

## Article

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### Two rhombognathine mites (Acari: Halacaridae) from the Gulf of Oman, Iran

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#### Abstract

This paper presents information on the Iranian halacarid fauna providing the first record of the genus *Rhombognathus* from the Gulf of Oman. Two species of the genus *Rhombognathus* are described from the Iranian coast, viz. *Rhombognathus scutulatus* Bartsch 1983 and *R. iranius* **sp. nov.**

**Key words:** First record, marine mites, new species, Prostigmata, *Rhombognathus*.

#### Introduction

The rhombognathine mites are free-living marine mites in the family Halacaridae and usually inhabit the coastal waters of the world. They are ecologically categorized as meiobenthos and taxonomically considered a monophyletic group consisting of four genera, *Rhombognathus*, *Rhombognathides*, *Isobacetrus* and *Metarhombognathus* (Abé 1998). The first record of halacarid mites from Iran was made by Bartsch (2012). She described one new species of *Isobacetrus* from Hormozgan Province in southern Iran. The faunal information on the halacarid mites from Iran is still quite limited. The present paper aims to provide information on the halacarid fauna in Iran describing one new species and one known species in the genus *Rhombognathus* collected from the Gulf of Oman.

#### Material and Methods

The materials examined in the present study were collected at Chabahar Beach (25°16' N, 60°40' E), Darya Bozorg on the coast of the Gulf of Oman, Iran, on May 13, 2012. In the intertidal zone of a rocky shore at 1 m depth, brown algae (*Sargassum* sp.) were taken by hand. The algae were placed into plastic bags and immediately washed in a 5% solution of commercial detergent. Then the solution was filtered through a sieve with a mesh size of 38 µm. Animals retained on the sieve were washed with 70% ethanol and placed into a Petri dish. Mites were picked up from them under a stereomicroscope and were mounted in glycerin jelly and the cover slips were sealed with Canada balsam. Observation was made under a light microscope using oil immersion. Other than general observation, additional analysis using a Scanning Electron Microscope (SEM) was also carried out for the morphologies of genital setae, ovipositor, areolae, dorsal pores, leg setae and claw teeth. Figures were drawn with the aid of a camera lucida and measurements were made with an ocular micrometer.

The following abbreviations are used in the description: AD, anterior dorsal plate; OC, ocular plate(s); PD, posterior dorsal plate; AE, anterior epimeral plate; PE, posterior epimeral plate(s); GP, genital plate; GF, genital foramen; p-1 to p-4, first to fourth segments of palp; L/W, the ratio of length to width. In addition, the following abbreviations are used in the figure legends: Ds, dorsal view; Vr, ventral view; R, right appendage; L, left appendage.

Metric characters are always given in micrometers ( $\mu\text{m}$ ). Leg chaetotaxy is expressed as "tibiae I-IV, 6-6-5-5" which means that the tibia of the first to the fourth legs each has 6, 6, 5, and 5 setae, respectively.

The holotype and allotype have been deposited in the Collection of the Acarology Laboratory, Shahid Bahonar University of Kerman, Kerman, Iran (SBUC), and the paratypes have been deposited in the arachnid collection of the National Museum of Nature and Science, Tokyo, Japan (NSMT).

## Results

Two species of the genus *Rhombognathus* in the family Halacaridae were reported from the Iranian coast of the Gulf of Oman. This is the first record of the genus *Rhombognathus* from Iranian waters.

Genus *Rhombognathus* Trouessart

Type species: *Rhombognathus notops* (Gosse)

*Rhombognathus iranius* sp. nov. (Figs. 1–22)

### Material examined

Holotype (SBUC-Ac1001): Male; on *Sargassum* sp. at 1 m depth; intertidal; 25° 16' N, 60° 39' E, Chabahar Beach, Darya Bozorg, Gulf of Oman, Iran; May 13, 2012; I. Etemadi coll. Allotype (SBUC-Ac1002): Female, same data as the holotype. Paratypes (NSMT-Ac14101-14112): Three females, five males, three tritonymphs, one protonymph, same data as the holotype.

### Diagnosis

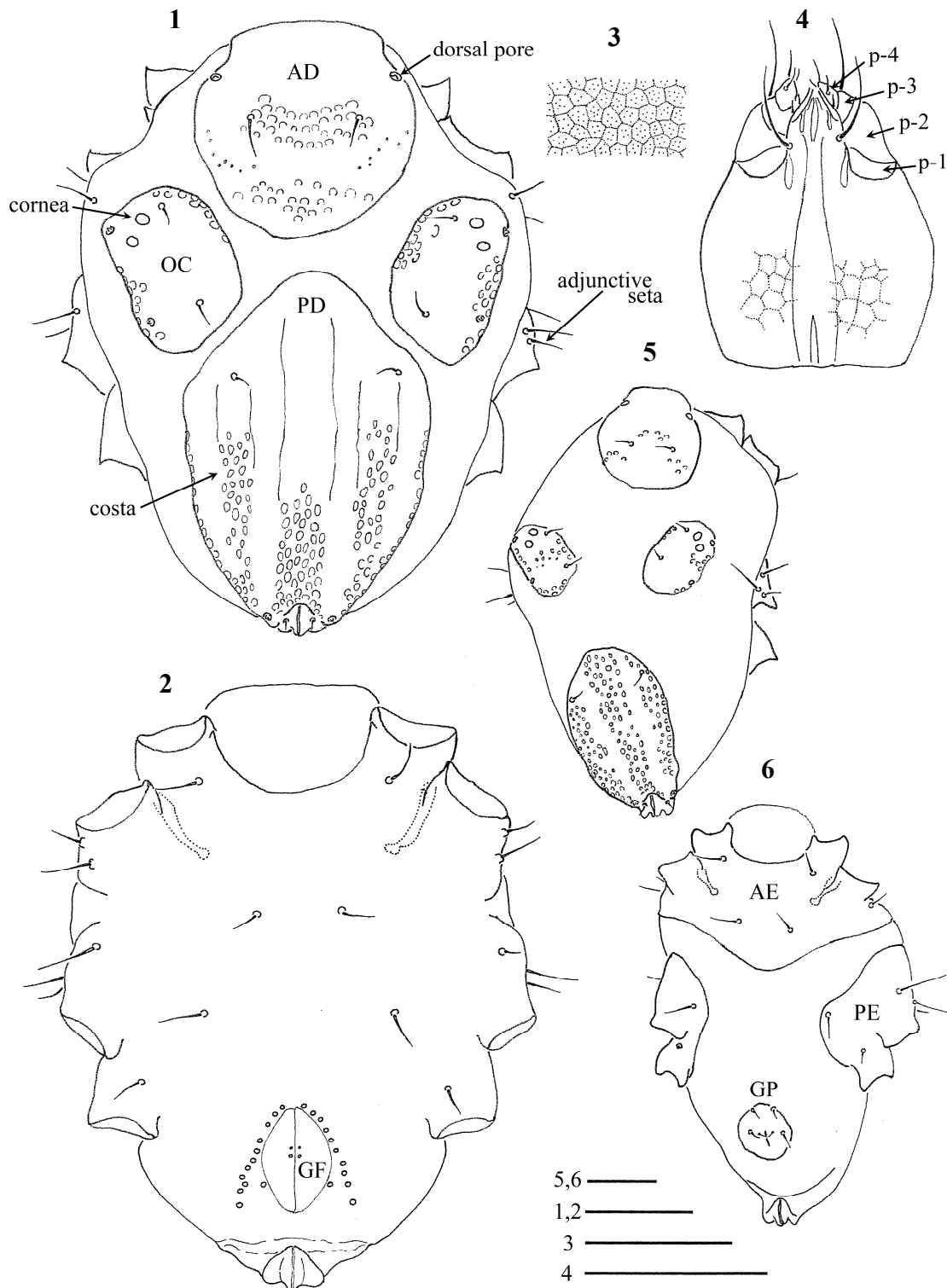
Dorsal plates separated and ornamented with distinct areolae and costae, OC with two corneae, PD with a pair of setae, anterior and posterior epimeral regions each with one adjunctive seta, five filiform perigenital setae surrounding GF, and two subgenital setae on each genital sclerite in the female, 11–12 branched perigenital setae surrounding each side of GF and two subgenital setae on each genital sclerite in the male, telofemora I-IV with 5-5-3-3 setae, genua I-IV with 5-5-3-3 setae, tibiae I-IV with 2-1-0-1 large bipectinate setae, lateral claw with broad endoplanate accessory process bearing about 15 teeth.

### Description

Male (holotype, SBUC-Ac1001)

Idiosoma 300 long, 210 wide. Dorsum (Figs. 1 & 15): Dorsal plates furnished with distinct areolae and costae, partly ornamented with fine canaliculi. AD and PD separated by interval approximately one-fourth of AD length. AD 103 long, 110 wide, rounded posteriorly, furnished with a pore near each lateral margin. OC 80 long, 55 wide, approximately square in form, furnished with two corneae anterolaterally and two dorsal

pores near lateral margin. PD 155 long, 118 wide, having protruded anterior margin, reaching anteriorly to more than half the level of idiosoma. A pair of dorsal pores placed near posterior end of PD.



**Figures 1–6.** *Rhombognathus iranius* sp. nov. Male (holotype), 1. Idiosoma (Ds); 2. Idiosoma (Vr); 3. Ornamentation in the center of idiosoma (Vr); 4. Gnathosoma (Vr); Tritonymph (paratype), 5. Idiosoma (Ds); 6. Idiosoma (Vr). Scale bars = 50  $\mu$ m.

Chaetotaxy of dorsal region: Dorsal setae short and filiform. A pair of relatively long setae on AD at about half level of AD. Two setae on each OC, one on anterior and another near posteromedial portions of OC. A pair of setae placed on anterolateral portion of PD.

Venter (Fig. 2): Ventral plates fused and ornamented with reticulate panels (Fig. 3). Anterior epimeral region furnished with epimeral pore between insertions of leg I and leg II on each side.

Chaetotaxy of epimeral region: Four filiform setae located at each side of anterior epimeral region as follows: One ventral seta on first coxal region; one ventral, one marginal, and one adjunctive seta on second coxal region. Five setae placed at each side of posterior epimeral region as follows: One ventral, one laterodorsal, and one adjunctive seta on third coxal region; two ventral setae on fourth coxal region.

Genitoanal region (Figs. 7 & 16): GF 55 long, 33 wide; anterior part located at level insertion of leg IV. Three pairs of genital acetabula present in GF. Spermatophorotype 80 long, 75 wide, rhombic in form.

Chaetotaxy of genitoanal region: Genitoanal region furnished with 10–11 branched perigenital setae on each side of GF as shown in Figs. 2 and 7. Subgenital setae filiform, two pairs on genital sclerites; anterior pair fairly short (Fig. 16). Adanal setae placed on anal papilla.

Gnathosoma (Fig. 4): 83 long, 68 wide, L/W 1.22, gnathosoma length/idiosoma length 0.28. Rostrum 28 long, nearly lanceolate, not reaching to level of distal end of palp. Two pairs of rostral setae as follows: Proximal pair long and robust, at swollen point of the rostrum; distal pair short, just anterior to proximal pair. Chelicera 83 long. Palp 43 long; p-1 short and cylindrical; p-2 longest and robust, with a long filiform seta distidorsally; p-3 short and cylindrical; p-4 conical, with three short filiform setae intermediately and two blunt spiniform projections terminally.

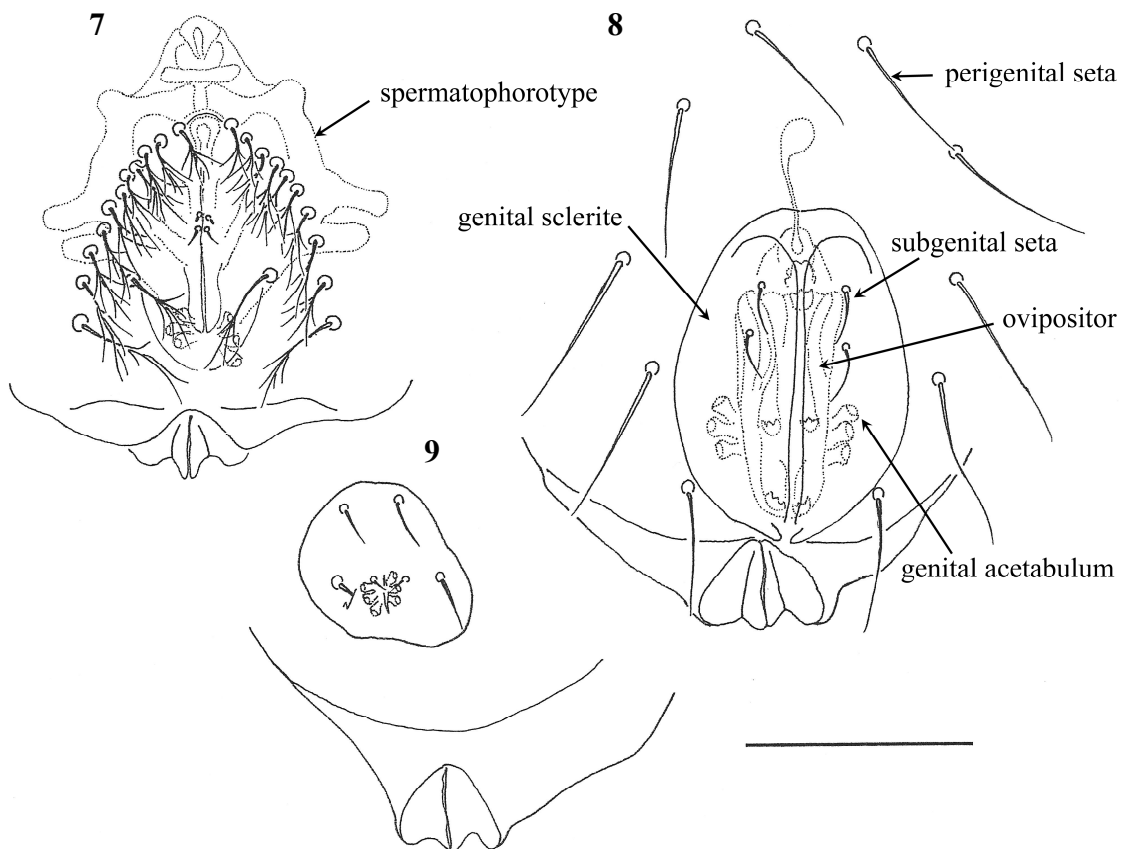
Legs (Figs. 10–13): Length of legs I, II, III, IV = 223, 218, 208, 213, respectively. Lateral claw with broad endoplanate accessory process bearing about 15 teeth (Fig. 19). Claw shaft smooth.

Leg chaetotaxy as follows: Trochanters I-IV, 1-1-1-0; basifemora I-IV, 2-2-2-2; telofemora I-IV, 5-5-3-3; genua I-IV, 5-5-3-3; tibiae I-IV, 5-5-5-5. Number of distinctly bipectinate setae: Tibiae I-IV, 2-1-0-1. Tarsal fossary setae faintly plumose. Tarsus I with three dorsal setae and paired doublet bacilliform parambulacral setae; solenidion bacilliform and tiny famulus papilliform (Fig. 17). Tarsus II with three dorsal setae and paired doublet bacilliform parambulacral setae; solenidion bacilliform (Fig. 20). Tarsus III with four dorsal setae, one bacilliform parambulacral seta on posterior side, and one scaliform parambulacral seta on anterior side. Tarsus IV with three dorsal setae, one branched parambulacral seta on posterior side and one floccus parambulacral seta on anterior side (Fig. 18).

Female (allotype, SBUC-Ac1002)

Idiosoma 310 long, 220 wide. Dorsum: Dorsal plates ornamented with distinct foveolae and costae. AD 113 long, 117 wide; OC 83 long, 58 wide; PD 145 long, 110 wide. AD and PD separated by interval almost one-third of AD length. Venter: Ventral plates ornamented with reticulate panels.

Genitoanal region (Fig. 8): Five long filiform perigenital setae located at each side of GF as shown in Fig. 8. GF 70 long, 50 wide. Two pairs of subgenital setae on genital sclerites. Three pairs of genital acetabula in GF. Ovipositor tube-like, 68 long, 23 wide; several genital claws present on distal portion (Fig. 22).



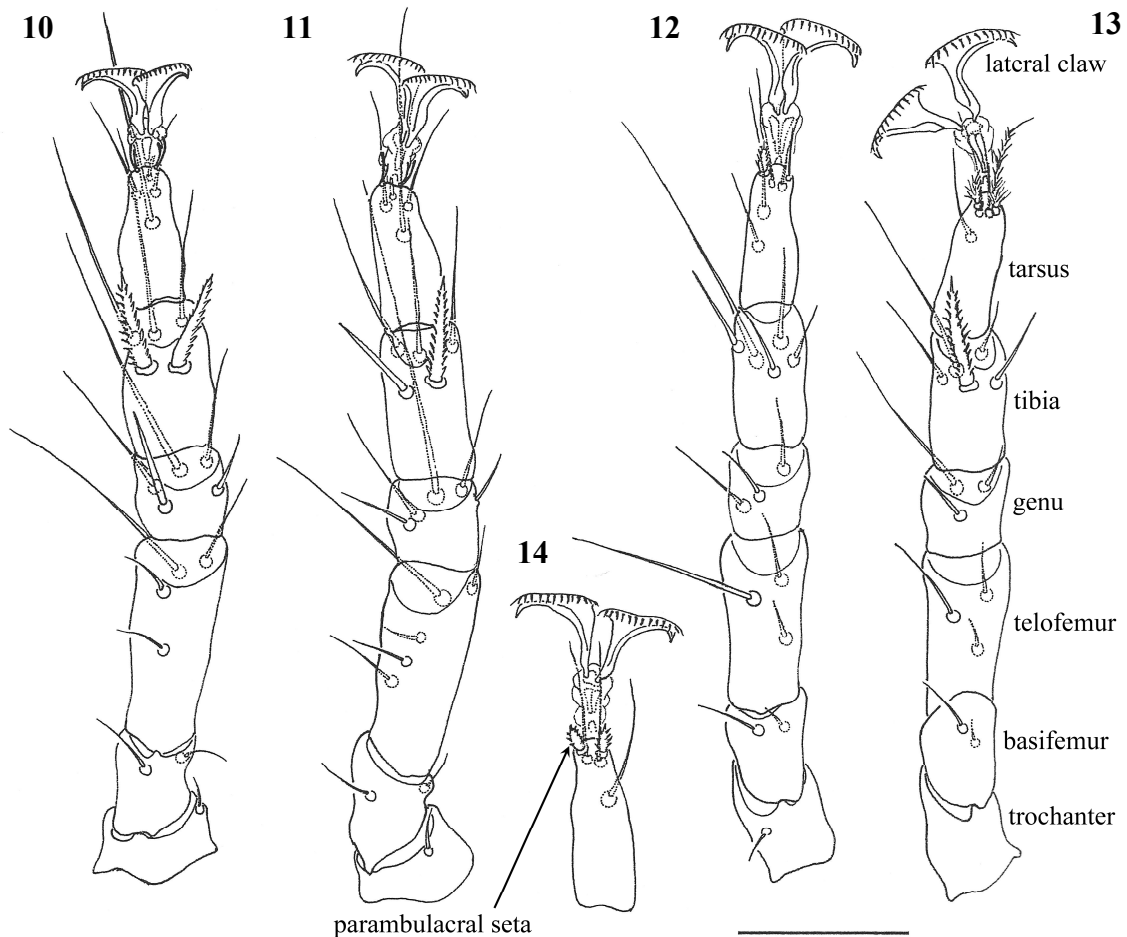
**Figures 7–9.** *Rhombognathus iranius* sp. nov. Male (holotype), 7. Genitoanal region; Female (allotype), 8. Genitoanal region; Tritonymph (paratype), 9. Genitoanal region. Scale bar = 50  $\mu$ m.

Gnathosoma: 75 long, 70 wide, L/W 1.07, gnathosoma length/idiosoma length 0.24. Rostrum 28 long. Chelicera 78 long. Palp 38 long.

Legs: Length of legs I, II, III, IV = 213, 213, 208, 215, respectively. Leg chaetotaxy of trochanter to tibia same as in holotype. Tarsus I with three dorsal setae, doublet bacilliform parambulacral setae, bacilliform solenidion, and papilliform famulus. Tarsus II with three dorsal setae, doublet bacilliform parambulacral setae, and bacilliform solenidion. Tarsus III with four dorsal setae, one scaliform parambulacral seta on anterior side, and one bacilliform parambulacral seta on posterior side (Fig. 21). Tarsus IV with three dorsal setae, scaliform parambulacral seta on anterior and posterior sides (Figs. 14 & 21).

Tritonymph (paratype, NSMT-Ac14109)

Idiosoma 290 long, 168 wide. Dorsum (Fig. 5): Dorsal plates partly foveolate; AD 80 long, 83 wide, furnished with a pair of pores and setae; OC 55 long, 33 wide, bearing two corneae and two setae; PD 110 long, 65 wide, furnished with a pair of setae; AD and PD separated by interval almost equaling PD length. Venter (Fig. 6): AE 73 long, 163 wide, with four setae on each side; PE each 113 long, 68 wide, with five setae; GP 35 long, 43 wide, furnished with two pairs of perigenital setae and a pair of subgenital setae (Fig. 9); three tiny genital acetabula present in genital slit; adanal setae placed on anal papilla.



**Figures 10–14.** *Rhombognathus iranius* sp. nov. Male (holotype), 10. Leg I (R); 11. Leg II (R); 12. Leg III (L); 13. Leg IV (L). Female (allotype), 14. Tarsus IV. Scale bar = 50  $\mu$ m.

Gnathosoma: 60 long, 50 wide, L/W 1.20, gnathosoma length/idiosoma length 0.21.

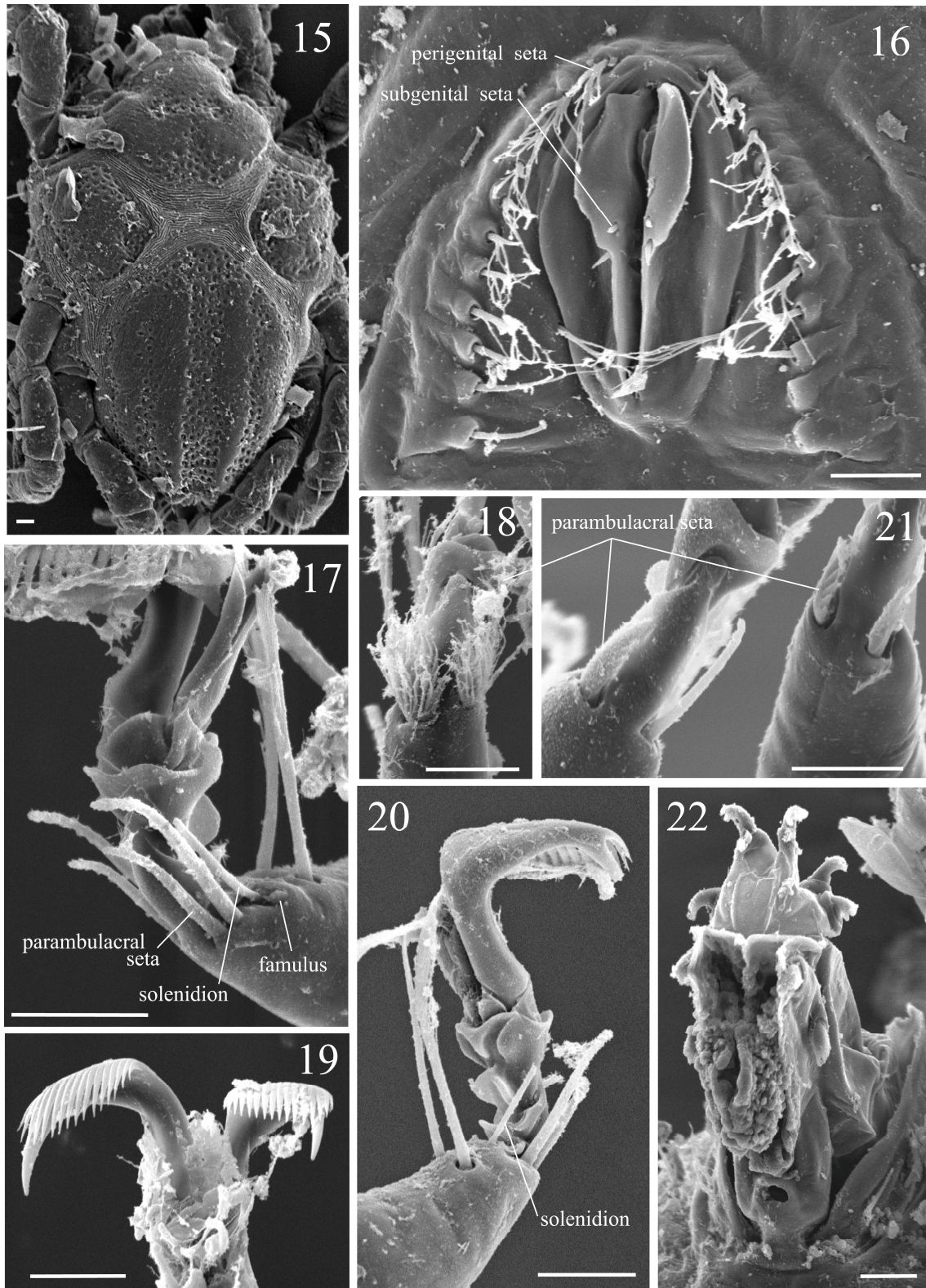
Legs: Length of legs I, II, III, IV = 165, 158, 163, 168, respectively. Leg chaetotaxy as follows: Trochanters I-IV, 1-1-1-0; basifemora I-IV, 2-2-2-1; telofemora I-IV, 5-5-2-2; genua I-IV, 5-4-3-3; tibiae I-IV, 5-5-5-5. As for large bipectinate setae: Tibiae I-IV, 2-1-0-1 (weakly pectinate). Tarsal chaetotaxy same as in allotype. Lateral claw with endoplanate accessory process bearing about 10 teeth.

Protonymph (paratype, NSMT-Ac14112)

Idiosoma 175 long, 125 wide. Dorsum: AD 50 long, 62 wide, furnished with a pair of setae; OC 33 long, 18 wide, bearing two corneae and two setae; PD 45 long, 33 wide, furnished with a pair of setae. Venter: AE 40 long, 85 wide, with three setae on each side; PE each 50 long, 20 wide, with four setae; GP 15 long, 17 wide, furnished with a pair of perigenital setae.

Gnathosoma: 38 long, 30 wide, L/W 1.27, gnathosoma length/idiosoma length 0.21.

Legs: Length of legs I, II, III, IV = 90, 83, 88, 88, respectively. Leg chaetotaxy as follows: Trochanters I-IV, 1-1-1-0; basifemora I-III, IV (femur), 2-2-1, 2; telofemora I-III, 3-3-2; genua I-IV, 4-4-3-3; tibiae I-IV, 5-5-4-4. As for large bipectinate setae: Tibiae I-IV, 2-1-0-0. Accessory process bearing about 8 teeth.



**Figures 15–22.** *Rhombognathus iranius* sp. nov. SEM observation of non-type material. Male, 15. Idiosoma (Ds); 16. Genital region; 17. Tarsus I; 18. Tarsus IV; 19. Lateral claws on tarsus II; 20. Tarsus II. Female, 21. Left: Tarsus III, Right: Tarsus IV; 22. Ovipositor excreted from GF. Scale bars = 10  $\mu$ m.

### *Morphological variation and abnormality*

The size range of the idiosoma, gnathosoma, and legs I-IV as follows: Female (n= 4); Idiosoma length 280–310, width 215–220. Gnathosoma length 70–80, width 60–70, L/W 1.07–1.33; gnathosoma length /idiosoma length 0.24–0.26. Leg length: Leg I 198–214, leg II 193–213, leg III 198–218, leg IV 203–220. Male (n= 6); Idiosoma length 270–300, width 185–210. Gnathosoma length 70–83, width 60–68, L/W 1.08–1.28; gnathosoma length /idiosoma length: 0.24–0.29. Leg length: Leg I 193–223, leg II 188–218, leg III 180–208, leg IV 185–213. Tritonymph (n= 3); Idiosoma length 268–305, width 168–193. Gnathosoma length 53–60, width 50–55, L/W 1.00–1.20; gnathosoma length/idiosoma length 0.17–0.21. Leg length: Leg I 155–170, leg II 155–163, leg III 150–170, leg IV 153–173.

The size range of dorsal plates, epimeral plates, GP, and GF as follows: Female (n= 4); AD length 95–113, width 108–118; OC length 73–83, width 48–60; PD length 145–160, width 100–110. GF length 65–73, width 40–50. Male (n= 6); AD length 88–103, width 103–118; OC length 68–80, width 50–60; PD length 138–155, width 110–118. GF length 45–55, width 33–38. Tritonymph (n= 3); AD length 60–80, width 68–83; OC length 50–60, width 33–40; PD length 93–110, width 63–73; AE length 63–73, width 148–163; PE length 88–113, width 63–68; GP length 35–45, width 43–48.

The leg chaetotaxy varies among specimens as follows: Female (n= 4) and male (n= 6); Trochanters I-IV, 1-1-1-0; basifemora I-IV, 2-2-(1, 2)-(1, 2); telofemora I-IV, (4, 5, 6)-(4, 5, 6)-(2, 3)-(2, 3); genua I-IV, 5-5-3-3; tibiae I-IV, (5, 6)-5-5-5. Accessory process bearing 14–18 teeth. Tritonymph (n= 3); Trochanters I-IV, 1-1-1-0; basifemora I-IV, 2-2-(1, 2)-1; telofemora I-IV, (4, 5)-(4, 5)-2-2; genua I-IV, (4, 5)-4-3-3; tibiae I-IV, 5-5-5-5. Accessory process bearing 9–14 teeth.

### *Remarks*

*Rhombognathus iranius* **sp. nov.** resembles *R. areolatus* Abé & Fernandes, 2011, *R. eltanini* Newell, 1984, *R. litoralis* Bartsch, 1972, *R. marginalis* Bartsch, 1993, *R. papuensis* Bartsch, 1989, *R. pectinatus* Viets, 1936 and *R. praegracilis* Viets, 1939 in characters: four dorsal plates, two corneae, one adjunctive seta on each of the second and third coxal regions, five perigenital setae in females and a lateral claw with endoplanate accessory process. However, *R. iranius* **sp. nov.** is distinguished from these congeners by the leg chaetotaxy: genua I-IV with 5-5-3-3 setae and tibiae I-IV with 2-1-0-1 large bipectinate setae. In addition, the posterior margin of AD is round in *R. iranius* **sp. nov.**, whereas the margin is protruded in *R. areolatus*, *R. litoralis*, *R. pectinatus* and *R. praegracilis*. The distance between AD and PD in *R. iranius* **sp. nov.** is shorter than that in *R. areolatus*, *R. eltanini*, *R. litoralis*, *R. papuensis* and *R. pectinatus*. Furthermore, the relative size of OC is smaller in *R. iranius* **sp. nov.** than that in *R. praegracilis* and *R. marginalis*.

### *Etymology*

The specific epithet is derived from the type locality (country), Iran.

### *Habitat*

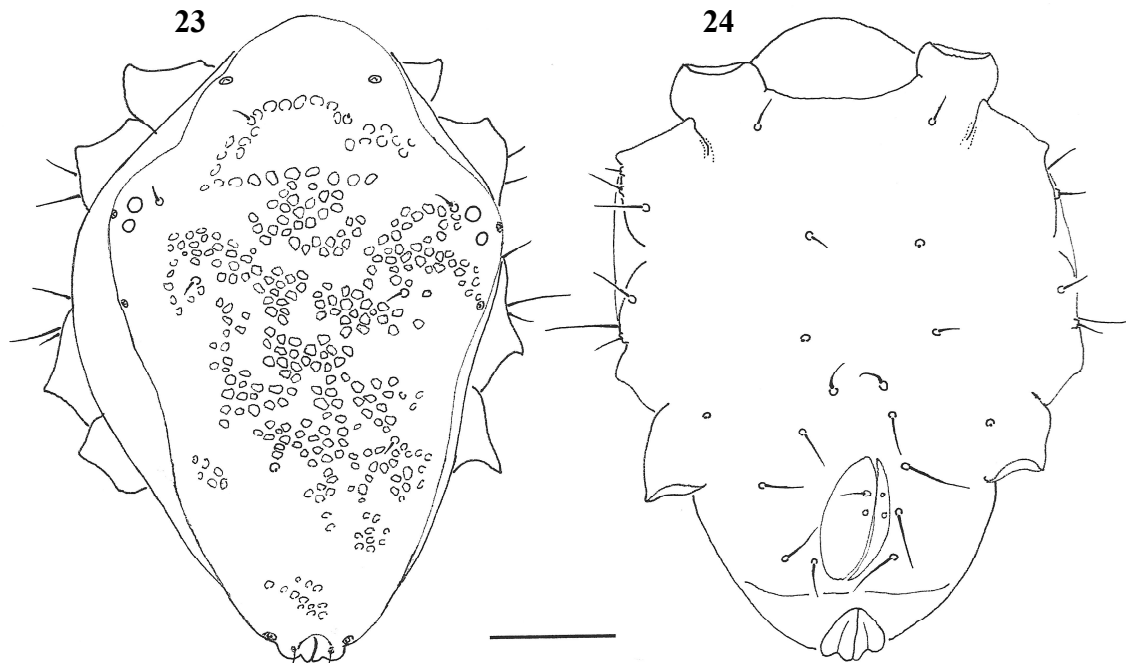
Intertidal zone. Among brown algae *Sargassum* sp. on a rocky shoreline fringe.

### *Distribution*

Chabahar Beach at the Darya Bozorg area on the Gulf of Oman, Iran.

*Rhombognathus scutulatus* Bartsch, 1983 (Figs. 23–24)

*Rhombognathus scutulatus* Bartsch, 1983: 413–415; 1993: 20–21; 1999: 354–355; 2003: 274–275; 2006: 42–43; 2009: 35–36; Chatterjee 1995: 284; Chatterjee & De Troch 2000: 187–189.



**Figures 23–24.** *Rhombognathus scutulatus* Bartsch, 1983. Female, 23. Idiosoma (Ds); 24. Idiosoma (Vr). Scale bar = 50  $\mu$ m.

#### *Material examined*

One female (NSMT-Ac14113); on *Sargassum* sp. at 1 m depth; intertidal; 25° 16' N, 60° 39' E, Chabhar Beach, Darya Bozorg, Gulf of Oman, Iran; May 13, 2012; I. Etemadi coll.

#### *Diagnosis*

Dorsal plates fused into a single large plate ornamented with areolae, area representing OC with two corneae, area representing PD with a pair of setae, anterior epimeral region with one or no adjunctive seta, posterior epimeral region with one or two adjunctive setae, female with five filiform perigenital setae surrounding GF, and two subgenital setae on each genital sclerite, male with 9–14 branched perigenital setae surrounding each side of GF, and two subgenital setae on each genital sclerite, telofemora I–IV usually with 6-6-3-3 setae, genua I–IV with 5-5-3-3 setae, tibiae I–IV with 2-1-1-2 large bipectinate setae, lateral claw with broad endoplanate accessory process bearing 13–28 teeth.

#### *Description*

##### Female

Idiosoma 270 long, 190 wide. Dorsum (Fig. 23): AD, OC, and PD fused into a single dorsal plate ornamented partly with foveolae. Region representing AD furnished with a pair of dorsal pores anteriorly. Region representing OC furnished with two corneae and two dorsal pores. Region representing PD with a pair of dorsal pores near posterior end. All dorsal setae short filiform. A pair of setae on region representing AD. Two setae on

region representing each OC. A pair of setae placed on anterior part of region representing PD. Adanal setae placed on anal papilla.

Venter (Fig. 24): Ventral plates fused into a single plate without distinct panels. Ventral setae fine filiform. On anterior epimeral part, one ventral seta placed on first coxal region; one ventral, one marginal, and one or no adjunctive seta on second coxal region. On posterior epimeral part; one ventral, one laterodorsal, and one adjunctive seta on third coxal region; two ventral setae on fourth coxal region.

Genitoanal region (Fig. 24): GF 50 long, 28 wide. Five long filiform perigenital setae located at each side of GF as shown in Fig. 2. Two pairs of subgenital setae on genital sclerites. Adanal setae placed on anal papilla dorsoproximally.

Gnathosoma: 73 long, 63 wide, L/W 1.16; gnathosoma length/idiosoma length 0.27. Rostrum 33 long, nearly lanceolate. Two pairs of rostral setae on rostrum. Chelicera 75 long and palp 35 long.

Legs: Length of legs I, II, III, IV= 193, 190, 190, 205, respectively. Lateral claw with endoplanate accessory process, bearing 10–14 delicate teeth. Claw shaft smooth. Leg chaetotaxy as follows: Trochanters I-IV, 1-1-1-0; basifemora I-IV, 2-2-1-1; telofemora I-IV, 6-6-3-3; genua I-IV, 5-5-3-3; tibiae I-IV, 5-5-5-5. As for large distinct bipectinate setae: Tibiae I-IV, 2-1-1-2. Dorsal filiform setae on tarsi I-IV, 3-3-4-3. Parambulacral setae paired doublets on tarsi I and II, scaliform on anterior side and bacilliform on posterior side of tarsus III, scaliform on each of anterior and posterior sides of tarsus IV.

#### Remarks

*Rhombognathus scutulatus* is originally described by Bartsch (1983) from Negros Island of the Philippines. Thereafter, this species was recorded also from Singapore (Bartsch 2006), the Great Barrier Reef (Bartsch 2000), Western Australia (Rottnest Island and Dampier Archipelago) (Bartsch 1993, 2003), Sri Lanka (Bartsch 2006), India (Chatterjee 1995), Kenya (Chatterjee & De Troch 2000), and Mauritius (Bartsch 2009). The morphological characteristics of the specimens from Iran accord well with the original description except for the body size and the number of claw teeth (corresponding condition in Philippine specimens in parentheses). The idiosomal length is 270 in females (355). Accessory process of lateral claws bears 10–14 teeth (16–19 teeth). These discrepancies between the Iranian and Philippine specimens are regarded as intraspecific variations. Among all females recorded so far from localities in the southwestern Pacific Ocean and Indian Ocean, the body size varies from 279 to 360 and the number of teeth of lateral claws varies from 13 to 28 (Bartsch 2009). The body size and the number of claw-teeth of the Iranian specimen closely resemble those in the specimens from Mauritius (279–287 in body size, 14–15 teeth on lateral claw).

#### Habitat

Intertidal and subtidal zones. Among red algae: *Amphiroa*; brown algae: *Cystophora*, *Zonaria*, *Padina*, *Ecklonia*, *Sargassum*; green algae: *Caulerpa*; seagrass: *Amphibolis*, *Thalassia*, *Halophila*, *Halodule*, *Syringodium*.

#### Distribution

This species is widely distributed in the southwestern Pacific Ocean and Indian Ocean (Bartsch 2003, 2009; Abé 1998): Philippines, Singapore, Australia, Sri Lanka, India, Iran and Kenya.

## Discussion

A total of three species of halacarid mites in the subfamily Rhombognathinae were recorded from the Iranian coasts: *Isobactrus scutatus* Bartsch, 2012, *Rhombognathus scutulatus* Bartsch, 1983, and *R. iranius* Abé and Etemadi **sp. nov.** Considering the wide distributional range of *R. scutulatus* in the tropical western Pacific and Indian Oceans, the other two species probably distribute along the entire coasts of the Arabian Sea.

*Rhombognathus scutulatus* exhibits wide variation in the number of teeth on the accessory process of lateral claws (Bartsch 2009). Specimens with a relatively large number of teeth, more than 20, were recorded from Western Australia and the Great Barrier Reef. On the other hand, specimens with a relatively small number of teeth, fewer than 15, were found from Sri Lanka, Mauritius, and Iran. This indicates that the number of claw teeth is quite changeable within one species. The number of claw teeth has been sometimes regarded as a diagnostic character of the rhombognathine species. It must be noted that the significant difference among the number of claw teeth of each species should be statistically tested in such cases where the number of claw teeth is designated as a discriminating character of the species.

## Acknowledgement

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## دو گونه کنه از زیرخانواده *Rhombognathinae* (Acari: Halacaridae) از دریای

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### چکیده

این مقاله اطلاعاتی در مورد فون کنه‌های خانواده *Halacaridae* به همراه نخستین گزارش از جنس *Rhombognathus* از دریای عمان ارائه می‌کند. دو گونه از جنس *Rhombognathus* از ساحل ایران به نام‌های *Rhombognathus scutulatus* Bartsch 1983 و *R. iranius sp. nov.* توصیف می‌شوند. واژگان کلیدی: نخستین گزارش، کنه‌های دریازی، گونه جدید، *Rhombognathus*، Prostigmata

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