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Article

A new species of larval *Abrolophus* (Trombidiformes: Erythraeidae) from Iran with a key to species without a comb-like seta on the palptarsus

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ABSTRACT
Larvae of *Abrolophus hajiqanbari* **sp. nov.** (Trombidiformes: Erythraeidae) collected from soil and litter (off host) in Chahardeh and Chahkand villages, Birjand, South Khorasan province, Iran are described and illustrated. It belongs to *Abrolophus* group which lacks a comb-like seta on palptarsus. A key to the larval species of *Abrolophus* of the world without comb-like seta on the palptarsus is presented.

KEY WORDS: Birjand; Chahkand; Chahardeh; larva; Prostigmata; South Khorasan.

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INTRODUCTION

The subfamily Abrolophinae Witte, 1995 (Trombidiformes: Erythraeidae) consists of seven genera (Mąkol & Wohltmann 2012; Clark 2014) among which , the genus *Abrolophus* consists of 40 species based on larvae or adults and larvae. The genus *Abrolophus* is divided in two groups based on precence/absence of a comb-like seta on the palptarsus as follows: **1) with a comb-like seta** including: *A. quisquiliarus* (Hermann, 1804) [P, L] [syn.: *A. montenegrinus* Saboori, Šundić & Pešić, 2012], *A. longicollis* (Oudemans, 1910) [L], *A. aitapensis* (Southcott, 1948) [L] [syn.: *A. karamani* Haitlinger & Šundić, 2019], *A. mortenseni* (Southcott, 1994) [L], *A. humberti* (Haitlinger, 1996) [L], *A. khanjanii* (Haitlinger & Saboori, 1996) [L], *A. tonsor* (Southcott, 1996) [L], *A. welbourni* Yao, Snider & Snider, 2000 [P, L], *A. benoni* (Haitlinger, 2002) [L], *A. bohdani* (Haitlinger, 2003) [L], *A. iraninejadi* Saboori & Hajiqanbar, 2005 [L], *A. penelopae* Haitlinger, 2006 [L], *A. unimiri* Haitlinger, 2006 [L], *A. basumtwiensis* Haitlinger, 2007 [L], *A. marinensis* Haitlinger, 2007 [L], *A. mirabelae* Haitlinger, 2007 [L], *A. crimensis* Haitlinger, 2008 [L], *A. nymindegabicus* Haitlinger, 2008 [L], *A. petanovicae* Saboori, Šundić & Pešić, 2012 [L], *A. anzelmi* Haitlinger & Łupicki, 2013 [L], *A. bochkovi* Hakimitabar, Saboori & Fadaei, 2020 [L], *A. diaoluoensis* Xu & Jin, 2021 [L] and **2) without a comb-like seta** including: *A. norvegicus* (Thor, 1900) [P, L], *A. gracilentus* (Willmann, 1937) [L], *A. willmanni* (Schweizer, 1951) [L], *A. nivalis* (Schmölzer, 1956) [L], *A. parvus* (Schweizer & Bader, 1963) [L], *A. kazimierae* (Haitlinger, 1986) [L], *A. silesiacus* (Haitlinger, 1986) [L] syn.: *A. kotorensis* (Haitlinger, 2007), *A. amilberti* (Haitlinger, 2010)], *A. stanislavae* (Haitlinger, 1986) [L], *A. wratislaviensis* (Haitlinger, 1986) [L], *A. viburnicolus* (Fain & Çobanoğlu, 1998) [L], *A. yanlingicus* (Zheng, 2002) [L], *A. baardi* (Haitlinger, 2004) [L], *A. podorasensis* (Haitlinger, 2007)

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[L], *A. sardiniensis* (Haitlinger, 2007) [L], *A. dagmarae* (Haitlinger, 2012) [L], *A. balkanicus* Haitlinger & Šundić 2015 [L], *A. marianopolicus* Haitlinger & Šundić, 2018 [L] and *A. poljankus* Haitlinger & Šundić, 2021 [L] (Hermann 1804; Thor 1900; Oudemans 1910; Willmann 1937; Schweizer 1951; Schmölzer 1956; Southcott 1948, 1994, 1996; Schweizer and Bader 1963; Haitlinger and Saboori, 1996; Fain and Çobanoğlu 1998; Haitlinger 1986, 1996, 2002, 2003, 2004, 2006a, b, c, 2007a, b, c, d, e, 2008a, b, 2009, 2010, 2012; Yao *et al*. 2000; Zheng 2002; Saboori and Hajiqanbar 2005; Łaydanowicz and Mąkol 2008; Mąkol and Wohltmann 2012, 2013; Saboori *et al*. 2012; Wohltmann and Mąkol 2012; Haitlinger and Łupicki 2013a, 2015; Haitlinger and Šundić 2015, 2018, 2019, 2021; Hakimitabar *et al*. 2020; Xu *et al*. 2021).

Abrolophus miyatakei (Kawashima, 1958), *A. trifarius* (Shiba, 1976), *A. rudaensis* (Haitlinger, 1986) [syn.: *A. viticolus* (Fain & Çobanoğlu, 1998)], *A. iranicus* (Haitlinger and Saboori, 1996), and *A. hieronimi* Haitlinger & Łupicki, 2013b were transferred to the genus *Marantelophus* (Mąkol and Wohltmann 2012, 2013; Haitlinger 2016; Haitlinger and Šundić 2018). Here, a new species of *Abrolophus* without a comb-like seta on palptarsus is described from Birjand, South Khorasan province, Iran, and a key to the world species (larvae) without a comb-like seta on the palptarsus is presented.

MATERIAL AND METHODS

Nine specimens were extracted from soil and litter by a Berlese funnel. Mites were cleared in Nesbitt's fluid and mounted on glass microscope slide using Hoyer's medium (Walter and Krantz 2009). Measurements (given in micrometers, µm) were taken using a CH30 Olympus microscope and figures were drawn by a BX51 Olympus microscope equipped with a drawing tube and a magnification changer. Lengths of leg tarsi were measured without the stalk and pretarsus. The terminology and abbreviations are adapted from Wohltmann *et al.* (2006), Saboori *et al.* (2009) and Wohltmann and Mąkol (2012).

RESULTS

Erythraeidae Robineau-Desvoidy, 1828
Abrolophinae Witte, 1995
Genus *Abrolophus* Berlese, 1891

Abrolophus hajiqanbari sp. nov. (Figs. 1–11)

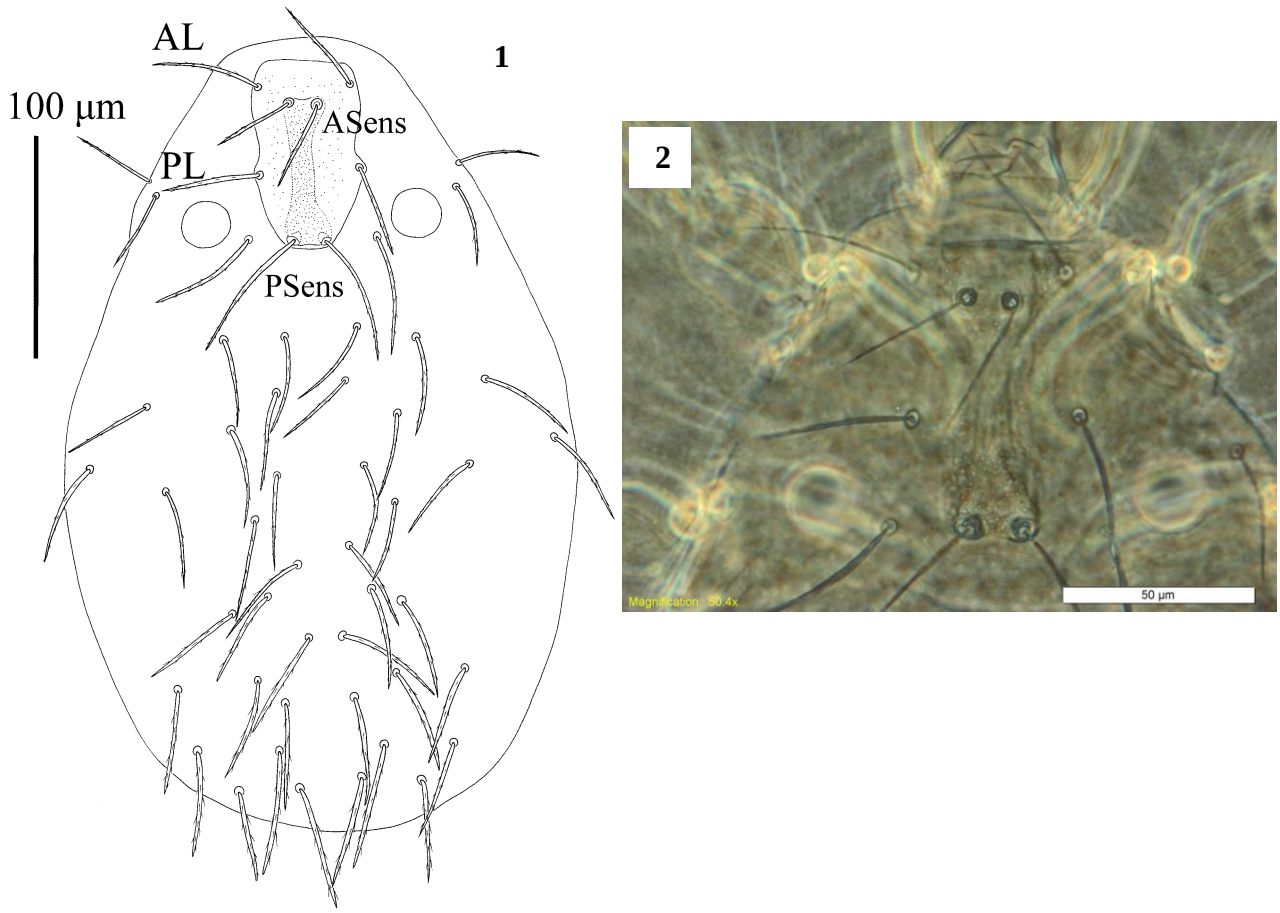
http://zoobank.org/urn:lsid:zoobank.org:act:2320252F-D136-466C-844F-95D12F6FDD5B

Diagnosis

Without a comb-like seta on the palptarsus, palpal femur without projection, Palpal tibial claw trifurcate (without a deep incision); PL scutalae located in the middle of ISD; AP 31–40; Ti III 107–120.

Description (n = 9)

Dorsum (Figs. 1, 2) – Dorsum of idiosoma with 44–47 barbed setae of which three pairs are around the scutum (two pairs lateral to scutum and anterior to eyes, and one pair between eyes and scutum). Scutum elongate, punctate, with two pairs of sensilla (ASens and PSens) and two pairs of normal setae (AL and PL). PSens longer than ASens, both barbed at distal two-third. AL longer than PL, both barbed. PL scutalae located in the middle of ISD. One eye (diameter 17–23) on each side of scutum posterolaterally .



Figures 1–2. *Abrolophus hajiqanbari* **sp. nov.** (larva) – 1. Dorsal view of idiosoma; 2. Scutum.

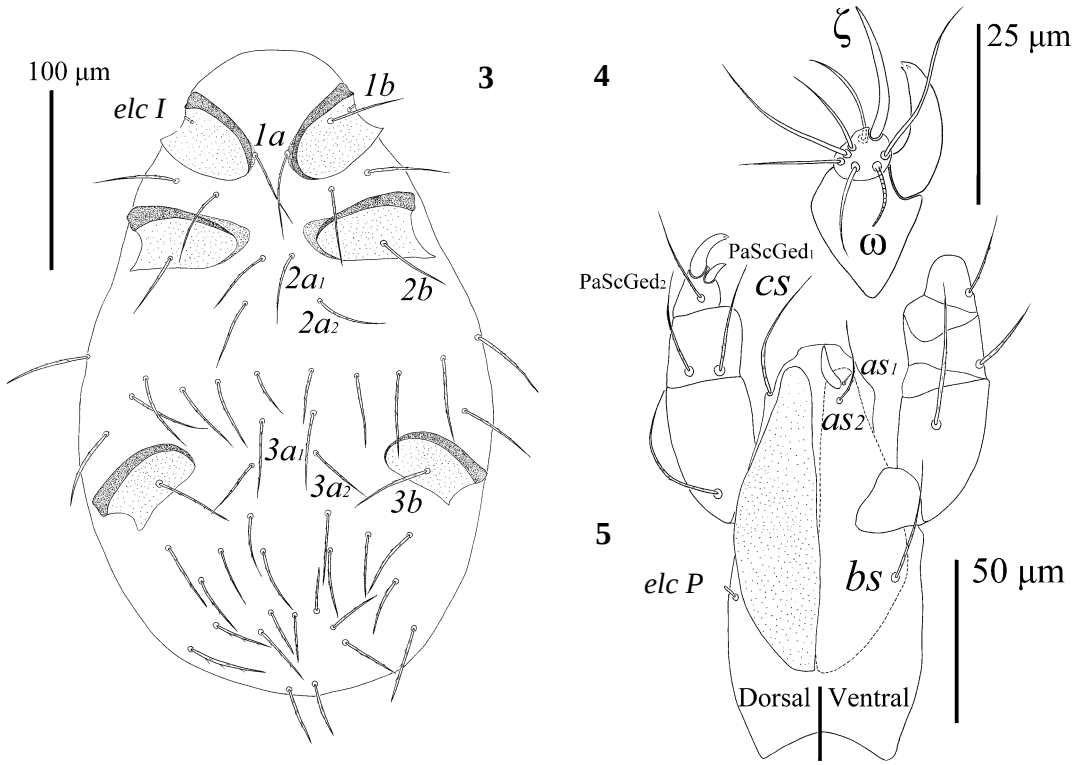
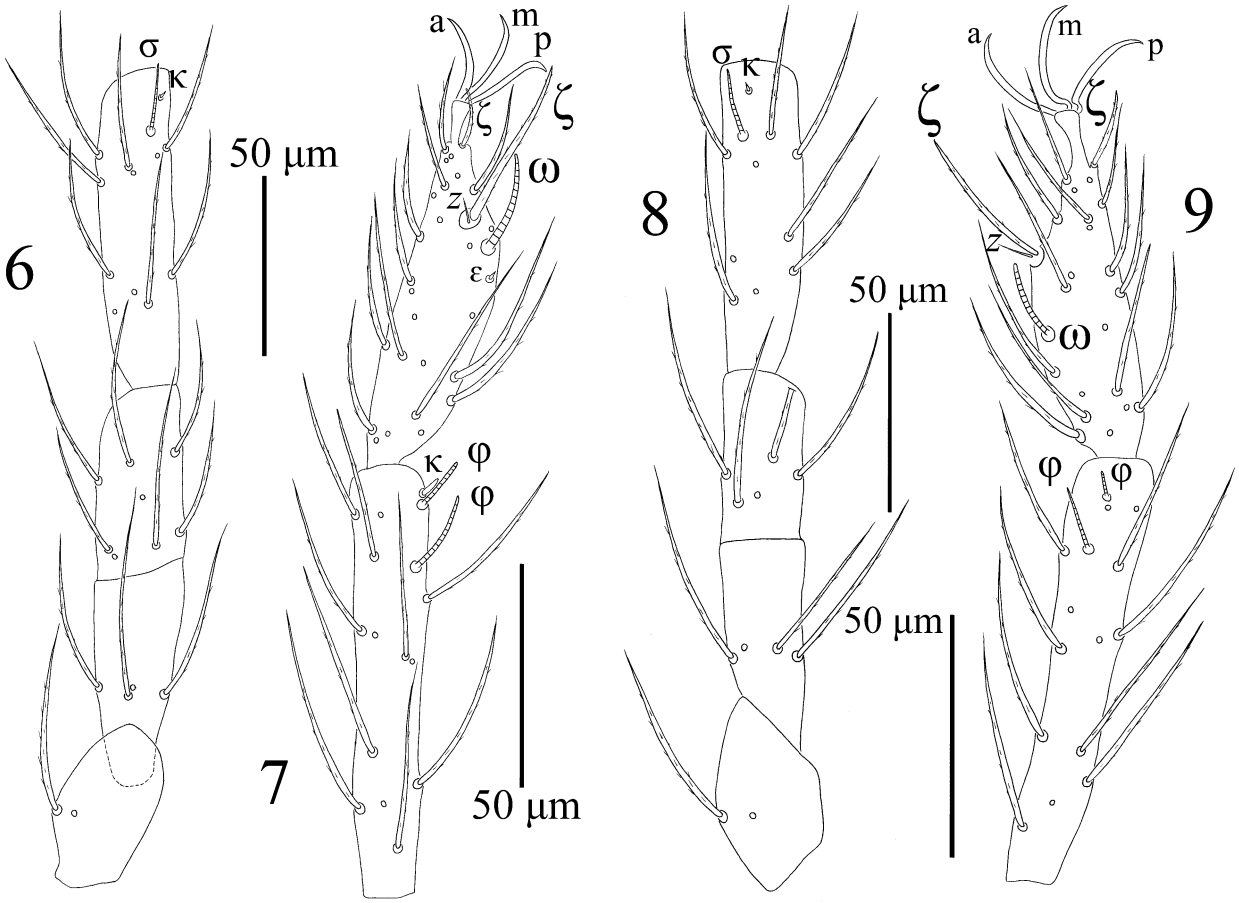


Figure 3–5. *Abrolophus hajiqanbari* **sp. nov.** (larva) – 3.Ventral view of idiosoma (without seta *1b* in the left side, which is an abnormality); 4. Ventral view of palpal tarsus; 5. Dorsal view (left) and ventral view of gnathosoma (right).

Venter (Fig. 3) – Idiosoma ventrally with five pairs of sternal setae (*1a*, *2a*$_1$, *2a*$_2$, *3a*$_1$, *3a*$_2$) (*1a* arising from a punctate area attached to the coxae I) and four barbed setae between coxae I and II; 11–13 setae between coxae II and III (excluding *2a*$_1$, *2a*$_2$, *3a*$_1$ and *3a*$_2$), a punctate area is attached to the coxae II; 18–21 ventral setae behind coxae III, all barbed and pointed. Each leg coxa with one seta. A peg-like supracoxal seta (*elc I*) present on coxa I, 5 long. NDV = 76–80 (Table 1).

Gnathosoma (Figs. 4, 5) – Cheliceral bases punctate on dorsal surface, cheliceral base 87–97 long; cheliceral blade slightly curved, 15–17 long, without teeth. Subcapitulum with a barbed galealae (*cs*), two anterior hypostomalae, (*as*$_1$ and *as*$_2$, nude and barbed, respectively), and a barbed posterior hypostomalae (*bs*); palp femur 45–52 long, with one dorsal and one ventral seta, both barbed and palp genu 20–25 long, with two dorsal and one ventral seta, all barbed. Palp tibia 15–17 long, with three setae [two barbed, and one nude conical seta (i.e. thick accessory claw)]; palpal tibial claw trifurcate (without deeply incision) 17–19; palp tarsus 6–10 with six nude setae, one solenidion and one eupathidium; fPp = 0-BB-BBB-BBN$_3$-6Nωζ. Palpal supracoxal setae (*elc P*) peg-like, 5 long.



Figures 6–9. *Abrolophus hajiqanbari* **sp. nov.** (larva) – 6. Tr–Ge I; 7. Ti–Ta I; 8. Tr–Ge II; 9. Ti–Ta II.

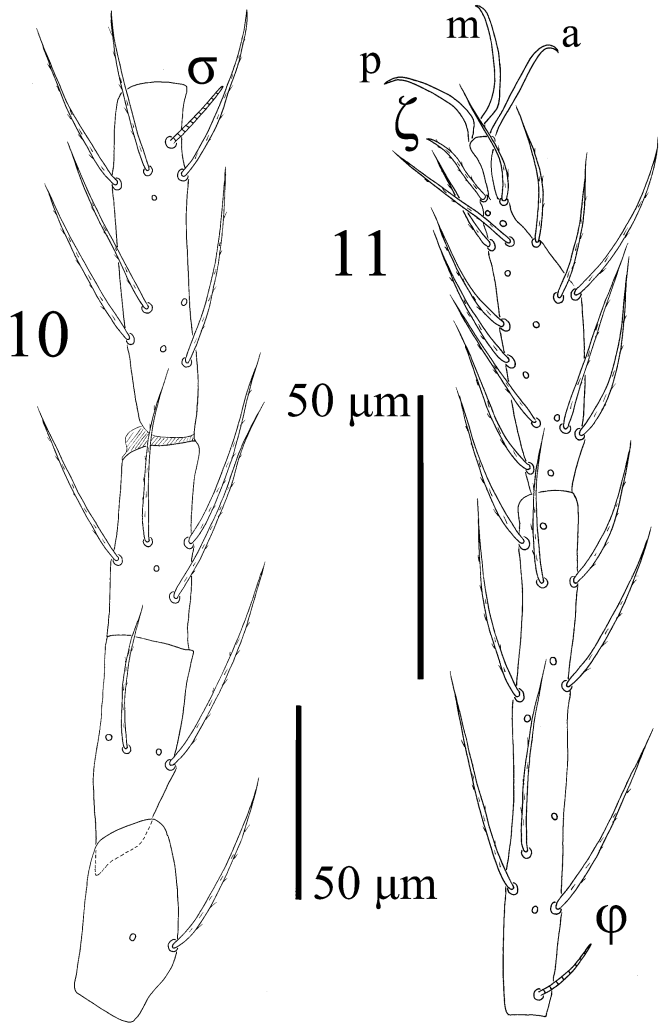
Legs (Figs. 6–11) – Leg segmentation formula 7-7-7. Leg setal formula: Leg I: Ta - 1ω, 1ε, 2ζ, 1*z*, 25n (24n in one paratype, ARS-20210829-3b; 26n in one side of symmetry axis in one specimen, ARS-20210829-3f); Ti - 2φ (1φ in the left side in one specimen, ARS-20210829-3d, also in the right side one solenidion placed in proximal half of tibia), 1κ, 13n; Ge - 1σ, 1κ, 11n; TFe - 8n; BFe - 4n; Tr - 2n; Cx - 1n (without setae in the holotype in the left side, ARS-20210829-3a) (Figs. 2 , 6, 7). Leg II: Ta - 1ω, 2ζ, 1*z*, 20n (21n in one side of symmetry axis in one specimen, ARS-20210829-3d; 19n in one side of symmetry axis in one specimen, ARS-20210829-3h; 18/19n in one specimen, ARS-20210829-3i); Ti - 2φ, 13n; Ge - 1σ, 1κ, 9n (10n in one side of symmetry axis in one specimen, ARS-

20210829-3b); TFe - 5n (6n in one side of symmetry axis in one specimen, ARS-20210829-3c); BFe - 4n; Tr - 2n; Cx - 1n (Figs. 2, 8, 9). Leg III: Ta - 1ζ, 19–20n (21n in one side of symmetry axis in two specimens, ARS-20210829-3c, 3d); Ti - 1φ, 13n (12n in one side of symmetry axis in one specimen, ARS-20210829-3d); Ge - 1σ, 9n; TFe - 5n (6n in one side of symmetry axis in one specimen, ARS-20210829-3b); BFe - 4n; Tr - 2n; Cx - 1n (Figs. 2, 10, 11). Each leg tarsus with lateral falciform claws and a claw-like empodium.

Metric data are given in Table 1.

Etymology

The species is named in memory of the Late Dr. Hamidreza Hajiqanbar (subject editor of Persian Journal of Acarology) for his great contributions to the taxonomy and systematics of Heterostigmatic mites.



Figures 10–11. *Abrolophus hajiqanbari* **sp. nov.** (larva) – 10. Tr–Ge III; 11. Ti–Ta III.

Type material

The holotype (ARS-20210829-3a) and seven paratype larvae (ARS-20210829-3b, c, e, f, g, h, i) were collected from soil and litter, IRAN: South Khorasan province, Birjand city, Chahkand village, 32° 49.55′ N, 59° 09.37′ E, 1716 m a.s.l., 31 May 2019, and one paratype larva (ARS-20210829-3d) same data as holotype, except Chahardeh village, 32° 48.52′ N, 59° 14.16′ E, 1658 m a.s.l., 21 May 2019, coll. Javad Noei.

Table 1. Metric and some meristic data for *Abrolophus hajiqanbari* **sp. nov.** (larva). 3a, holotype; 3b–3i, paratypes.

Character	3a	3b	3c	3d	3e	3f	3g	3h	3i	Range
IL	350	390	350	350	380	410	370	520	660	350–660
IW	225	237	220	232	250	260	230	312	370	220–370
SD	80	77	78	67	70	80	75	70	77	67–80
W	51	47	50	42	43	48	48	45	46	42–51
AW	41	37	37	38	37	40	37	36	37	36–41
PW	45	40	38	42	36	42	40	41	37	36–45
MA	16	15	11	16	12	16	13	15	15	11–16
AA	12	11	12	10	12	10	10	10	12	10–12
SB	15	12	12	12	11	12	12	12	13	11–15
ISD	62	57	61	50	52	62	57	52	60	50–62
AP	40	35	36	31	32	32	32	32	36	31–40
AL	52	52	53	47	41	50	52	55	47	41–55
PL	43	45	41	42	40	43	41	42	42	40–45
ASens	41	38	38	40	35	35	38	35	40	35–41
PSens	65	67	60	55	65	67	63	62	62	55–67
DS min	37	40	32	30	35	32	32	35	33	30–40
DS max	55	57	60	52	57	60	57	57	55	52–60
eye	23	20	22	22	17	22	22	21	21	17–23
1a	45	50	47	42	45	45	47	45	45	42–50
1b	46	50	52	50	45	53	52	50	50	46–53
***2a*$_1$**	41	40	40	40	35	42	40	37	40	35–42
***2a*$_2$**	40	40	40	37	37	41	40	40	40	37–41
2b	41	40	41	42	38	42	38	40	40	38–42
***3a*$_1$**	41	42	40	42	32	42	40	35	40	32–42
***3a*$_2$**	37	33	35	37	30	36	37	33	37	30–37
3b	43	42	45	42	42	45	45	40	42	40–45
GL	127	130	127	130	120	135	134	125	125	120–135
PaScFed	45	45	42	45	45	45	40	40	42	40–45
PaScFev	42	52	50	50	42	45	52	45	45	42–52
PaScGed$_1$	40	40	37	32	32	35	35	32	32	32–40
PaScGed$_2$	32	35	35	35	30	35	32	32	35	30–35
PaScGev	27	32	27	32	30	32	30	30	27	27–32
cs	40	37	37	40	35	35	37	37	35	35–40
***as*$_1$**	5	5	6	6	6	6	6	8	6	5–8
***as*$_2$**	27	30	30	32	27	32	30	30	29	27–32
bs	40	37	37	40	35	38	37	35	38	35–40
Ta I*	77	72	72	70	67	72	75	67	75	67–77
Ti I	97	95	97	96	87	95	96	90	95	87–97
Ge I	87	87	87	85	75	86	87	80	86	75–87
TFe I	50	52	55	50	47	52	55	52	55	47–55
BFe I	65	65	67	65	62	67	66	63	65	62–67
Tr I	42	45	42	41	40	45	45	45	40	40–45
Cx I	52	52	52	50	51	57	55	50	52	50–57
Leg I	470	468	472	457	429	474	479	447	468	429–479
Ta II*	62	65	62	63	59	62	62	56	62	56–65
Ti II	90	90	92	87	82	90	90	85	90	82–92
Ge II	80	80	82	77	72	80	80	75	77	72–82
TFe II	41	43	42	40	40	45	42	39	42	39–45
BFe II	57	57	55	54	54	58	56	55	53	53–58
Tr II	47	50	45	47	41	42	47	46	45	41–50

* Tarsi were measured without the stalk and pretarsus.

Table 1. Continued.

Character	3a	3b	3c	3d	3e	3f	3g	3h	3i	Range
Cx II	60	57	57	60	57	62	60	60	62	57–62
Leg II	437	442	435	428	405	439	437	416	431	405–442
Ta III*	67	67	67	67	62	67	67	65	67	62–67
Ti III	120	120	117	112	107	116	115	112	116	107–120
Ge III	92	92	95	92	85	92	92	90	95	85–95
TFe III	55	55	53	50	45	53	53	45	52	45–55
BFe III	65	60	65	62	57	65	63	57	60	57–65
Tr III	52	45	52	51	47	55	55	52	50	45–55
Cx III	57	55	55	52	60	60	57	56	60	52–60
Leg III	508	494	504	486	463	508	502	477	500	463–508
IP	1415	1404	1411	1371	1297	1421	1418	1340	1399	1297–1421
fD	46	44	46	46	46	47	46	45	46	44–47
fV	21	20	20	19	20	18	20	18	20	18–21
NDV	80	77	79	78	77	78	78	76	79	76–80
Intercoxalae I–II	4	4	4	4	4	4	4	4	4	4
Intercoxalae II–III	13	13	13	13	11	13	12	13	13	11–13

* Tarsi were measured without the stalk and pretarsus.

Type deposition

The holotype larva (ARS-20210829-3a) and four paratype larvae (ARS-20210829-3b–3e) are deposited in the Acarological Collection, Jalal Afshar Zoological Museum, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran, and four paratype larvae (ARS-20210829-3f–3i) are deposited in the Acarological Collection, Acarological Society of Iran, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran,

Remarks

The new species belongs to the species group of *Abrolophus* without a comb-like seta on palptarsus. *Abrolophus hajiqanbari* **sp. nov.** is most similar to *A. norvegicus* and *A. marianopolicus* in this species group based on the identification keys. The new species differs from *A. norvegicus* in its shorter W (42–51 vs. 68–84), AW (36–41 vs. 42–57), PW (36–45 vs. 62–80), DS max (52–60 vs. 66), in the longer AL (41–55 vs. 25–40), DS min (30–40 vs. 28), Leg I (429–479 vs. 333–418), and palpal tibial claw (trifurcate vs. bifurcate) and from *A. marianopolicus* in the shorter W (42–51 vs. 60–69), PW (36–45 vs. 53–65), in the longer ISD (50–62 vs. 44–50), AP (31–40 vs. 20–29), AL (41–55 vs. 21–33), PL (40–45 vs. 29–37), ASens (35–41 vs. 15–23), PSens (55–67 vs. 40–56), GL (120–135 vs. 94–106), *cs* (35–40 vs. 14–19), IP (1297–1421 vs. 1047–1169), Palpal tibial claw (trifurcate vs. bifid), number of normal setae on Ta I (25 vs. 17), Ta II (20 vs. 17), Ta III (19–20 vs. 15).

Key to the larval species of *Abrolophus* without a comb-like seta on the palpal tarsus
(excluding *A. gracilentus*, *A. nivalis*, *A. parvus* and *A. willmanni* because of incomplete description)

1. Palpal femur with projection 2
– Palpal femur without projection 3
2. AL 33–41, PL 30–36, ASens 20–25 ..... *A. kazimierae*
– AL 55–71, PL 45–65, ASens 33–50 ..... *A. balkanicus*
3. fD ~126, W 122, PW 110 ..... *A. yanlingicus*
–fD ≤ 78, W < 84, PW < 80 4

4. Scutum quadrate, TFe I with 6 setae ..... *A. dagmarae*
– Scutum not quadrate, TFe I with more than 6 setae 5
5. Ge I with 8 or 9 setae 6
– Ge I with more than 9 setae 7
6. Ge I with 8 setae ..... *A. sardiniensis*
– Ge I with 9 setae ..... *A. baardi*
7. Ti I with 15 setae ..... *A. viburnicolus*
– Ge I with less than 15 setae 8
8. Accessory claw on plapal tibia bifurcate 9
– Accessory claw on plapal tibia entire 10
9. Scutum subquadrate, Ta I 40–44, fD 36 ..... *A. podorasensis*
– Scutum diamond shape, Ta I 50–56, fD 52–60 ..... *A. stanislavae*
10. Palpal tibial claw not divergent ..... *A. wratislaviensis*
– Palpal tibial claw bifurcate or trifurcate 11
11. Scutum rectangular in outline, palpal tibial claw trifurcate (without deeply incision) ..... *A. hajiqanbari* **sp. nov.**
– Scutum not rectangular in outline, palpal tibial claw bifurcate 12
12. Ge III with 9 setae 13
– Ge III with 10 setae 14
13. PL 44–63, ASens 28–50 ..... *A. norvegicus*
– PL 29–37, ASens 15–23 ..... *A. marianopolicus*
14. GL 98–125, IP 1026–1334 ..... *A. silesiacus*
– GL 74–84, IP 920–979 ..... *A. poljankus*

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گونهٔ جدید لاروی از جنس *Abrolophus* (Trombidiformes: Erythraeidae) از ایران همراه با کلید شناسایی گونه‌های بدون موی شانه‌وش روی پنجهٔ پالپ

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چکیده

لاروهای گونهٔ جدید *Abrolophus hajiqanbari* **sp. nov.** (Trombidiformes: Erythraeidae) از خاک و بقایای گیاهی در ایران، استان خراسان جنوبی، شهر بیرجند و روستاهای چهارده و چهکند جمع‌آوری و توصیف می‌شود. این گونه متعلق به گروهی از جنس *Abrolophus* است که موی شانه‌وش روی پنجه پالپ ندارند. کلید شناسایی از لارو گونه‌های جنس *Abrolophus* در جهان که بدون موی شانه‌وش روی پنجه پالپ هستند، ارایه می‌شود.

واژگان کلیدی: بیرجند؛ چهکند؛ چهارده؛ لارو؛ پیش‌استیگمایان؛ خراسان جنوبی.

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