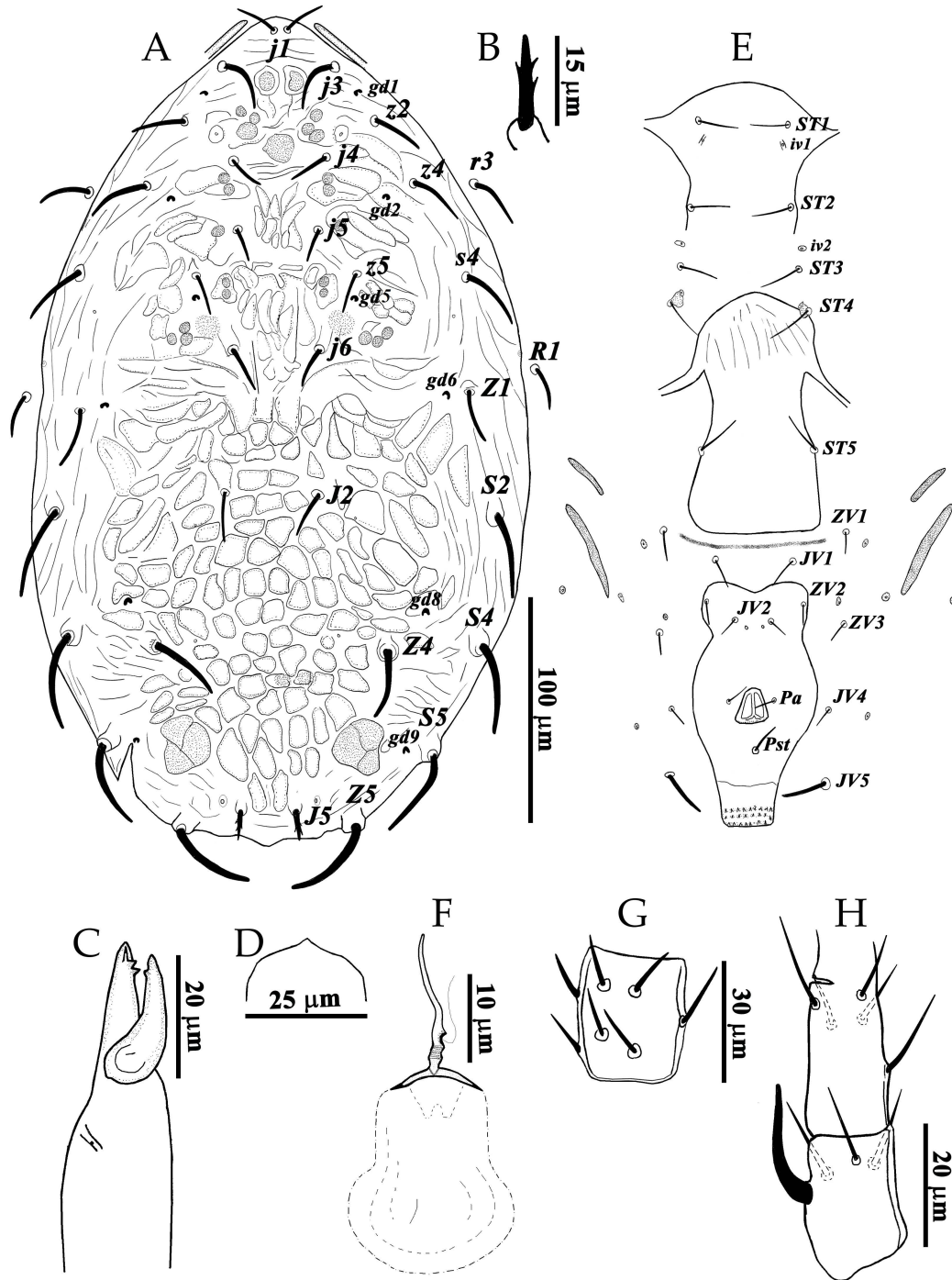


FIGURE 1: *Paragigagnathus iraniensis* n. sp. (Female): A – Dorsal view of idiosoma; B – Dorsal seta *j*5; C – Chelicera; D – Tectum; E – Ventral view of idiosoma; F – Spermatheca; G – Genu II; H – Basitarsus IV.

22 (21 – 23), *Pa* 15 (13 – 15) and *Pst* 15 (14 – 16) (Fig. 1E).

Spermatheca (Fig. 1F) — Calyx dish-like followed by an annulated neck 5 (5 – 6) long and 10 (10 – 11) wide at junction with vesicle; major duct thick and 25 (25 – 26) long, minor duct very fine (Fig. 1F).

Peritreme (Fig. 1A) — Stippled; extending to level of setae *j1*, 170 (165 – 172) long (Fig. 1A).

Legs II, IV (Figs. 1G-H) — Genu II with seven setae, 2-2/0-2/0-1 setae (Fig. 1G); Basitarsus IV with one robust macroseta 20 (19 – 22) long (Fig. 1H).

Remarks — The Iranian new species closely resembles to *Paragigagnathus strunkovae* from Tajikistan in having ventri-anal shield with two pairs of pre anal setae and one pair of pores, only posterior dorsal setae set on prominent tubercles, setae *J5* serrated, movable digit of chelicera with one tooth, setae *ST4* on metasternal shields, however, it differs from the later by:

- 1) Setae *ST3* set on soft cuticle in *P. iraniensis* instead of set on metasternal shields in *P. strunkovae*;
- 2) Spermatheca with dish shaped calyx in new species opposed to funnel shaped in *P. strunkovae*;
- 3) Ventrianal shield with notched anterior margin in the former whereas convex in the later;
- 4) Measurements of dorsal setae: *j3* 24 – 26, *s4* 33 – 35, *Z1* 23 – 24, *JV5* 21 – 23 *vs.* *j3* 32, *s4* 28, *Z1* 31, *JV5* 16 μ m.

The new species *P. iraniensis* **n. sp.** also resembles *P. bidentatus* from Armenia in having only posterior dorsal setae set on prominent tubercles, ventri-anal shield with two pairs of pre-anal setae and a pair of pores, calyx of spermatheca dish shaped, setae *J5* serrated, setae *ST3* set on soft cuticle, tarsus IV with a macroseta but it differs in that:

- 1) Setae *ST4* on metasternal shields in new species on cuticle in other species;
- 2) Movable digit of chelicera with one tooth in Iranian species whereas two teeth in *P. bidentatus*;
- 3) Ventrianal shield with notched anterior margin *vs.* convex in *P. bidentatus*;
- 4) Opisthogaster with one slender platelet between setae *JV4-5* in the former oppose to four platelets in the latter;
- 5) Measurements: dorsal setae: *J2* 23 – 24, *z2* 24 – 26, *z4* 25 – 27, *Z1* 23 – 24, *S5* 40 – 41 *vs.* *J2* 33, *z2* 30, *z4*,

Z1, *S5* 33 – 34; macroseta on tarsus IV 20 versus 14 μ m;

6) Length of dorsal setae *Z4* < *S4* *vs.* *Z4* > *S4*;

7) Opistogastric setae *JV1* long and reached over anterior margin of ventrianal shield in new species whereas short, not reaching over margin in *P. bidentatus*.

Furthermore the new species is similar to *P. tamaricis* in having dish-shaped calyx of spermatheca, two pairs of preanal setae, anterior margin of ventri-anal shield notched, setae *ST4* on metasternal shields, the posterior border of sternal shield indistinct but it differs in:

- 1) Only posterior dorsal setae set on prominent tubercles in *P. iraniensis* **n. sp.** opposed to all dorsal setae set on prominent tubercles in *P. tamaricis*;
- 2) Dorsal seta *J5* serrated in the former instead of smooth in latter;
- 3) Tarsus IV with a macroseta in the new species opposed to absent in *P. tamaricis*;
- 4) Measurement of dorsal setae 17 – 41 versus 13 – 33 μ m. Comparisons species of the genus *Paragigagnathus* is given on table 1.

Male: Unknown.

Etymology — This species is named after the country of origin, Iran.

Material examined — The specimens were collected from leaves of almond trees, *Prunus dulcis* (Rosaceae), infested with two spotted spider mite (Tetranychidae), in the Kondor village (34°43'N, 48°15'E, 2010 m a.s.l.), 20 Sept. 2015, Tuyserkhan county, Hamedan province, Iran, by M. Karimi. The holotype female and five paratype slides are deposited in the Collection of the Acarology Laboratory, University of Bu-Ali Sina, Hamedan, Iran and two paratype females will be deposited in the National Collection of Arachnida, Plant Protection Research, Pretoria, South Africa.

Key to species of *Paragigagnathus* Amitai & Grinberg of the world (Females)

1. Ventrianal shield with two pairs of preanal setae.....2
- Ventrianal shield with three pairs of preanal setae.....5

TABLE 1: Comparisons species of the genus *Paragigagnathus*

Taxa/Ch.	Setae on tubercles*	Setae J5	ST3 on platelet	ST4	Dorsal setae	Calyx	Mov. digit	St IV	Pre-anal seta (pair)/pore
<i>P. amantis</i>	O.P.D.S.	Smooth	-	-	Short stout	Dish shaped	1	+	3/+
<i>P. bidentatus</i>	O.P.D.S.	Serrated	-	-	Short stout	Dish shaped	2	+	2/+
<i>P. cataractus</i>	O.P.D.S.	Serrated	+	+	Long, slender	Disk shaped	1	-	3/-
<i>P. desertorum</i>	A.P.D.S.	Smooth	-	-	Long, stout	Dish shaped	0	-	3/+
<i>P. insuetus</i>	O.P.D.S.	Serrated	-	+	Short setiform	Funnel shaped	1	+	3/+
<i>P. madinaensis</i>	O.P.D.S.	Smooth	-	-	Long, slender	Dish shaped	1	+	3/+
<i>P. molestus</i>	O.P.D.S.	Smooth	+	+	Short setiform	Funnel shaped	1	+	3/+
<i>P. namibiaensis</i>	O.P.D.S.	Smooth	-	-	Short setiform	Funnel shaped	1	+	3/+
<i>P. strunkovae</i>	O.P.D.S.	Serrated	+	+	Long, stout	Funnel shaped	1	+	2/+
<i>P. tamaricis</i> = <i>tawfiki</i>	A.P.D.S.	Serrated	-	+	Short stout	Dish shaped	1	-	2/+
<i>P. iraniensis n. sp.</i>	O.P.D.S.	Serrated	-	+	Short stout	Dish shaped	1	+	2/+

Note:

O.P.D.S.: Only posterior dorsal setae

A.P.D.S.: All posterior dorsal setae

- All dorsal setae serrated and dorsum with lateral incision at level of seta *r3* in *P. cataractus*.

- The third sternal setae *ST3* set on posterior sternal lobes in *P. namibiaensis*

- Setae *ST3* on sternal shield in *P. amantis* and *P. namibiaensis*

- 2. Only posterior dorsal setae set on prominent tubercles 3
— All dorsal setae set on prominent tubercles
P. tamaricis Amitai & Grinberg [= *P. tawfiki* (Yousef)]
- 3. Movable digit of chelicera with one tooth, setae *ST4* on metasternal shields 4
— Movable digit of chelicera with two teeth, setae *ST4* on soft cuticle *P. bidentatus* (Kuznetsov)
- 4. Setae *ST3* on metasternal shields, spermatheca with funnel shaped calyx
..... *P. strunkovae* (Wainstein)
— Setae *ST3* on soft cuticle, spermatheca with dish shaped calyx *P. iraniensis n. sp.*
- 5. All dorsal setae smooth (ex. setae *J5* or *Z5*), all or only posterior dorsal setae set on prominent tubercles, dorsal shield without lateral incision at level of setae *r3* 6
— All dorsal setae serrated (ex. *z5*), dorsal setae without prominent tubercles, dorsal shield with lateral incision at level of setae *r3*
..... *P. cataractus* (Ueckermann and Loots)
- 6. Setae *ST4* set on metasternal shields 7
— Setae *ST4* set on soft cuticle 8

- 7. Dorsal shield with five pairs of solenostomes, setae *ST3* inserted on sternal shield, setae *J5* serrated *P. insuetus* (Livshitz and Kuznetsov)
— Dorsal shield with six pairs of solenostomes, setae *ST3* on metasternal shields, setae *J5* smooth
..... *P. molestus* (Kolodochka)
- 8. Only posterior dorsal setae set on prominent tubercles, tarsus IV with macroseta, movable digit of chelicera with one tooth 9
— All dorsal setae set on prominent tubercles, tarsus IV without macroseta, movable digit of chelicera without tooth *P. desertorum* (Amitai and Swirski)
- 9. Sternal shield with three pairs of setae (*ST1-3*), dorsal shield setae short (11 to 35 μm) 10
— Sternal shield with two pairs of setae (*ST1-2*), dorsal shield setae slightly long (15 to 48 μm) *Paragigagnathus madinaensis* Alatawi, Kamran and Basahih
- 10. Spermatheca with dish shaped calyx, posterior margin of sternal shield normal and without lateral lobes *P. amantis* (Chaudhri, Akbar and Rasool)
— Spermatheca with funnel shaped calyx, posterior

margin of sternal shield with lateral lobes and bearing setae ST3.....*P. namibiaensis* (Ueckermann and Loots)

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