First record of the genus *Paragigagnathus* Amitai and Grinberg, 1971 (Mesostigmata: Phytoseiidae) from Saudi Arabia with description of a new species

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**ABSTRACT**

The genus *Paragigagnathus* Amitai and Grinberg (Acari: Phytoseiidae) is reported for the first time from Saudi Arabia. *Paragigagnathus desertorum* (Amitai and Swirski) and *P. insuetus* (Livshitz and Kuznetsov) were collected from *Acacia* sp. (Fabaceae) and *Tamarix* sp. (Tamaricaceae), respectively. *Paragigagnathus madinaensis* n. sp. is described and illustrated. The new species was found on *Tamarix* sp. in association with *Obdulia daadi* Al-Gboory (Prostigmata: Tenuipalpidae) from Al-Riyadh and Al-Madina regions of Saudi Arabia.

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Phytoseid mites; desertorum; insuetus; Al-Riyadh; Al-Madina

**Introduction**

The genus *Paragigagnathus* Amitai and Grinberg, 1971 (Acari: Phytoseiidae) comprises eight valid species (Chant and McMurtry 2007; Hajizadeh et al. 2010). Moraes et al. (2004) listed 10 species in this genus. But, *Paragigagnathus tawfiki* (Yousef, 1974) is a synonym of *P. tamaricis* Amitai and Grinberg (Hajizadeh et al. 2010), while *P. amantis* (Chaudhri et al., 1979) is declared as uncertain species because of inadequate description and illustrations (Chant and McMurtry 2007). The species of this genus are known from Egypt, Namibia, Madagascar, South Africa (Africa), Greece, Ukraine (Southeast Europe), Iran, Israel, Jordan, Pakistan, Russia, Turkmenistan, Tadjikistan, Yemen (Middle East, Central and South Asia) (Amitai and Grinberg 1971; Livshitz and Kuznetsov 1972; Wainstein 1973; Yousef 1974; Amitai and Swirski 1978; Chaudhri et al. 1979; Ueckermann and Loots 1988; Kolodochka 1989; Papadoulis and Emmanouel 1991; Kuznetsov 1994; Ueckermann 1996; Moraes et al. 2004; Hajizadeh et al. 2010). Most of the species have been reported from *Tamarix* sp. (Tamaricaceae), suggesting that the species of this genus are confined in arid to semi-arid regions.

The genus *Paragigagnathus* was first placed in the subfamily Gigagnathiniae Wainstein. Kolodochka (1994) transferred it to subfamily Amblyseiiniae and tribe Amblyseiini Muma on the basis of dorsal setal pattern. After that, it was placed in the tribe Neoseiulini Chant and McMurtry because of cheliceral morphology, dorsal setal pattern and shape of female ventrianal shield (Chant and McMurtry 2003). Chant and
McMurtry (2007) divided the genus *Paragigagnathus* in two species groups, *desertorum* and *strunkovae*, based on the position of sternal shield setae $ST_3$ (on or off the sternal shield). However, in some species this character is not distinctive (Chant and McMurtry 2007; Hajizadeh et al. 2010). A key to the eight valid species of this genus was created by Hajizadeh et al. (2010). They separated the species based on the following morphological characters: length and shape of dorsal setae, most of dorsal setae either with or without tubercles, sternal setae $ST_4$ on the soft cuticle or on metasternal shields and number of teeth on moveable digit.

Phytoseiid mites are poorly investigated in Saudi Arabia, and to date only 19 species are known (Dabbour and Abdel-Aziz 1982; Fouly and Al-Rehiayani 2011; Al-Atawi 2011a, 2011b; Negm et al. 2012a, 2012b). This paper presents the first record of the genus *Paragigagnathus* from Saudi Arabia, with description of a new species *P. madinaensis* n. sp. and two new records, *P. desertorum* (Amitai and Swirski) and *P. insuetus* (Livshitz and Kuznetsov).

**Materials and methods**

Three regions of Saudi Arabia, Al-Riyadh, Al-Madina and Al-Baha, were surveyed for the collection of Phytosiid mites during the years 2012–2014. Two collection methods were used: (1) different plant parts were shaken over a white paper and the mites were transferred using a camel hair brush into 70% alcohol; (2) Tullgren funnels were used to extract mites from plant materials. The collected mite specimens were cleared in Nesbitt’s fluid for 10–12 h. Subsequently, the specimens were mounted on slides in Hoyer’s medium, and dried in oven at 40°C for 1 week. The mounted specimens were examined under a phase-contrast microscope (DM2500, Leica®, Germany). Template illustrations were either drawn with pencil by using a drawing tube (Olympus®, Japan) attached to the microscope, or different body parts of mites were pictured with an Auto-montage Software System (SYNCROSCOPY®, Cambridge, UK) attached to the microscope. Final processing of drawings was done in Adobe Illustrator (Adobe Systems Incorporated, USA). The terminology used in this study follows that of Chant and McMurtry (2003, 2007). All measurements are given in micrometers. Holotype and eight paratypes of new species are deposited at the King Saud University Museum of Arthropods (KSMA) and Acarology Laboratory, Department of Plant Protection, College of Food and Agriculture Sciences, King Saud University. One paratype (P1-accession no. Acy: 15/04) is deposited at the Agriculture Research Council, Plant Protection Research Institute, Pretoria, South Africa (ARC-PPRI).

**Results and discussion**

*Paragigagnathus* Amitai and Grinberg

*Paragigagnathus* Amitai and Grinberg 1971: 327; Karg 1983: 300; Kolodochka 1994: 3; Chant and McMurtry 2003: 39; Chant and McMurtry 2007: 31–32; Hajizadeh et al. 2010: 222-226.

*Afrogigagnathus* Yousef 1974: 381; Chant and McMurtry 2003: 39.

*Ansaria* Chaudhri, Akbar and Rasool 1979: 63; Chant and McMurtry 2003: 39.

*Amblyseius* (*Pamiroseius*) Karg 1983: 13.
Amblyseius (Amblyseius) Ueckermann and Loots 1988: 118.
Pamiroseius Wainstein 1973: 954; Kolodochka 1989: 221; Chant and McMurtry 2003: 39.
Phytocerus Amitai and Swirski 1978: 124; Chant and McMurtry 2003: 39.
Phytodromus Muma, Denmark 1993: 107.

Paragigagnathus madinaensis n. sp.
(Figures 1, 2)

Female (Figures 1, 2). n = 16, the measurements of holotype followed by those of 15 paratypes (female) in parenthesis.

Dorsal Idiosoma (Figure 1): Dorsal shield 339 (337–324) long and 196 (185–210) wide, elongate, slightly concave near seta $S_2$, strongly sclerotized, ornamented and with rugose lines/patches; with 19 pairs of setae including setae $r_3$ and $R_1$ and 11 pairs of pores. Dorsal setae vary in length, only posteriorly set on prominent tubercles. Dorsal shield setal length: $j_1$ 17 (16–18), $j_3$ 27 (25–29), $j_4$ = $j_5$ 26 (22–30), $j_6$ 32 (31–32), $J_2$ 34 (32–38), $J_2$ 20 (18–25), $z_2$ 34 (32–36), $z_4$ 35 (34–37), $z_5$ 25 (21–29), $Z_1$ 41 (39–46), $Z_4$ 43 (40–46), $Z_5$ 38 (35–41), $s_4$ 37 (35–38), $S_2$ 46 (41–50), $S_4$ 48 (41–50), $S_5$ 44 (39–48) and lateral setae $r_3$ 18 (15–21), $R_1$ 19 (16–22). Peritreme extending up to setae $j_1$.

Ventral Idiosoma (Figure 2A): Sternal shield smooth, convex anteriorly, slightly concave posteriorly, 70 (67–75) long, 52 (50–56) wide at the level of setae $ST_2$ with two pairs of setae and one pair of pores. $ST_3$ and $ST_4$ present on soft cuticle. $ST_1$ = $ST_2$ 15 (14–16), $ST_3$ = $ST_4$ 14 (13–15). Genital shield truncate posteriorly, 69 wide, wider than ventrianal shield, with one pair of setae. One pair of pores present lateral to genital shield on soft cuticle. Ventrianal shield and genital shield 7 apart, with a membranous fold in between. Ventrianal shield sole shaped, with marked waist, 28 wide at preanals, 57 wide (at anal setae), 106 long. L/W ratio at narrowest point 3.78, with three pairs of preanal setae, three circumanal setae and one pair of pores. Four pairs of setae, six pairs of pores and two pairs of metapodal platelets present on the membrane surrounding the ventrianal shield. $ZV_1$ = $ZV_3$ = 13, $JV_4$ 13 (13–14), $JV_5$ 22 (22–24), primary metapodal platelet 50 (47–52), secondary 18 (17–19).

Spermatheca
Vesicle is saccular, calyx thick, dish shaped, with annulated neck, atrium not adjacent to the calyx, major duct thick and long, minor duct not visible (Figure 2C).

Chelicerae
Fixed digit with three small apical teeth and a pilis dentilis; movable digit with one subapical blunt tooth (Figure 2D).

Leg IV
One macroseta on basitarsus 27 (26–27) (Figure 2B).

Etymology
The specific epithet ‘madinaensis’ refers to the city name ‘Madina’ where some paratypes of the new species were collected.
Figure 1. *Paragagnathus madinaensis* n. sp. Female, Dorsal Shield.
Figure 2. *Paragigagnathus madinaensis* n. sp. Female, (A) Idiosoma venter; (B) Spermatheca, (C) Chelicera; (D) Genu, tibia and basitarsus of Leg IV.
**Type material**

Holotype and 10 paratype females, on aerial part of *Tamarix* sp. (Tamaricaceae), near Arqa over bridge, Wadi-e-Hanifa, Al-Riyadh, Saudi Arabia, 24. 4135ºN, 46.3704ºE, 18, Oct., 2012; five paratype females, *Tamarix* sp., ’Uhad’ mountain, Al-Madina, Saudi Arabia, 24.3008ºN, 39.364ºE, 23 Feb., 2013; all collected by M. Kamran.

**Remarks**

*Paragigagnathus madinaensis* n. sp. closely resembles *Paragigagnathus namibiaensis* (Ueckermann and Loots, 1988) because both share the following characters: sternal setae $ST_4$ on soft cuticle, movable digit with one tooth, ventrianal shield with three pairs of preanal setae, dorsal setae smooth and only posterior setae set on prominent tubercles. The new species can be distinguished from *P. namibiaensis* by much longer dorsal setae (15–48), sternal shield without posterolateral lobes, a dish shaped calyx of spermatheca, instead of comparatively short dorsal setae (13–35), sternal shield with posterolateral lobes and funnel shaped spermatheca in later species. The new species differs from *P. strunkovae* (Wainstein, 1973) by dish-shaped calyx of spermatheca and 3 pairs of preanal setae, while calyx of spermatheca is funnel shaped and preanal setae 2 pairs in later species.

**Paragigagnathus desertorum** (Amitai and Swirski)

*Phytocerus desertorum* Amitai and Swirski 1978: 123–127; Swirski and Amitai 1985: 185; 1997: 31.

*Amblyseius desertorum* Ueckermann 1996: 28.

*Paragigagnathus desertorum* (Amitai and Swirski), Chant and McMurtry 2003: 39–44; Moraes et al. 2004: 159; Chant and McMurtry 2007: 33; Hajizadeh et al. 2010: 22–227.

**Female.** ($n = 8$), the measurements of Saudi Arabian specimens in range.

**Dorsal idiosoma**

Dorsal shield 288–302 long and 204–212 wide at the level of setae $R_1$, strongly sclerotized and with wax plates, rugose lines/patches; with 19 pairs of setae including setae $r_3$ and $R_1$. All dorsal setae thick and set on prominent tubercles. Dorsal shield setal length: $j_1$ 16–18, $j_3$ 26–31, $j_4$ 24–27, $j_5$ 29–30, $j_6$ 32–35, $J_2$ 38–40, $J_5$ 13–14, $z_2$ 35–37, $z_4$ 36–38, $z_5$ 24–26, $Z_1$ 36–39, $Z_4$ 46–49, $Z_5$ 45–47, $s_4$ 39–42, $S_2$ 45–47, $S_4$ 45–48, $S_5$ 46–49 and lateral setae $r_3$ 23–24, $R_1$ 18–19. Peritreme extending up to setae $j_1$.

**Ventral idiosoma**

Sternal shield smooth, convex anteriorly and posteriorly, 76–79 long, 57–59 wide at the level of setae $ST_2$; with two pairs of setae and one pair of pores. $ST_3$ present on metasternal platelets, $ST_4$ present on soft cuticle. Genital shield truncate posteriorly, 55–58 wide, wider than ventrianal shield, with one pair of setae. One pair of pores present lateral to genital shield on soft cuticle. Ventrianal and genital shields with a membranous fold in between. Ventrianal shield smooth, elongate, sole shaped, with marked waist, 36–37 wide at preanals, 60–61 wide (at anal setae), 99–105 long. L/W ratio at narrowest point 3.43, with three pairs of preanal setae, three circumanal setae and one pair of pores. Four pairs of setae, six pairs of pores and two pairs of metapodal platelets present on the membrane.
surrounding the ventrianal shield. \( ZV_1 = ZV_3 = 11–12, JV_4 = 14–15, JV_5 = 17–18 \), primary metapodal platelet 36–39, secondary 16–18.

**Spermatheca**

Vesicle is saccular, calyx, dish shaped, not very thick, atrium not adjacent to the calyx, major duct long, thick, minor duct not prominent.

**Chelicerae**

Fixed digit with one bifid tooth and a pilis dentilis; the movable digit smooth.

**Leg IV**

One macroseta on basitarsus 23–25.

**Material examined**

Eight females, 130 km Al–Madinah road, Makkah, *Acacia raddiana* L. (Fabaceae), 7 Feb., 2014, coll. M. Kamran.

**Distribution and hosts**

Israel, ex. *Acacia raddiana* L. (Fabaceae), association with *Thrips* sp. (Thripidae) (Amitai and Swirski 1978; Swirski and Amitai 1985, 1997); Yemen ex unidentified plants (Ueckermann 1996). It was found on *Acacia raddiana* in association with *Sonotetranychus* sp. (Acari: Tetranychidae) in Saudi Arabia.

**Paragigagnathus insuetus** (Livshitz and Kuznetsov)

*Amblyseius insuetus* Livshitz and Kuznetsov 1972: 27.
*Pamoroseius insuetus* Kolodochka 1989: 227.
*Paragigagnathus insuetus* (Livshitz and Kuznetsov), Kolodochka 1994: 3; Chant and McMurtry 2007: 31–33.

**Female.** \( n = 3 \), the measurements of Saudi Arabian specimens in range.

**Dorsal idiosoma**

Dorsal shield 338–345 long and 228–235 wide at the level of setae \( R_1 \), strongly sclerotized, ornamented with rugose lines/ patches; with 19 pairs of setae including setae \( r_3 \) and \( R_1 \). All dorsal setae thick, only posterior setae set on prominent tubercles. Dorsal shield setal length: \( j_1 = 14–15, j_3 = 15–16, j_4 = 14–15, j_5 = 14, j_6 = 16–17, J_2 = 16–17, J_5 = 10–11, z_2 = 16–17, z_4 = 17–18, z_5 = 14–15, Z_1 = 16–18, Z_4 = 17–19, Z_5 = 25–27, S_4 = 16–18, S_2 = 18–19, S_3 = 22–23, Z_5 = 25–26 and lateral setae \( r_3 = 16–17, R_1 = 14–15 \). Peritreme extending up to setae \( j_1 \).

**Ventral idiosoma**

Sternal shield smooth, 76–78 long, 65–67 wide at the level of setae \( ST_2 \), with two pairs of setae and one pair of pores. \( ST_3 \) present on soft cuticle, \( ST_4 \) present on metasternal platelets. Genital shield truncate posteriorly, wider than ventrianal shield, with one pair of setae. One pair of pores present lateral to genital shield on soft cuticle. Ventrianal shield smooth, elongate, sole shaped, with marked waist, 45–48 wide at preanals, 65–67 wide (at anal setae), 106–109 long. L/W ratio at narrowest point 2.78, with three pairs of
preanal setae, three circumanal setae and one pair of pores. Four pairs of setae, six pairs of pores and two pairs of metapodal platelets present on the membrane surrounding the ventrianal shield. \( Z_V^1 = Z_V^3 = 10–11, J_V^4 = 12, J_V^5 = 17–18 \), primary metapodal platelet 45–46, secondary 15–16.

**Spermatheca**

Vesicle is saccular, calyx, dish shaped, thick, atrium not adjacent to the calyx, major duct long, thick, minor duct not prominent.

**Chelicerae**

Fixed digit with one tooth and a pilis dentilis; the movable digit with tooth.

**Leg IV**

One macroseta on basitarsus 20–21.

**Material examined**

Three females, *Tamarix* sp. (Tamaricaceae), Wadi-e-Turba, Al-baha, Saudi Arabia, 19.4957°N, 041.4734°E, alt. 1798 m, 24 Feb., 2013, coll. M. Kamran.

**Distribution and hosts**

Ukraine, Crimea ex (Livshitz and Kuznetsov 1972); Greece and Turkmanestan (Kolodochka 1989; Papadoulis and Emmanouel 1991); Iran (Hajizadeh et al. 2010); ex *Tamarix* sp., *Thuja occidentalis* L. (Cuspressaceae); *Populus* sp. (Saliaceae).

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**Disclosure statement**

No potential conflict of interest was reported by the authors.

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