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A new species of *Paragigagnathus* Amitai & Grinberg (Mesostigmata: Phytoseiidae) from Iran

Alireza Arjmandi-Nezhad[a] , Serge Kreiter [b] , Alireza Saboori[c] , Sultan Ravan[a]

[a] Department of Plant Protection, College of Agriculture, University of Zabol, Zabol, Iran.
[b] Institut Agro (Montpellier SupAgro), UMR CBGP INRAE/ IRD/ CIRAD/ IA (SupAgro), Univ Montpellier, 755 Avenue du Campus Agropolis (Baillarguet), CS 30016, 34988 Montferrier-sur-Lez cedex, France.
[c] Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran.

Original research

ABSTRACT

Paragigagnathus sistaniensis Kreiter, Arjmandi-Nezhad and Saboori **n. sp.** belongs to the tribe Neoseiulini, subfamily Amblyseiinae, is described and illustrated, based on females and males. The new species was collected from foliage of tamarisk trees in Sistan region, Sistan and Baluchestan province, southeastern Iran.

Keywords Gamasina; predatory mites; new taxon; morphology; *Tamarix*; Sistan and Baluchestan
Zoobank http://zoobank.org/5A740452-7CC1-4592-BF45-E936355E3787

Introduction

The family Phytoseiidae is widespread, present on all continents except Antarctica, and it consists of about 2,500 valid species in 94 genera and three subfamilies (Demite *et al.* 2021). They are active predators on phytophagous mites and small insects, like thrips and whiteflies, on cultivated plants and plants of the natural vegetation.

During 2018-2020, phytoseiid mite fauna of Sistan and Baluchestan province (Iran) was studied. The province of Sistan and Baluchestan (25°03′–31°27′ N, 58°50′–63°21′ E) is the second largest province in Iran with an area of 187, 502 km². It is in the southeast of the country, bordering South Khorasan province in the north, Kerman province and Hormozgan province in the west, the Gulf of Oman in the south, and Afghanistan and Pakistan in the east. The province of Sistan and Baluchestan is one of uninvestigated provinces of Iran with regard to phytoseiid mite fauna. It is necessary to mention, the territory of Iran is important from a zoogeographical point of view, as it straddles several major ecoregions of the world including the Palaearctic, Ethiopian and Oriental Realms. Iran is also part of the Irano-Anatolian hotspot of biodiversity with great floristic and faunistic diversities (Esmaeili *et al.* 2017).

The genus *Paragigagnathus* Amitai and Grinberg, 1971, consists of two species groups, *desertorum* and *strunkovae*, which based on the position of setae *ST3* (on or off sternal shield, respectively), and include 12 species in total (Demite *et al.* 2021; Kreiter et al. 2021). The *strunkovae* species group is composed of seven species: *P. strunkovae* (Wainstein 1973), *P. cataractus* (Ueckermann and Loots 1988), *P. molestus* (Kolodochka 1989), *P. bidentatus* (Kuznetsov 1994), *P. madinaensis* Alatawi, Kamran and Basahih, in Alatawi *et al.* (2015), *P. iraniensis* Khanjani, Karimi, Asali-Fayaz and Ueckermann, in Khanjani *et al.* (2016), *P. philippei* Kreiter et al. 2021. The *desertorum* species groups composed of five species: *P. tamaricis* Amitai and Grinberg (1971), *P. insuetus* (Livshitz and Kuznetsov 1972), *P.*

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Corresponding author
Sultan Ravan: sultanravan@uoz.ac.ir

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desertorum Amitai and Swirski (1978), *P. amantis* (Chaudhri, Akbar and Rasool, in Chaudhri *et al.* 1979), *P. namibiaensis* (Ueckermann and Loots 1988).

This study aims to describe a new species, *Paragigagnathus sistaniensis* Kreiter, Arjmandi-Nezhad and Saboori **n. sp.** based on the material collected from *Tamarix* sp. (Tamaricaceae) and *Haloxylon* sp. (Amaranthaceae) in southeastern Iran.

Material and methods

The material used in this study were collected by the senior author and the specimens were mounted in permanent slides. Species studied here are represented as adults. Foliage samples were taken from different regions, north of Sistan and Baluchestan province during 2018–2020. Mites were extracted from samples with two methods either by using Berlese-Tullgren funnels set over vials with 75% ethanol or washing method of Boller (1984). When the sampling sites were close to the laboratory, the foliage samples were transferred to plastic bags and immediately were moved to the laboratory whereas if they were located at a far distance, to protect the mites the washing processes of the host plants were performed in the sampling site. The collected mites were cleared in lactophenol fluid and permanently mounted on slides in Hoyer's medium (Walter and Krantz 2009). The slides were placed in an oven at 45 °C for two weeks. The specimens were examined under a phase-contrast microscope (BX51, Olympus, Japan) equipped with a drawing tube and digital camera (Olympus U-TVO.63XC). The setal nomenclature system adopted was that of Lindquist and Evans (1965) and Lindquist (1994) as adapted by Rowell *et al.* (1978) and Chant and Yoshida-Shaul (1989) for the dorsal idiosoma and by Chant and Yoshida-Shaul (1991) for the ventral idiosoma. Pore (solenostome) and poroid (lyrifissure) notations are those of Athias-Henriot (1975). Macrosetal notations (*St* = tarsal macroseta) are those of Muma and Denmark (1970). Types of spermatheca or insemination apparatus are those proposed by Denmark and Evans (2011). Numbers of teeth on the fixed and movable cheliceral digits do not include the respective apical teeth. Setae not referred to in results section should be considered as absent. The classification system follows Chant and McMurtry (2003 and 2007). All measurements are given in micrometers (µm). The average measurements are followed by ranges of the measurements in parentheses. We used the following abbreviations: dorsal length (Dsl); dorsal width (Dsw); solenostomes (*gd*); genital shield length (Gensl); genital shield width (Gensw); primary metapodal shield length (Lisl); primary metapodal shield width (Lisw); secondary metapodal shield length (Sisl); ventri-anal shield length (Vsl); ventri-anal shield width (Vsw); spermatheca calyx length (scl); spermatheca calyx width (scw); fixed digit length (Fdl); movable digit length (Mdl).

Results

Subfamily Amblyseiinae Muma

Amblyseiinae Muma 1961: 273.

Tribe Neoseiulini Chant & McMurtry

Neoseiulini Chant & McMurtry 2003: 6.

Paragigagnathus Amitai & Grinberg

Paragigagnathus Amitai & Grinberg 1971: 327, Chant & McMurtry 2003: 39, Moraes *et al.* 2004: 158.

Type species: *Paragigagnathus tamaricis* Amitai & Grinberg 1971: 327.

Paragigagnathus sistaniensis Kreiter, Arjmandi-Nezhad and Saboori n. sp.

Zoobank: BCDBA472-6B38-416F-8543-7631A27D2A3E

Diagnosis

All of dorsal setae set on prominent tubercles, except *j1*; dorsal setae short, setiform and subequal in length, *J5* and *Z5* serrate; setae *ST3* and *ST4* set on soft cuticle; movable digit of chelicera with one tooth, fixed digit of chelicera with two teeth; macroseta present on leg IV; anterior margin of ventrianal shield straight, with three pairs of preanal setae and preanal pores.

Description

Female (n = 10)

Figures 1 & 3.

Dorsal idiosoma — (Figure 1A & Figure 3B): Dorsal shield strongly sclerotized and ornamented, 320 (320–340) long and 190 (190–220) wide at level of setae *Z1*, constricted between *Z1* and *S2*, with 17 pairs of short, smooth, sharp tipped and setiform setae, except *J5* and *Z5* serrated, all dorsal setae set on tubercles, except *j1*, with five pairs of solenostomes (*gd1*, *gd2*, *gd6*, *gd8*, *gd9*) and 13 pairs of visible poroids. Length of setae: *j1* 14 (13–15), *j3* 15 (15–17), *j4* 14 (14–15), *j5* 16 (14–16), *j6* 15 (14–16), *J2* 16 (16–18), *J5* 6 (6–8), *z2* 15 (15–17), *z4* 16 (16–18), *z5* 16 (14–16), *Z1* 17 (17–18), *Z4* 16 (16–18), *Z5* 20 (20–21), *s4* 18 (18–19), *S2* 17 (16–17), *S4* 17 (16–18), *S5* 19 (18–20), *r3* 14 (13–15), *R1* 13 (12–14).

Peritreme and peritremal shield — (Figure 1E & Figure 3C): extending to the level of setae *j1*, 174 (170–176) long; peritremal shield fused with dorsal shield at level of *r3*.

Ventral idiosoma — (Figure 1B): sternal shield smooth, convex anteriorly, with two pairs of subequal setae in length *ST1* and *ST2* 12 (11–13) and one pair of pores (*iv1*); distances between *ST1* – *ST1* 38 (35–40), *ST2* – *ST2* 44 (39–45). Poroid *iv2*, *iv3* and setae *ST3*, *ST4* present on soft cuticle, 15(11–15) long. Genital shield 87 (88–90) long, 58 (53–59) wide at level setae *ST5* and 40 (37–40) at posterior corners, distance between *ST5* – *ST5* 55 (49–55), one pair of pores *iv5* present laterally to genital shield at the level of setae *st5* on soft cuticle. Ventrianal shield 105 (105–107) long, width at level *ZV2* 34 (34–35) and broadest at anus 55 (52–56), anterior margin straight, with three pairs of preanal setae *JV1* 12 (9–12), *JV2* 12 (9–12), *ZV2* 12 (9–12) and one pair of pores (*gv3*), distance between *gv3* – *gv3* 10 (9–11). Four pairs of smooth, setiform and subequal setae [*ZV1* 12 (10–13), *ZV3* 12 (10–12), *JV4* 13 (12–15), *JV5* 12 (12–15)]. Two pairs of metapodal platelets; length of primary metapodal plate 47 (45–48) and length of secondary metapodal plate 22 (20–23), and five pairs of poroids *ivo* present on the membrane surrounding the ventrianal shield. No poroids *ivp* visible posteriorly to the ventrianal shield. Several cases of larvae inside the body of females were observed as viviparity phenomenon (Figure 3A), this phenomenon is common among *Paragigagnathus* species) Amitai & Grinberg 1971).

Spermatheca — (Figure 1C & Figure 3D): calyx dish-shaped; atrium not adjacent to the calyx and between of these considered as a neck, major duct thick, minor duct not visible.

Chelicera — (Figure 1D & Figure 3E): fixed digit 23 (23 – 25) long and with two small teeth and pilus dentilis; movable digit 20 (20 – 23) long with one tooth.

Legs — Chaetotaxy: Leg I: coxa 0 0/1 0/1 0, trochanter 1 1/2 0/1 0, femur 2 2/1 3/2 1, 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 1/2 0/1 0, femur 2 2/1 3/0 2, genu 1 2/0 2/0 2, tibia 1 2/0 2/0 2. Leg III: coxa 0 0/1 0/1 0, trochanter 1 1/1 0/1 1, femur 1 2/1 0/1 1, genu 0 2/1 2/0 2 , tibia 0 2/1 2/1 1. Leg IV: coxa 0 0/1 0/0 0, trochanter 1 1/2 0/1 0, femur 1 2/1 0/1 1, genu 1 2/0 2/1 1, tibia 1 2/0 2/1 1; all setae setiform and needle-like. Basitarsus of the leg IV with one thick and sharp tipped macroseta; *StIV* 21(21 – 22) long (Figure 1F & Figure 3I).

Male (n = 10).

Figures 2 & 3

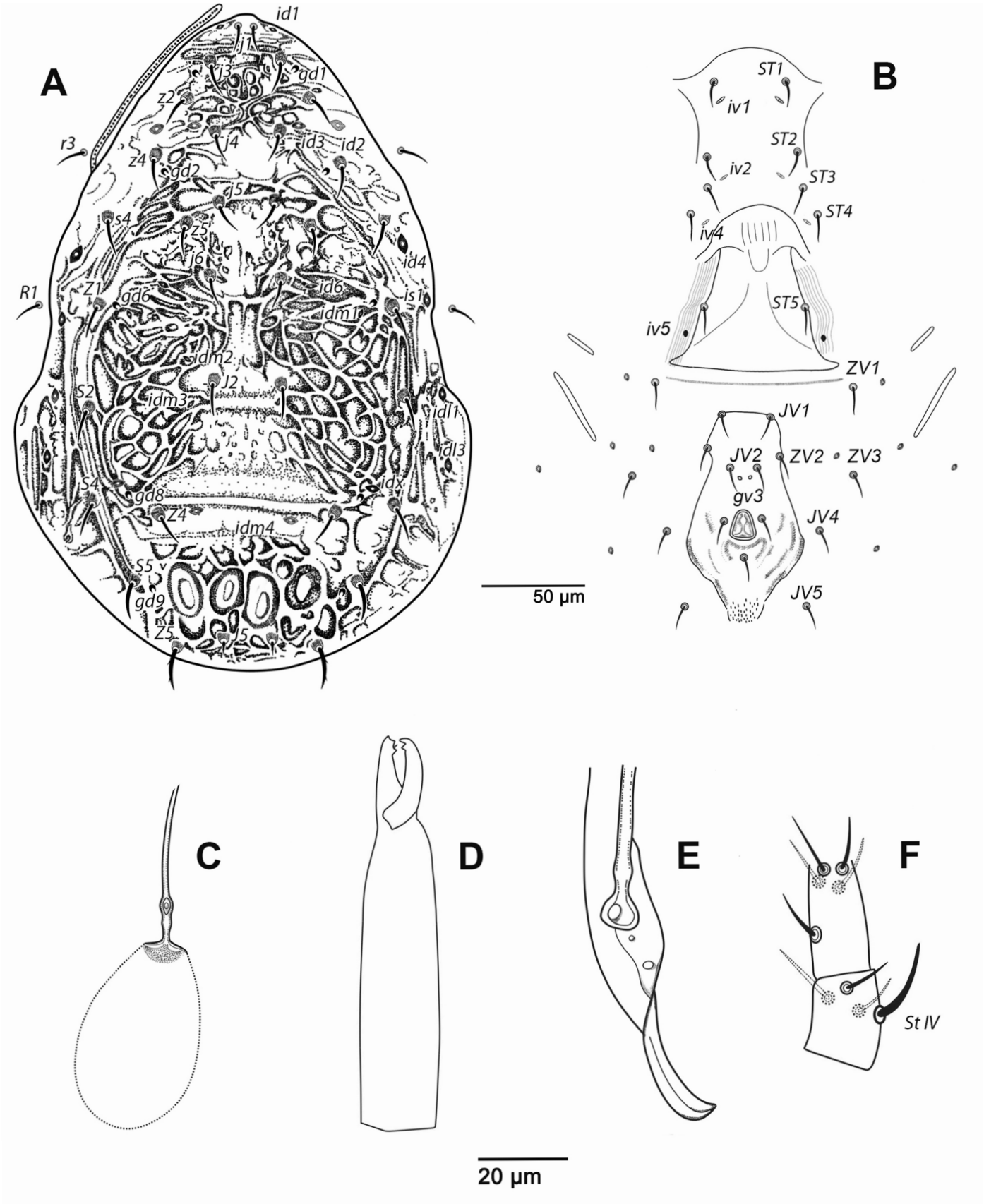

Figure 1 *Paragigagnathus sistaniensis* **n. sp.** Kreiter, Arjmandi-Nezhad and Saboori (Female): A — dorsal idiosoma; B — ventral view of idiosoma; C — spermatheca; D — chelicera; E — peritremal shield; F — basitarsus IV.

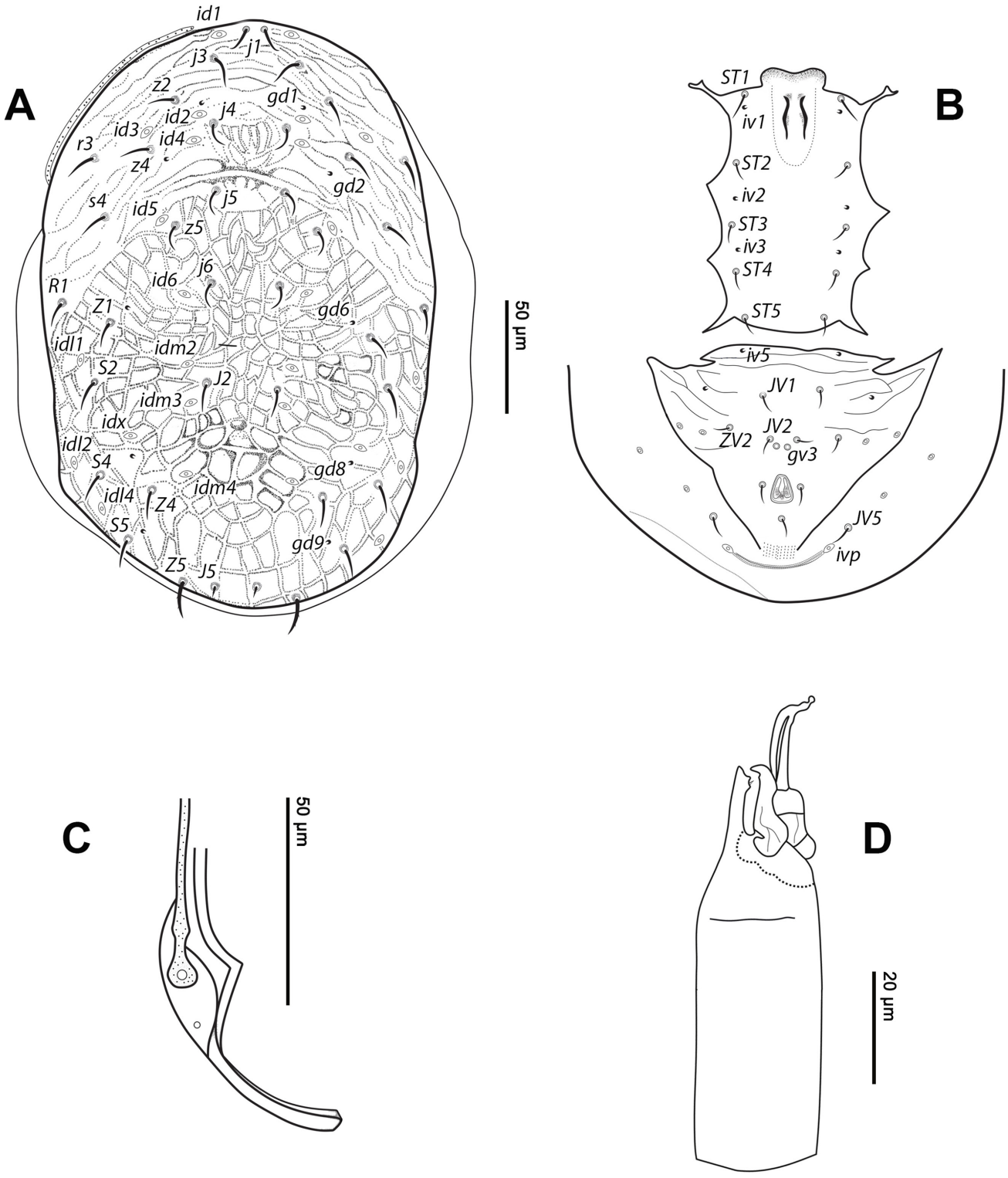

Figure 2 *Paragigagnathus sistaniensis* **n. sp.** Kreiter, Arjmandi-Nezhad and Saboori (Male): A — dorsal idiosoma; B — ventral view of idiosoma; C — peritremal shield; D — chelicera.

Dorsal idiosoma — (Figure 2A): dorsal shield 260 (260–270) long and 160 (160–170) wide at level of *R1*, anteriorly lineate, and reticulated posteriorly, with five pairs of solenostomes (*gd1*, *gd2, gd6, gd8* and *gd9*) and 13 visible pairs of poroids (*id1*, *id2*, *id3*, *id4*, *id5*, *id6*, *idl1*, *idl2*, *idl4*, *idx*, *idm2*, *idm3*, *idm4*) but probably more present. The dorsal shield bears 17 pairs of dorsal setae and two pairs of sub-lateral setae which are inserted on the dorsal shield: *j1* 11 (11–12), *j3* 13 (12–13), *j4* 11 (10–13), *j5* 11 (10–12), *j6* 11 (10–12), *J2* 12 (13–14), *J5* 4 (4–5), *z2* 13 (12–13), *z4* 13 (12–13), *z5* 11 (10–12), *Z1* 15 (13–15), *Z4* 14 (13–14), *Z5* 17 (17–19), *s4* 13 (12–13), *S2* 15 (13–15), *S4* 15 (13–15), *S5* 15 (13–15), *r3* 15 (14–15), *R1* 13 (13–14). All setae sharp-tipped and smooth, except *J5* and *Z5* slightly serrated.

Peritreme and peritremal shield — (Figure 2A): peritreme extending to level of setae *j3*; peritremal shield fused with dorsal shield at level of *s4 – r3* level.

Ventral idiosoma — (Figure 2B): sternogenital shield smooth with five pairs of setae (*ST1* to *ST5*) and three pairs of poroids *iv1, iv2* and *iv3*. Distances between *ST1 – ST1* 52 (50–55), *ST2 – ST2* 55 (50–58), *ST3 – ST3* 55 (51–58), *ST1 – ST5* 114 (112–118), *ST4 – ST4* 36 (31–40), *ST5 – ST5* 31 (30–34). Ventrianal shield (Figure 3H) anteriorly striated with three pairs of pre-anal setae (*JV1*, *JV2* and *ZV2*) and one pair of small crateriform pores *gv3*, posteromedian to *JV2*, one pair of *iv5* (close to anterior margin of ventrianal shield). Ventrianal shield 100 (95–110) long, 120 (125–130) wide at level of anterior corners and 59 (50–65) wide at level of paranal setae. Soft cuticle surrounding ventrianal shield with three pair of pores, *JV5* pointed and smooth 9 (9–11) long.

Chelicera — (Figure 2D & Figure 3F): fixed digit 18 (18 – 20) long, with two teeth and movable digit 16 (16 – 18) long with one tooth. Spermatodactyl L-shaped with toe slightly bulbous tip.

Legs — Chaetotaxy as in female; all setae setiform and needle-like. Basitarsus of the leg IV with one macroseta; *St*IV 17 (17 – 19) long.

Type material and depository

Holotype, female, Nimrooz city, Sistan region, Sistan and Baluchestan Province, Iran, 31°07′07″ N, 61°24′39″ E, alt. 480 m, 18 May, 10 September and 1 October 2018, on *Tamarix* sp. (Tamaricaceae). Paratypes (52): seven females and four males same data as holotype; three females and two males, Firouzehie Village, Hamoon City, 30°57′39″ N, 61°28′53″ E, alt. 480 m, 25 May 2020, on *Haloxylon* sp. (Amaranthaceae); seven females, Zahak City, 30°52′54″ N, 61°40′17″ E, alt. 491 m, 14 May, 2 July and 9 August 2018, on *Tamarix* sp.; five females, Khamak Village, Zabol City, 30°55′52″ N, 61°37′05″ E, alt. 487 m, 20 August 2018 and 15 June 2019, on *Tamarix* sp.; one female and one male, Zabol City, 31°05′08″ N, 61°34′00″ E, alt. 486 m, 20 June 2019, on *Tamarix* sp.; eight females and three males, Hamoon lake, 31°20′17″ N, 61°21′34″ E, alt. 475 m, 7 July 2018 and 11 August 2019, on *Tamarix* sp.; seven females and four males, Hirmand city, 31°08′ 41″ N, 61°47′27″ E, alt. 489 m, 26 July, 15 September and 7 May 2018, on *Haloxylon* sp. All specimens collected by A. Arjmandi-Nezhad.

The holotype, 10 paratypes (7 females and 3 males) are deposited in the Acarological Collection, Jalal Afshar Zoological Museum (JAZM), Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran; 20 paratypes (17 females and 3 males) are deposited in the mite collections of Montpellier SupAgro conserved in UMR CBGP INRAE/ IRD/ CIRAD/ IA (SupAgro) and 23 paratypes (15 females and 8 males) are deposited in the collection of the Department of Plant Protection, College of Agriculture, Zabol University, Zabol, Iran.

Etymology

The specific epithet is derived from the type locality, Sistan region, Sistan and Baluchestan Province, Iran.

Figure 3 Microphotographs of *Paragigagnathus sistaniensis* **n. sp.** Kreiter, Arjmandi-Nezhad and Saboori: A — viviparity; B — dorsal idiosoma (Female); C — peritreme and peritremal shield; D — spermatheca; E — chelicera (Female); F — chelicera (Male); G — ventri-anal shield (Female); H — ventri-anal shield (Male); I — basitarsus IV. Not scaled.

Discussion

Paragigagnathus sistaniensis Kreiter, Arjmandi-Nezhad and Saboori n. sp. belongs to the *strunkovae* species group by insertion of seta *ST3* off sternal shield and differ from all other species in this group by its all of dorsal setae set on prominent tubercles. This new species is morphologically very similar to *P. desertorum* Amitai and Swirski (1978) because both share the following characters: all of dorsal setae set on prominent tubercles, disk shaped calyx, three pairs of preanal setae, and *ST4* set on soft cuticle. However it differs from *P. desertorum* by having: *J5* and *Z5* serrate, dorsal setae short and setiform, movable digit of chelicera with one tooth, fixed digit of chelicera with two teeth, presence of macroseta on the basitarsus of the leg IV and anterior margin of ventrianal shield straight. *Paragigagnathus sistaniensis* **n. sp.** also closely resembles to *P. amantis* (Chaudhri *et al.* 1979 in Honey *et al.* 2015) in having all of dorsal setae short/medium and subequal in length, disk shaped calyx, *ST4* sets on soft cuticle, three pairs of preanal setae, anterior margin of ventrianal shield straight and macroseta on basitarsus of the leg IV present. However it differs from the later by following characters: setae *ST3* sets on soft cuticle, setae *Z5* and *J5* serrated, post-anal seta equal to para-anal setae and fixed digit of chelicera with two teeth. Comparison of characters of the 12 species of *Paragigagnathus* is given in Table 1.

Table 1 Comparison of characters of the 13 species of *Paragigagnathus* (female), after Kreiter et al. (2021).

	P. amantis* Chaudhri, Akbar & Rasool Chaudhri *et al.* 1979	***p. bidentatus*** (Kuznetsov) Kuznetsov 1994	***p. cataractus*** (Ueckermann & Loots) Ueckermann & Loots 1988	***p. desertorum*** (Amitia & Swirski Amitai & Swirski 1978	***p. desertorum*** (Amitia & Swirski) Alatawi *et al.* 2015	***p. insuetus*** (Livshitz & Kuznetsov) Hajizadeh *et al.* 2010	***p. traniensis*** Khanjani, Karimi, Asali Fayas & Ueckermann Khanjani *et al.* 2016	***p. madinaensis*** Alatawi, Kamran & Basahih Alatawi *et al.* 2015	***p. molestus*** (Kolodochka) Hajizadeh *et al.* 2010	***p. namibiaensis*** (Ueckermann & Loots) Ueckermann & Loots 1988	***p. strunkovae*** (Wainstein) Wainstein 1973 & Kolodochka 1989	***p. tamaricis*** Amitai & Grinberg Amitai & Grinberg 1971	***p. tamaricis*** (Amitai & Grinberg) Swirski *et al.* 1998	***p. philippei*** Kreiter *et al.* 2021	***p. sistaniensis*** Kreiter, Arjmandi-Nezhad and Saboori **n. sp.**
n	16	2	25	13	8	7	8	16	5	3	5	35	–	1	39
Dsl	357	335	385 (377 - 408)	325 (312 - 340)	288 - 302	345(348)	370 (365 – 371)	339 (337 – 324)	343 (373)	312 (309 – 312)	390	299 - 332	–	265	330(330 – 340)
Dsw	200	200	246 (234 - 262)	–	204 - 212	225(210)	240 (240 – 245)	196 (185 – 210)	213 (224)	192 (189 – 195)	215	–	–	155	200 (200– 220)
Peritreme	*j1*	*j1 - j3* , close *j1*	*j1*	*j1 - j3* , close *j1*	*j1 - j3* , close *j1*	*j1*	*j1 - j3*	*j1 - j3* , close *j1*	*j1 - j3*	*j1*	*j1 - j3*	*j1 - j3* , close *j1*	j1	*j1*	close to *j1*
gd	–	1, 2, 5, 6, 8 , 9	1, 2, 6, 8, 9	1, 2, 6, 8, 9	1, 2, 6, 8, 9	1, 2, 6, 8, 9	1, 2, 5, 6, 8 , 9	–	1, 2, 5, 6, 8 , 9	1, 2, 6, 8 , 9	1, 2, 5, 6, 8 , 9	1, 2, 6, 8, 9	1, 2, 6, 8 , 9	1, 2, 4, 8 , 9	1, 2, 6, 8 , 9
All dorsal setae set on prominent tubercles	–	–	–	+	+	–	–	–	–	–	–	+	+	–	+
Shape of dorsal setae	thick	thick, pointed	thick, serrated	thick, rouded		thick, pointed	pointed	pointed	thick, pointed	pointed	pointed	thick	some blunt and some pointed	plumose	short and setiform and some serrate
R1	16	–	39 (39 - 54)	19 (18 - 20)	18 – 19	17 (17)	20 (20 –21)	19 (16 –22)	17 (16)	16	20	13 – 17	–	15	13(12 – 14)
S2	21	36 – 38	69 (62 - 77)	52 (45 - 58)	45 – 47	23 (19)	39 (39 – 40)	46 (41 –50)	22 (21)	25	37 – 38	23 (20 – 27)	–	33	17(16 – 17)
S4	26	36 – 38	54 (54 - 69)	53 (45 - 61)	45 – 48	23.5 (19)	40 (39 – 41)	48 (41 –50)	23 (21)	28 (26 –28)	42 – 43	26 (23 – 28)	–	25	17(16 – 18)
S5	26	33 – 34	39 (39 - 54)	55 (46 - 66)	46 – 49	23 (20)	41 (40 – 41)	44 (39 – 48)	21 (21)	28 (26 –28)	41	27 (23 – 28)	–	18	19(18 – 20)
z2	18	30	42 (46 – 49)	37 (35 – 40)	35 – 37	19 (18)	25 (24 – 26)	34 (32 – 36)	19 (18)	19	26 – 27	23 (20 – 25)	–	28	15 (15 – 17)
z4	21	33 – 34	57 (54 – 62)	42 (35 – 50)	36 – 38	19 (18)	26 (25 – 27)	35 (34 – 37)	20 (19)	19	27 –28	23 (20 – 25)	–	30	16 (16 – 18)
z5	18	18 – 20	23 (22 – 31)	27 (25 – 30)	24 – 26	19 (15)	18 (18 – 19)	25 (21 – 29)	18 (16)	19 (16)	20	18 (17 – 22)	–	15	16 (14 – 16)
Z1	21	33 – 34	46 (39 – 46)	47 (42 – 53)	36 – 39	21 (17)	23 (23 – 24)	41 (39 – 46)	22 (20)	23 (22)	31	23 (20 – 27)	–	28	17 (17 – 18)
Z4	23	–	54 (54 – 69)	50 (45 – 55)	46 – 49	22 (20)	30 (30 – 32)	43 (40 – 46)	22 (18)	25 (22 – 25)	34	23 (20 – 25)	–	45	16 (16 – 18)
Z5	31	36 – 38	54 (54 – 69)	52 (45 – 66)	45 – 47	25 (23)	41 (40 – 41)	38 (35 – 41)	24 (21)	35 (32)	41	27 (23 – 28)	–	40	20 (20 – 21)
***st3* on/ off st. sh.**	on	off	off	on	on	on	off	off	off	on	off	on	on	off	off
Gensl	–	–	77 (69 – 77)	–	–	–	110 (100 – 112)	–	–	–	–	–	–	108	87 (88 – 90)
Gensw *st5*	–	–	–	–	–	–	50 (48 – 50)	–	–	–	–	–	–	58	58 (53 – 59)
Gensw post. corn.	–	–	–	–	55 – 58	–	–	69	–	72	–	–	–	58	34 (34 – 35)
Lisl	44	–	–	–	36 – 39	48	47 (46 – 48)	50 (47 – 52)	51	–	–	–	–	29	47 (45 – 48)
Lsiw	–	–	–	–	–	–	–	–	–	–	–	–	–	3	2 (1/7 – 2)
Sisl	16	–	–	–	16 – 18	16	20 (20 – 21)	18 (17 – 19)	20	–	–	–	–	6	22 (20 – 23)
Vsl	117	–	131 (131 – 142)	96 (91 – 103)	99 – 105	110 (110)	110 (110 – 111)	106	111 (125)	107 (104 – 107)	118	83 – 91	–	93	105 (105 – 107)
Vsw *ZV2*	65	–	69 (62 – 69)	62 (53 – 66)	36 – 37	49	46 (45 – 47)	28	38	–	–	43 – 50	–	60	34 (34 – 35)
Vsw anus	–	–	–	–	60 – 61	59 (54)	58 (58 – 60)	57	56 (65)	60	64	53 – 66	–	56	55 (51 – 56)
JV5	16	18 – 20	46 (39 – 46)	19 (18 – 20)	17 – 18	18	22 (21 – 23)	22 (22 – 24)	16	13 (13 – 16)	16 – 18	15 – 18	–	12	12 (12 – 15)
***St* IV**	26	14	no MS	–	23 – 25	25 (22)	20 (19 – 22)	27 (26 – 27)	24 (23)	19	20	no MS	if pronounced, pointed, short, not reaching the dorsal lyriform fissure, 22	12	21 (21 – 22)
scl	–	–	5	–	–	–	5 (5 – 6)	–	–	–	–	–	–	4	3 (3 – 4)
scw	–	–	–	–	–	–	10 (10 – 11)	–	–	–	–	–	–	–	11 (10 – 12)
Fdl	26	–	–	–	–	–	–	–	–	–	–	–	–	20	23 (23 – 25)
No. teeth Fd	3	4	2	one bifurcated tooth	one bifurcated tooth	1	3	3	5	2 – 3	4	1	one tooth sometimes with an additional one, scarcely discernible	3	2
Mdl	26	–	–	–	–	–	20 (19 – 21)	–	–	–	–	–	–	20	22 (21 – 23)
No. teeth Md	1	2	1	0	0	1	1	1	one bifurcated tooth	1	1	1	1	1	1

*** In each upper boxes of the first line; the first name is the name of the species, the second line of name(s) is name(s) of describer(s) and the third line is the source of measurements**

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References

Alatawi F.J., Kamran M., Basahih J. 2015. First record of the genus *Paragigagnathus* Amitai and Grinberg, 1971 (Mesostigmata: Phytoseiidae) from Saudi Arabia with description of a new species. J. Nat. Hist., 41: 1-9. https://doi.org/10.1080/00222933.2015.1082656

Amitai S., Grinberg T. 1971. Description of a new phytoseiid genus and species (Acarina: Mesostigmata) from Israel. Israel J. Entomol., 6: 327-335.

Amitai S., Swirski E. 1978. A new genus and new records of phytoseiid mites (Mesostigmata: Phytoseiidae) from Israel. Israel J. Entomol., 12: 123-143.

Athias-Henriot C. 1975. Nouvelles notes sur les Amblyseiini. II. - Le relevé organotaxique de la face dorsale adulte (Gamasides, Protoadénique, Phytoseiidae). Acarologia, 17: 20-29.

Berlese A. 1916. Centuria prima di Acari nuovi. Redia., 12: 19-66.

Boller, E.F. 1984. Eine einfache Ausschwemm methode zur schellen Erfassung von Raumilben, Trips und anderen Kleinarthopoden im Weinbau.Zeitschr. Obstund Weinbau, 120: 249-255.

Chant D.A., McMurtry J.A. 2003. A review of the subfamily Amblyseiinae Muma (Acari: Phytoseiidae): Part I. Neoseiulini new tribe. Internat. J. Acarol., 29: 3-46. https://doi.org/10.1080/01647950308684319

Chant D.A., McMurtry J.A. 2007. Illustrated keys and diagnoses for the genera and subgenera of the Phytoseiidae of the world (Acarina: Mesostigmata). Indira Publishing House, West Bloomfield, Michigan, USA, 220 pp.

Chant D.A., Yoshida-Shaul E. 1989. Adult dorsal setal patterns in the family Phytoseiidae (Acari: Gamasina).Internat. J. Acarol., 15: 219-232. https://doi.org/10.1080/01647958908683852

Chant D.A., Yoshida-Shaul E. 1991. Adult ventral setal patterns in the family Phytoseiidae (Acari: Gamasina).Intern. J. Acarol., 17(3): 187-199. https://doi.org/10.1080/01647959108683906

Chaudhri W.M., Akbar S., Rasool A. 1979. Studies on the predatory leaf inhabiting mites of Pakistan. University of Agriculture, Faisalabad, Pakistan, 243 pp.

Demite P.R., Moraes G.J. de, McMurtry J.A., Denmark H.A., Castilho R. de C. 2021. Phytoseiidae Database. [internet] [10 March 2021]. Available from: http://www.lea.esalq.usp.br/phytoseiidae.

Denmark H.A., Evans G.A. 2011. Phytoseiidae of North America and Hawaii (Acari: Mesostigmata). Indira Publishing House, West Bloomfield, USA, 451 pp.

Esmaeili, H.R., Mehraban, H.R., Abbasi, K., Keivany, Y. Coad, B. 2017. Review and updated checklist of freshwater fishes of Iran: Taxonomy, distribution and conservation status. Iranian Soc. Ichthyol. 4(1): 1-114.

Hajizadeh J., Faraji F., Rafatifard M., Kamranfard F. 2010. The genus *Paragigagnathus* Amitai and Grinberg (Acari: Phytoseiidae) in Iran, with a key to the known species. Syst. Appl. Acarol., 15: 222-227. https://doi.org/10.11158/saa.15.3.6

Honey S.F., Bashir M.H., Khan B.S., Shahid M. 2015. On the identity of *Paragigagnathus amantis* (Chaudhri et al., 1979) (Acari: Phytoseiidae: Amblyseiinae) from Pakistan. Syst. Appl. Acarol., 20(4): 449-454. https://doi.org/10.11158/saa.20.4.10

Khanjani M., Karimi M., Asali Fayaz B., Ueckermann E.A. 2016. *Paragigagnathus iraniensis* n. sp. (Acari: Phytoseiidae) from Western Iran. Acarologia 56: 195-201. https://doi.org/10.1051/acarologia/20162246

Kolodochka L.A. 1989. A revision of the phytoseiid mites of the genus *Pamiroseius* Wain. (Parasitiformes: Phytoseiidae). Entomol. Obozr. Russia, 68: 221-229.

KKreiter S., Payet R.-M., Abo-Shnaf R., Douin M. 2021, New Phytoseiidae (Acari: Mesostigmata) of Mascareignes and Comoros Archipelagos (Indian Ocean): one new record, three new species groups and description of six new species and of six unknown males. Acarologia 61(4): 845-889. https://doi.org/10.24349/Krky-e23s

Kuznetsov N.N. 1994. Two new phytoseiid mite species (Parasitiformes, Phytoseiidae) from Armenia and Tadjikistan [in Russian]. Vestn. Zool., 2: 78- 81.

Lindquist E.E. 1994. Some observations on the chaetotaxy of the caudal body region of gamasine mites (Acari: Mesostigmata), with a modified notation for some ventrolateral body setae. Acarologia, 35: 323-326.

Lindquist E.E., Evans G.W. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina. Mem. Entomol. Soc. Canada, 47: 1-64. https://doi.org/10.4039/entm9747fv

Livshitz I.Z., Kuznetsov N.N. 1972. Phytoseiid mites from Crimea (Parasitiformes: Phytoseiidae) [in Russian]. In: Pests and diseases of fruit and ornamental plants. Proceedings of The All-Union V. I. Lenin Academy of Agricultural Science, The State Nikita Botanical Gardens, Yalta, Ukraine, 61: 13-64.

Moraes G.J.de, McMurtry J.A., Denmark H.A., Campos C.B. 2004. A revised catalog of the mite family Phytoseiidae. Zootaxa, 434: 1-494. https://doi.org/10.11646/zootaxa.434.1.1
Muma M.H. 1961. Subfamilies, genera, and species of Phytoseiidae (Acarina: Mesostigmata). Fla St. Mus. Bul., 5(7): 267-302.
Muma M.H., Denmark H.A. 1970. Phytoseiidae of Florida. Arthropods of Florida and neighboring land areas. 6. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville, USA, 150 pp.
Rowell H.J., 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
Swirski E., Chiara S.R., Tsolakis H. 1998. Keys to the Phytoseiid Mites (Parasitiformes, Phytoseiidae) of Israel. Phytophaga, Palermo, 8: 85-154.
Ueckermann E.A., Loots G.C. 1988. The African species of the subgenera *Anthoseius* De Leon and *Amblyseius* Berlese (Acari: Phytoseiidae). Entomol. Mem. Dept. Agric. Water Supply Rep. S. Africa, 73: 168 pp.
Wainstein B.A. 1973. New genus and species of Phytoseiidae (Parasitiformes) [in Russian]. Zool. Zhurnal., Russia, 52: 953-955.
Walter D.E., Krantz G.W. 2009. Collecting, rearing and preparing specimens. *In*: Krantz G.W., Walter D.E. (eds) A manual of acarology, 3rd ed. Texas Tech University Press, Lubbock. 807 pp.