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urn:lsid:zoobank.org:pub:BBBCDE51-7444-4352-BF51-D429A45DF2E5

A new genus and species of Apoloniinae (Acari: Trombiculidae) from Oman

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Abstract

A new chigger mite genus and species, *Arabapolonia omanensis* **gen. nov. et sp. nov.** is described from 4 gecko species, *Hemidactylus lemurinus*, *H. homoeolepis* (Gekkonidae), *Ptyodactylus hasselquistii* (Phyllodactylidae), and *Pristurus rupestris* (Sphaerodactylidae) collected in Oman. The new genus is characterized by the simple cheliceral blade, single palpal claw, palpal tarsus 6BS, non-reduced scutum without nasus bearing 2 AM, 2 AL and 2 PL setae, flagelliform sensilla branched in the distal half, 2 pairs of eyes, 7-segmented legs with onychotriches, the absence of some leg setae (subterminala, parasubterminala, pretarsalae I and II, microgenuala II, tibiala III, and coxala II), the absence of the sternal setae between leg coxae I (fSt = 0.2.4), and by the presence of tracheae.

Key words: chiggers, fauna, systematics, Arabian Peninsula

Introduction

Apoloniinae is a small subfamily of chigger mites comprising eight genera and 19 species (Brown 2006, 2009) with the characters intermediate between the Leeuwenhoekinae and Trombiculinae. We follow the system of chiggers where the family Trombiculidae includes Trombiculinae, Leeuwenhoekinae, and Apoloniinae as its subfamilies (Goff *et al.* 1982; Kudryashova 1998; Fernandes & Kulkarni 2003; Shatrov & Kudryashova 2008). In the systems where Leeuwenhoekinae is raised to the family status, Apoloniinae is considered as its subfamily (Vercammen-Grandjean 1968; Vercammen-Grandjean & Kolebinova 1968; Wen 1984; Kolebinova 1992). All Apoloniinae have legs with seven articulated segments, just as Trombiculinae, while in the Leeuwenhoekinae, legs are with six segments (basifemur and telofemur are fused). The traits characteristic of Leeuwenhoekinae, i.e. presence of two anteromedian setae on the scutum, presence of the nasus, microgenuala II, onychotriches on leg claws, and the absence of the anterior sternal setae, are scattered irregularly within Apoloniinae genera.

A small collection of chigger mites from geckos made by Salvador Carranza and Elena Gómez-Díaz in Oman provided us with a new genus and species with a very peculiar set of characters, which is described below. The subfamily has been revised in several works (Vercammen-Grandjean & Kolebinova 1968; Goff 1983; Brown 2006); therefore, there is no need for a new revision.

Material and methods

Four lizard hosts belonging to all three gecko families found in the Arabian Peninsula (*Hemidactylus lemurinus* Arnold and *H. homoeolepis* Blanford from Gekkonidae, *Ptyodactylus hasselquistii* (Donndorff) from Phyllodactylidae and *Pristurus rupestris* Blanford from Sphaerodactylidae) were collected in October 2010 and May 2011 in the following five localities of the Sultanate of Oman.

1. Wadi Ayoun (*Hemidactylus lemurinus*). This wadi is located in Dhofar, the southern Province of Oman. It is a northward draining deep gorge always filled with water that has been carved through limestone. It is famous for its wild frankincense trees and also for the big, white, water-smoothed boulders that occur in extensive patches in the wadi. The boulders at Wadi Ayoun are one of three only localities known for the Arabian endemic *Hemidactylus lemurinus* (Carranza & Arnold 2012).

2. Close to Qumaylah (*Hemidactylus homoeolepis*). This locality is within the Ash Sharqiyah Region of Oman and is very close to the Arabian Sea. It is characterized by the presence of very poor vegetation (small shrubs) and a mixed terrain of coastal sand dunes and rocks.

3. Wadi Tiwi (*Ptyodactylus hasselquistii*). This wadi within the Ash Sharqiyah Region flows into the Arabian Gulf ca. 120 km southeast of Musqat and stretches for 36 km in a northeast—southeast direction. The river bed of this wadi is always filled with water throughout the year.

4. Eight km N of Tanuf, Jebel Akhdar (*Pristurus rupestris*). This locality is within the Ad Dakhiliyah Governorate. The Jebel Akhdar is the largest structural domain in the western Hajar Mts reaching 2980 m a.s.l. It is thus high enough to influence the local climate significantly, the rainfall being considerably higher than that of the arid lowland regions to the west and south. Many of the mountain wadis have some surface water, at least intermittently, and then often support areas of quite luxuriant vegetation.

5. Haat Village (*Pristurus rupestris*), also in the Jebel Akhdar (see above) but within the Al Batinah Region.

During the expedition, coordinates and altitudes were obtained using the GPS navigation device Garmin Etrex Legend HCx and datum WGS84. Lizards were captured manually and examined with naked eyes for the presence of ectoparasites. Identification of the hosts was performed on the base of morphological and molecular characters using works and identification keys by Arnold (1977, 1986) and Carranza and Arnold (2006, 2012). Mites were extracted using tweezers and preserved in 70% ethanol. Most of the chiggers were found attached in the folds of soft skin around hosts' armpits. After examination, lizards from localities 1 and 3 were released at the location where they were captured and lizards from localities 2, 4 and 5 were preserved in 80% ethanol for further taxonomic studies.

Alcohol-fixed chigger mite specimens were mounted on microscopic slides in Faure-Berlese medium under uniform conditions. Mites were examined under a compound microscope MBI-3 (LOMO plc, St. Petersburg, Russia) with phase contrast optics. Measurements were made with an ocular micrometer; drawings were made using a camera lucida. Terminology follows that of Goff *et al.* (1982) and Stekolnikov and Daniel (2012). In Table 1, abbreviation TaW means width of leg III tarsus. In the figure showing the dorsal idiosomal setae arrangement, tentative bounds between rows of setae are outlined by dotted lines; setae situated at the opposite side of idiosoma are represented by open circles. In figures of the legs, double circles correspond to the bases of non-specialized setae; single circles represent the non-specialized setae situated at the opposite side of the leg.

All examined mite specimens were engorged; as a consequence, taking measurements and recording of some non-metric characters were impossible for a part of our material.

Systematics

Family Trombiculidae Ewing

Subfamily Apoloniinae Wharton

Arabapollonia gen. nov.

Type species: *Arabapollonia omanensis* sp. nov., designated here.

Diagnosis. SIF = 6BS-N(b)-1-2110.0000; fsp = 7.7.7; fCx = 1.0.1; fSt = 0.2.4; fPp = B/B/BBB. Cheliceral blade with 1 inconspicuous denticle near its apex; galeal seta nude or having 1 small cilium; palpal claw single; all palpal setae branched; palpal tarsus with 6 non-specialized setae, nude subterminala and tarsala. Tracheae present; spiracles not found. Scutum with projected anterior margin, without nasus, posterior scutal margin slightly prominent, angulated or rounded; two anteromedian setae, two anterolateral and two posterolateral setae situated

on scutum; sensilla flagelliform, branched in distal half; eyes 2 + 2. Legs 7-segmented, with 1 pair of claws and claw-like empodium; onychotriches present; leg subterminala and parasubterminala absent; pretarsalae I (?) and II absent; microgenuala II absent; microtarsala I situated distal of tarsala I; microtarsala II situated distal of tarsala II; tarsala II slender, with bulbiform apex; tibiala III and mastitarsalae III absent. Number of setae on leg coxae I–III: 1, 0, 1; sternal setae between coxae I absent; two sternal setae between coxae II and four sternal setae between coxae III.

Hosts. Geckos of the families Gekkonidae, Phyllodactylidae and Sphaerodactylidae.

Distribution. Oman.

Etymology. The name of the new genus refers to the Arabian Peninsula, where its type species was found, and to *Apolonia* Torres and Braga, 1939, the nominate genus of Apoloniinae.

Remarks. *Arabapollonia* differs from all other Apoloniinae in a single palpal claw, the absence of coxala II (fCx = 1.0.1 vs. 1.1.1 or 1.2.1) and the absence of the sternal setae between leg coxae I (fSt = 0.2.4). The new genus shares the non-reduced scutum with the genera *Sauracarella* Lawrence, 1949 and *Afracarella* Vercammen-Grandjean and Koblebinova, 1968 (all other genera of Apoloniinae have peniscutum, i.e. scutum with reduced posterior angles, with PL setae situated off scutum), but these two genera, unlike *Arabapollonia*, possess the nasus and clavate sensilla. *Arabapollonia* is the second known genus of Apoloniinae (after the monotypic genus *Apolonia*) having onychotriches and the second genus with palpal tarsus 6BS (after the monotypic genus *Afracarella*).

Arabapollonia is the first known Apoloniinae genus having tracheae. These structures belong to the duct system of unknown function which was previously recorded in some genera of Leeuwenhoekinae (Goff *et al.* 1982), while in other genera of this subfamily it is certainly absent.

We were unable to find pretarsala on leg I in the new genus; actually, in the compact group of setae at the tip of the tarsus, one seta may be pretarsala, but its recognition can probably be realized only on new material of better quality or by scanning electron microscope. Tentatively, the absence of this seta can be regarded as another autapomorphy of *Arabapollonia*.

Arabapollonia omanensis sp. nov.

(Figs. 1, 2)

Diagnosis. SIF = 6BS-N(b)-1-2110.0000; fsp = 7.7.7; fCx = 1.0.1; fSt = 0.2.4; fPp = B/B/BBB; fSc: PL > AM > AL; Ip = 711–941; fD = 2H-10-8-8(7)-6-4(2); DS = 35–38; VS = 15–17; NDV = 52–53. Standard measurements given in Table 1.

TABLE 1. Standard measurements of *Arabapollonia omanensis* gen. et sp. nov.

Slide	AW	PW	SB	ASB	PSB	SD	P-PL	AP	AA	AM	AL	PL	S	H
8423 (holotype)	45	62	23	23	12	35	14	15	5	31	25	36	72	32
8424 (EGD-7)	49	62	26	24	8	32	12	15	5	29	25	34	-	27
8419 (EGD-1)	42	56	22	21	9	30	14	11	5	26	22	29	58	-
8417 (EGD-6)	41	52	22	19	13	32	12	13	5	-	15	22	52	20
8421 (EGD-8)	40	54	23	23	11	33	14	14	5	26	16	24	54	20

continued.

Slide	D _{min}	D _{max}	V _{min}	V _{max}	pa	pm	pp	Ip	DS	VS	NDV	TaIII	TaW
8423 (holotype)	29	37	29	36	315	290	337	941	-	-	-	95	11
8424 (EGD-7)	29	34	19	32	295	261	304	860	38	15	53	86	11
8419 (EGD-1)	29	34	20	30	283	230	274	787	-	-	-	77	10
8417 (EGD-6)	20	23	16	24	248	211	252	711	35	17	52	70	10
8421 (EGD-8)	20	23	-	-	256	230	268	754	-	-	-	70	10

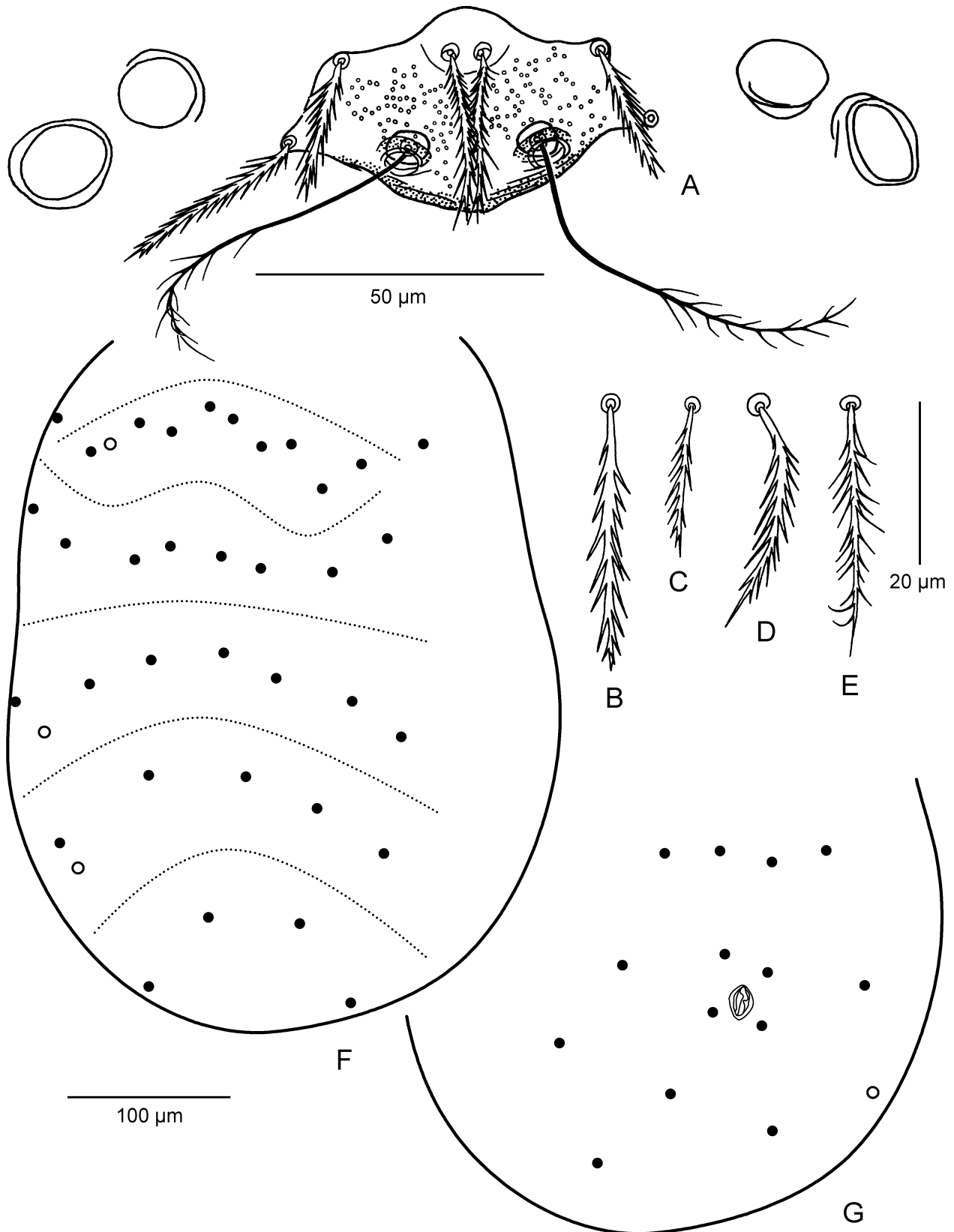


FIGURE 1. *Arabapollonia omanensis* gen. nov. et sp. nov. **A**, scutum and eyes of holotype; **B**, dorsal idiosomal seta of 1st row in holotype; **C**, dorsal idiosomal seta of 1st row in specimen No. 8421; **D**, ventral idiosomal seta in holotype; **E**, ventral idiosomal seta in specimen No. 8421; **F**, arrangement of dorsal idiosomal setae; **G**, arrangement of ventral idiosomal setae. Scale bars: 50 µm (**A**), 20 µm (**B–E**), 100 µm (**F, G**).

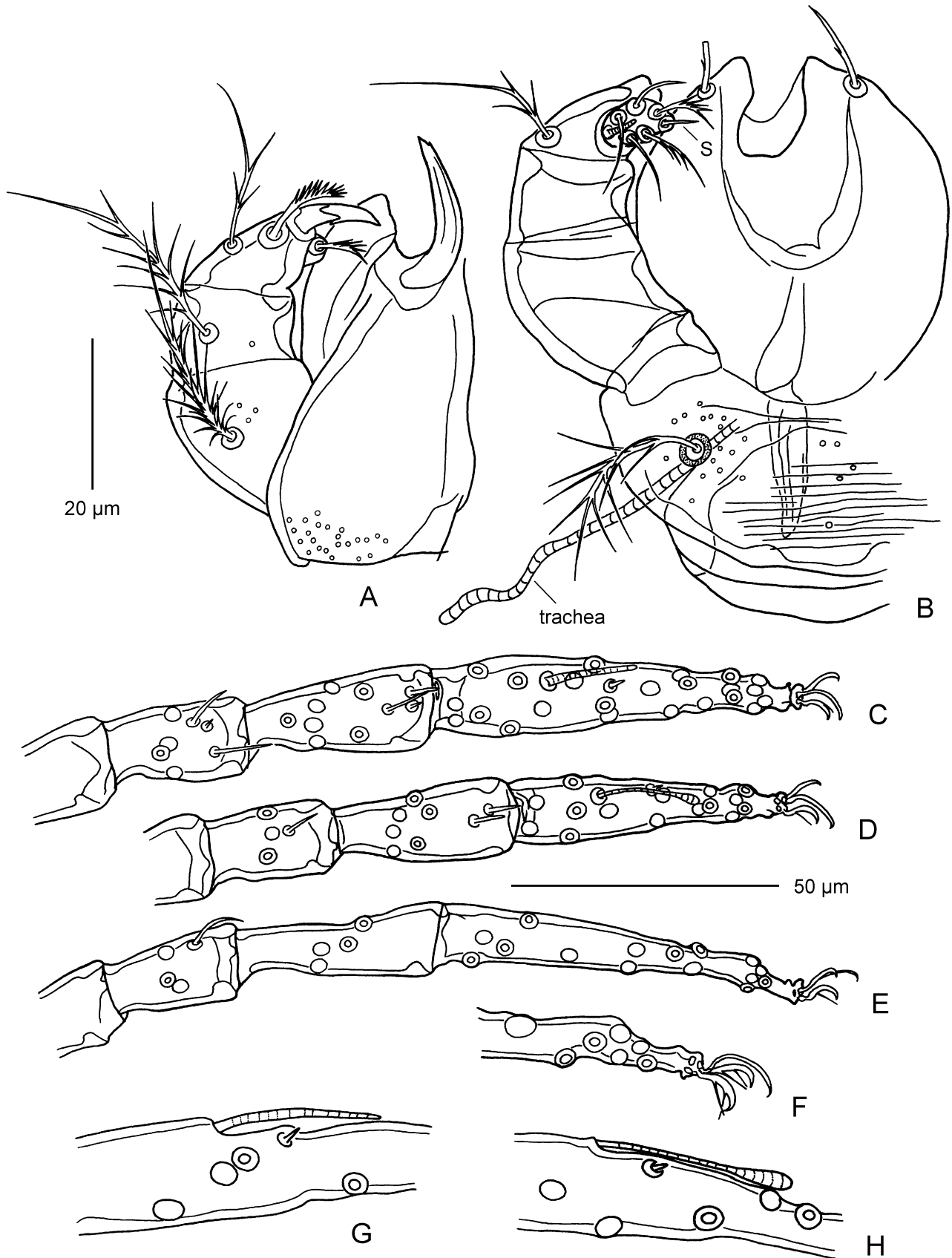


FIGURE 2. *Arabapollonia omanensis* gen. nov. et sp. nov. **A**, dorsal aspect of gnathosoma in holotype; **B**, ventral aspect of gnathosoma in holotype; **C**, leg I; **D**, leg II; **E**, leg III; **F**, tip of leg tarsus III in holotype showing two onychotriches in both claws; **G**, tarsala and microtarsala I in holotype; **H**, tarsala and microtarsala II in holotype. Scale bars: 20 μm (**A**, **B**, **F**–**H**), 50 μm (**C**–**E**). Abbreviation: S—subterminala (eupathidium) on palpal tarsus.

Description (larva). IDIOSOMA. Eyes large, 2 + 2; eyes of anterior and posterior pair separated, ocular plate absent. One or 2 pairs of humeral setae (marginal idiosomal setae of 1st dorsal row may be considered as second pair of humeral setae), 33–36 moderately barbed dorsal idiosomal setae, fD=2H-10-8-8(7)-6-4(2); 2 sternal setae between leg coxae II and 4 sternal setae between leg coxae III; 15–17 ventral setae; total number of idiosomal setae excluding coxal and sternal 52–53.

GNATHOSOMA. Cheliceral blade with 1 inconspicuous denticle near apex, without tricuspid cap; cheliceral base with few puncta in proximal part; gnathobase with sparse puncta and transverse cuticular striations, with 1 pair of branched setae; tracheae extend from gnathobase to leg coxa I, spiracles not found; palpal femur and genu with few puncta; galeala nude or having one small cilium; palpal claw single; setae on palpal femur and genu branched; ventral and lateral palpal tibial setae branched, dorsal palpal tibial seta heavily barbed in distal half, in shape of tooth-brush; palpal tarsus with 6 non-specialized setae (3 setae definitely branched and 3 setae seem nude), nude subterminala and tarsala.

SCUTUM. Nearly hexagonal, with large, rounded anterior projection, without nasus, posterior scutal margin slightly prominent, angulated or rounded, with few cuticular striations; 2 anteromedian setae, 2 anterolateral and 2 posterolateral setae situated on scutum; AM bases at level of ALs; SB slightly posterior to level of PLs; PL > AM > AL; flagelliform sensilla heavily branched in distal half.

LEGS. All 7-segmented, with 1 pair of claws and claw-like empodium; claws with 1–2 long onychotriches, almost as long as claw itself. Leg I: coxa with 1 non-specialized branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, two genualae, microgenuala; tibia 7B, two tibialae, microtibiala; tarsus 23B, tarsala 16–22 long, with sparse annulation, microtarsala distal of tarsala; subterminala, parasubterminala and pretarsala absent. Leg II: coxa without seta; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala, without microgenuala; tibia 6B, 2 tibialae; tarsus 15B, tarsala 19–26 long, very thin, with sparse annulation and bulbiform apex, microtarsala distal of tarsala, pretarsala absent. Leg III: coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 4B, tibiala absent; tarsus 15B, mastitarsalae absent.

Type material. Holotype larva (ZISP collection number 8423, T-Tr.-56) ex *Hemidactylus lemurinus* (Sauria: Gekkonidae) (mite Id S7609, tube No. EGD-3), **OMAN:** Dhofar Governorate, Wadi Ayoun (locality No. 1 according to above list), 17.24218 N, 53.89095 E, 678.8 m a.s.l., 1 May 2011, coll. S. Carranza and E. Gómez-Díaz; 1 larva paratype (8419) ex *H. homoeolepis* (S7673, EGD-1), Ash Sharqiyah Region, 2 km W from Qumaylah (locality No. 2), 21.95181 N, 59.6082 E, 42 m a.s.l., 10 October 2010, coll. S. Carranza; 1 larva paratype (8424) ex *Ptyodactylus hasselquistii* (Sauria: Phyllodactylidae) (S7652, EGD-7), Ash Sharqiyah Region, Wadi Tiwi (locality No. 3), 22.75737 N, 59.09399 E, 1196.5 m a.s.l., 7 May 2011, coll. S. Carranza and E. Gómez-Díaz; 2 larva paratypes (8417 and 8418) ex *Pristurus rupestris* (Sauria: Sphaerodactylidae) (S7270, EGD-6), Ad Dakhiliyah Governorate, 8 km N of Tanuf, Jebel Akhdar (locality No. 4), 23.12441 N, 57.45664 E, 1742.7 m a.s.l., 10 May 2011, coll. S. Carranza and E. Gómez-Díaz; 2 larva paratypes (8421 and 8422) ex *Pristurus rupestris* (S7251, EGD-8), Al Batinah Region, Haat Village, Jebel Akhdar (locality No. 5), 23.17711 N, 57.41018 E, 1307.7 m a.s.l., 8 May 2011, coll. S. Carranza and E. Gómez-Díaz.

Type deposition. Holotype and paratypes are deposited in the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia.

Etymology. The species epithet refers to the Sultanate of Oman where the type locality is situated.

Remarks. Size differences within the examined material are very significant. First two specimens in Table 1 (Nos 8423 and 8424) have the widest scutum (measurements AW and PW), longest setae (AM–V_{max}) and longest legs (pa–Ip and TaIII). Other two specimens (Nos 8417 and 8421) are the smallest, and specimen No. 8419 occupies the intermediate position. It is remarkable that the dorsal idiosomal setae in the largest specimens are almost twice longer than those in the smallest specimens (compare Fig. 1 B and C) and the legs of the holotype are 1.3 times longer than the legs of the smallest specimen (Ip = 941 vs. 711). In view of the fact, that non-metric characters are identical in all examined specimens, we consider these differences to be an individual variation. Dependence of size parameters on climatic factors was repeatedly recorded in chigger mites (e.g. Stekolnikov 1998, 2002; Stekolnikov & Klimov 2010); revealing of such variability is very natural in generally hot and dry climate of Oman. It is noteworthy that two smallest specimens (Nos 8417 and 8421) were collected in the places having the same ecological characteristics—localities 4 and 5, respectively. They are situated in the mountains, at elevations higher than in other collection localities (1743 and 1308 vs. 679, 1197, and 42 m), and in more wet local climate.

Acknowledgements

The authors wish to express their gratitude to Ali Alkiyumii and the other members of the Ministry of Environment and Climate Affairs for support and collection permits (Refs: 38/2010; 12/2011). We thank M. Robinson for logistic support and F. Amat for field assistance. Authors thank Dr Joanna Mąkol (Institute of Biology, Department of Invertebrate Systematics and Ecology, Wrocław University of Environmental and Life Sciences, Wrocław, Poland) for the careful review of our manuscript and valuable comments. This research was supported by a grant from the Russian Foundation for Basic Research No. 12-04-00354-a (A.A.S.), Marie Curie reintegration grant from the European Commission (PERG08-GA-ERG-2010- 276838) (E.G.D.) and by grant CGL2009–11663/BOS from the Ministerio de Educación y Ciencia, Spain (S.C.).

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