J. Insect Biodivers. Syst. 11 (in press) *Paper in Press, Proofed, Available online 27 September, 2024* *https://jibs.modares.ac.ir*

OPEN ACCESS

Tarbiat Modares University Press | Research Article | ISSN: 2423-8112
Entomological Society of Iran | Faunistic | https://zoobank.org/urn:lsid:zoobank.org:CAE13F9B-3B35-48CD-88C3-FC2DDFA3E919

Discovery of the genus *Parawenhoekia* Paoli (Acari: Chyzeriidae) in the Western Asian area

Najmeh Kiany
School of Biology and Center of Excellence in Phylogeny of Living Organisms, College of Science, University of Tehran; Iran.
✉ *najmeh.kiany@ut.ac.ir* *https://orcid.org/0000-0002-9258-2292*

Marjan Seiedy
School of Biology and Center of Excellence in Phylogeny of Living Organisms, College of Science, University of Tehran; Iran.
✉ *mseyyedi@ut.ac.ir* *https://orcid.org/0000-0002-7661-9905*

Masoud Hakimitabar
Department of Horticulture and Plant Protection, College of Agriculture, Shahrood University of Technology, Shahrood, Iran.
✉ *hakimitabar@shahroodut.ac.ir* *https://orcid.org/0000-0002-0161-7008*

Martin Husemann
Staatliches Museum für Naturkunde Karlsruhe, Karlsruhe, Germany.
✉ *martin.husemann@smnk.de* *https://orcid.org/0000-0001-5536-6681*

ABSTRACT. We here present the first record of *Parawenhoekia aginapaica* (Haitlinger, 1999) from Iran, which also represents the first record for the genus of the whole continent (Asia). The specimens were collected in association with an Oedipodinae grasshopper of the genus *Aiolopus* (Orthoptera: Acrididae). The genus *Parawenhoekia* Paoli, 1937 has only been known from three Mediterranean countries so far (Italy, Cyprus, and Montenegro) and hence our finding represents a large area extension. This study provides new metric and meristic data and supplements the current knowledge on the species based on new specimens of *P. aginapaica* collected from Khumeh Zar, Mamasani County, Fars Province, Iran. Photographs of important characteristics are provided. A key to the world species of *Parawenhoekia* is given.

Keywords: Grasshopper, Fars province, new record, Parasitengona, Pteridopodinae

Received: *July 22, 2024*
Accepted: *September 06, 2024*
Available online: *September 27, 2024*
Subject Editor: *Omid Joharchi*

Citation: Kiany, N., Seiedy, M., Hakimitabar, M. & Husemann, M. (2025) Discovery of the genus *Parawenhoekia* Paoli (Acari: Chyzeriidae) in the Western Asian area. *Journal of Insect Biodiversity and Systematics*, 11 (in press).

INTRODUCTION

Mites represent an important and diverse, yet largely understudied group of arachnids. Many families of mites remain relatively unknown. This is also true for the family Chyzeriidae which belongs to the superfamily Trombidioidea *sensu* Söller et al., 2001 and epifamily Trombelloidae Thor, 1935 associated with other arthropods (Costa et al., 2024). Within the epifamily Chyzeriidae, the subfamily Pteridopodinae is characterized by two pairs of prodorsal trichobothria and a unique cheliceral blade in the active post-larval and larval forms (Mayoral et al., 2018). *Parawenhoekia* Paoli, 1937 belongs to this subfamily and was described from Italy based only on larva parasitizing the bush cricket, *Decticus loudoni* Ramme, 1933 (Orthoptera: Tettigoniidae). As a parasite of insects, like other members of Chyzeriidae, *Parawenhoekia* is a generalist and is not restricted to a specific host (Saboori et al. 2008).

Based on Mayoral et al. (2018) the taxonomic position of *Parawenhoekia* was considered doubtful due to an incomplete description and missing type species. Hence, it has been moved between five different parasitengone families and was placed in Pteridopodinae (Chyzeriidae) by Mąkol and Wohltmann (2012). Haitlinger (1999) described *Napassenia aginapaica* (Haitlinger, 1999) from Cyprus as an ectoparasite of an unknown grasshopper host. After re-examining the type specimen, the genus was synonymized with *Parawenhoekia* by Mayoral et al. (2018). Saboori et al. (2008) described the third species of this genus, *Parawenhoekia seadi* from Montenegro from the heteropteran *Dolycoris baccarum* (Linnaeus, 1758) (Hemiptera: Pentatomidae) and an unknown grasshopper host (Orthoptera: Acrididae).

Corresponding authors: Marjan Seiedy, ✉ *mseyyedi@ut.ac.ir* and Masoud Hakimitabar, ✉ *hakimitabar@shahroodut.ac.ir*

Data on *Aiolopus* spp. as a host of parasitengona mites is scarce; however, it has been recorded in some papers e.g. three larvae of *Cretessenia leoni* Haitlinger, 1999 (Chyzeriidae) and *Eutrombidium robauxi* Southcott, 1993 (Microtrombidiidae) have been collected from *Aiolopus strepens* (Latreille, 1804) (Haitlinger, 1999; Antonatos & Emmanouel, 2014; Felska et al., 2018), and one larva of *Eutrombidium tehranicum* Karimi Iravanlou, Kamali & Talebi, 2000; two larvae of *Eutrombidium australiense* Southcott, 1993, and *Eutrombidium trigonum* from *Aiolopus thalassinus* (Fabricius, 1781) (Key, 1994; Karimi Iravanlou et al., 2000; Nayeem & Usmani, 2012). *Leptus* (*Leptus*) *aeolopae* Chinniah & Mohanasundaram, 1998 was found on *Aiolopus thalassinus tamulus* (Fabricius, 1798) and two larvae of *Charletonia kaliksti* Haitlinger, 2003 on *Aiolopus* sp. (Haitlinger, 2003, 2013).

This study is part of a two-year faunistic survey (2020–2021) in the southeastern parts of the Zagros Mountains. Members of *Aiolipus* in different locations with their parasite mites were collected, including 47 and six larvae of *Eutrombidium sorbasiensis* Mayoral & Barranco, 2004 on *Aiolopus* sp. and *Aiolopus simulatrix* (Walker, 11870), respectively and four larvae of *Charletonia baluchestanica* Tashakor & Hakimitabar 2015 on *Aiolopus* sp. Here, we report *Parawenhoekia aginapaica* collected as an ectoparasite of *Aiolopus* sp. (Orthoptera: Acrididae) from Khumeh Zar, Mamasani County, Fars Province, Iran on 19 August 2020 by N. Kiany. This is the first record of this genus from Asia. The original description of the species was insufficient in terms of leg chaetotaxy (see Table 2); hence, we here supplement the original description with additional data based on the six specimens collected from Iran to more completely reflect the morphology of the species.

MATERIAL AND METHODS

As part of a larger study on parasitic mites on Orthoptera, grasshopper hosts were collected in southern Iran (Fars Province) using insect nets (Kiany et al., 2022, 2023, 2024). All grasshoppers were searched for mites. Here, we focus on the mites found hidden under the pronotum of an undetermined *Aiolopus* species. Mites were detached with an insect pin and preserved in 75% ethanol, then were cleared in Nesbitt's fluid and mounted on glass slides using Faure medium (Dhooria, 2016; Walter & Krantz, 2009). All microscopic images of the specimens were taken using a Canon® EOS 90D mounted on a Carl Zeiss® Jena compound microscope and stacked with Zerene Stacker (ver. 1.04). Measurements were recorded using an eyepiece graticule attached to a Carl Zeiss Jena microscope. The terminology and abbreviations of body parts follow Southcott (1986) and Wohltmann et al. (2007). All measurements are given in micrometers (µm).

RESULTS

Taxonomic hierarchy

Class Arachnida Lamarck, 1801

Order Trombidiformes Reuter, 1909

Family Chyzeriidae Womersley, 1954

Subfamily Pteridopodinae, Southcott, 1987

Genus *Parawenhoekia* Paoli, 1937

***Parawenhoekia aginapaica* (Haitlinger, 1999)**

Type specimen: *Parawenhoekia aginapaica* Haitlinger 1999:4, Cyprus, Agi Napa, the Museum of Natural History, Wroclaw University (MNHWU).

Material examined. Six larvae (ZUTC15003a–f) on *Aiolopus* sp. 1♂, Khumeh Zar, Mamasani County, Fars Province, Iran (29°58'43.92"N, 51°37'41.15"E, 1186 m a.s.l.), 19-VIII-2020.

Habitat. The main natural vegetation in our sampling location include *Crataegus azarolus* L., *Ziziphus* sp. Mill. (1754), *Prunus* sp., *Carthamus oxyacantha* Bieb., *Phragmites australis* (Cav.) Trin. ex Steud., *Vitex* sp. L., *Echinops* sp. L., *Heliotropium europaeum* L., *Hyoscyamus reticulatus* L. There were also corn and paddy fields near the sampling site (Fig. 1). The vegetation provides sufficient humidity for *Aiolopus* sp. to survive even during intense evaporation through the summer months.

Figure 1. Habitat and collecting site of *Parawenhoekia aginapaica* (Haitlinger, 1999) in Fars Province, Iran with its vegetation cover.

Distribution. Cyprus, Iran (**new country record**)

Specimen deposition. The mite specimens (ZUTC15003a–f) and grasshopper host are deposited in the Zoological Museum, Faculty of Biology, University of Tehran, Iran.

Diagnosis (based on original description and new larval materials)**.**

Larva. Cheliceral blades with (18–21) small teeth (Figs 2A & 3D), scutum trapezoidal with nasus (Figs 2B & 3E), coxalae 1b conical, thick, short, with fine barbs and pointed tip; coxalae 2b thick and short, with fine barbs and bifid blunted tip (Figs. 2C–D, 3A–B); Ge III with 7–11 solenidia, Ge I and II each with one solenidia. Dorsal and ventral idiosomal, AL and PL setae with a blunted tip.

Haitlinger (1999) stated the palptarsus has seven setae of which only one seta being smooth. He also mentioned that this part of the prepared slide was badly visible so, errors can be considered, but our specimens showed a palptarsus with 10 setae including seven barbed, and one short nude seta, one nude eupathidium (ζ) and one short solenidion (ω). After comparison of legs specialized setae of the specimen from Cyprus with our specimens it was evident that no famulus setae (ε) were mentioned on Tarsus I in Cyprus specimen in comparison to our specimen which has one; no eupathidium (ζ) on Ta I– III were mentioned but one *N* seta on each tarsi were referred; solenidia (φ) on tibia I & II (1 vs. 2); solenidia (σ) on Ge I & II (0 vs. 1) and on Ge III (8 vs 7–11). The ranges of metric and meristic data are also given (Table 1 & Table 2).

Re-description (based on the new materials, n = 6).

Scutum. Dorsal scutum trapezoidal with nasus, anterior and posterolateral angles rounded. Anterior and anterolateral margins slightly concave and posterolateral margins slightly convex; Scutum punctated in all parts except in nasus and its base which has fine and scattered punctation (Fig. 2B). Setae AM and SE barbed in distal half. Setae AL and PL barbed and blunt-ended; AL shorter than PL (AL/PL (0.83–0.92)). AM and SE situated between AL and PL; SE longer than AM (SE/AM (2.08–2.81)). Each lateral eye pair on the punctate ocular plate, about 53–60 × 31–36. Eyes circular, anterior 24, posterior 19. Urstigma oval, attached to coxa II, 36–38 × 22–24.

Table 1. Comparison of metric data of *Parawenhoekia aginapacia* (Haitlinger, 1999) (present study, (ZUTC15003a–f); from Cyprus (g); and *Parawenhoekia seadi* Saboori, Pesic & Hakimitabar, 2008 (h).

Characters	a	b	c	d	e	f	range	g	h
LN	48	58	62	65	60	62	48–65	–	57–69
MA	46	43	46	41	46	48	41–48	–	42–47
AW	96	101	98	94	98	96	96–101	96	97–106
PW	139	156	144	146	144	151	139–156	156	149–173
MS	29	34	29	31	29	34	29–34	30	~30–45
L	137	144	146	146	144	149	137–149	140	~143–173
W	166	180	173	166	187	173	166–187	174	186–220
AP	65	67	72	70	65	72	65–72	74	67–89
AM	38	46	38	41	34	36	36–46	~40	42–52
SE	101	96	96	98	84	101	84–101	88	119–136
AL	50	58	58	53	60	50	50–60	52	33–42
PL	60	–	67	60	65	60	60–67	66	30–39
AMB	12	17	17	17	17	12	12–17	20	15–20
SB	24	29	24	24	26	26	24–29	30	30–37
DS	30–60	34–58	30–62	38–62	29–62	34–58	29–62	36–52	37–101
or$_1$	41	36	36	36	36	34	34–41	40	20–27
bs	29	26	29	29	31	24	24–31	30	52–67
PaFed	72	65	70	65	65	72	65–72	64	~47–67
PaGed	46	43	48	50	48	48	43–50	44	54–64
GL	190	180	–	192	192	187	180–192	140	198–217
1a	19	22	19	22	17	19	17–22	20	47–59
1b	17	17	17	17	19	17	17–19	24	15–22
2b	17	17	17	17	17	17	17	18	15–20
3a	22	–	24	22	22	24	22–24	24	24–33
3b	24	26	24	26	24	26	24–26	–	25–42
Ta I	194	204	192	202	192	209	192–209	166	223–243
Ti I	89	84	91	90	82	89	84–91	82	82–97
Ge I	82	81	84	91	84	86	82–91	82	89–104
TFe I	79	77	84	79	72	86	72–86	68	82–94
BFe I	67	56	67	62	55	62	62–67	56	37–74
Tr I	60	50	62	48	53	50	48–62	52	57–74
Cx I	96	101	108	91	115	110	91–115	110	106–136
Leg I	667	653	688	663	653	692	653–692	616	719–761
Ta II (L)	180	173	170	168	173	180	168–180	154	205–228
Ti II	74	77	72	72	74	70	72–74	64	82–94
Ge II	70	70	62	70	77	67	62–77	64	79–92
TFe II	65	60	53	60	53	65	53–65	50	55–82
BFe II	41	44	41	41	55	50	41–55	38	49–62
Tr II	62	60	67	72	65	62	62–72	52	62–74
Cx II	132	137	132	118	132	137	118–137	134	136–173
Leg II	624	621	597	601	629	631	597–631	556	696–778
Ta III	288	288	274	262	273	276	273–288	252	299–319
Ti III	108	108	91	106	91	103	91–108	94	106–124
Ge III	96	106	96	98	96	98	96–106	92	101–121
TFe III	60	60	62	62	60	67	60–67	70	92–106
BFe III	86	86	60	60	67	72	60–86	54	42–79
Tr III	72	67	67	68	72	70	67–72	56	72–81
Cx III	96	108	96	98	101	99	96–108	80	89–119
Leg III	816	823	746	754	760	785	746–823	698	846–913
IP	2107	2096	2031	2018	2042	2108	2018–2108	1870	2331–2419

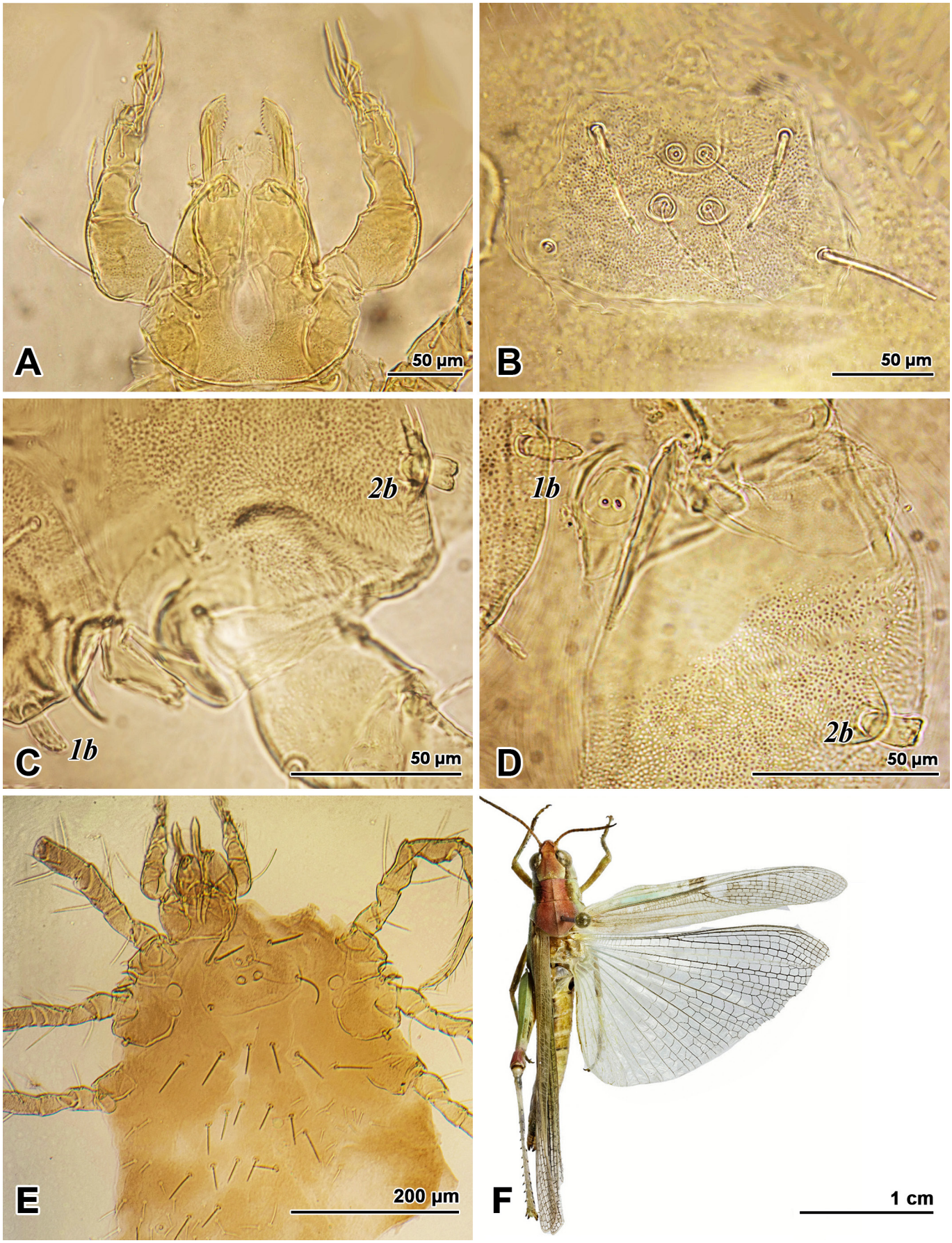

Figure 2. *Parawenhoekia aginapaica* (Haitlinger, 1999) (larva, Zagros Mountains). **A.** Gnathosoma (ZUTC15003a); **B.** Scutum (ZUTC15003e); **C.** Coxalae *1b* and coxalae *2b* (ZUTC15003d); **D.** Coxalae *1b* and coxalae *2b* (ZUTC15003f); **E.** Dorsal view (ZUTC15003d); **F.** *Aiolopus* sp. (female), dorsal view.

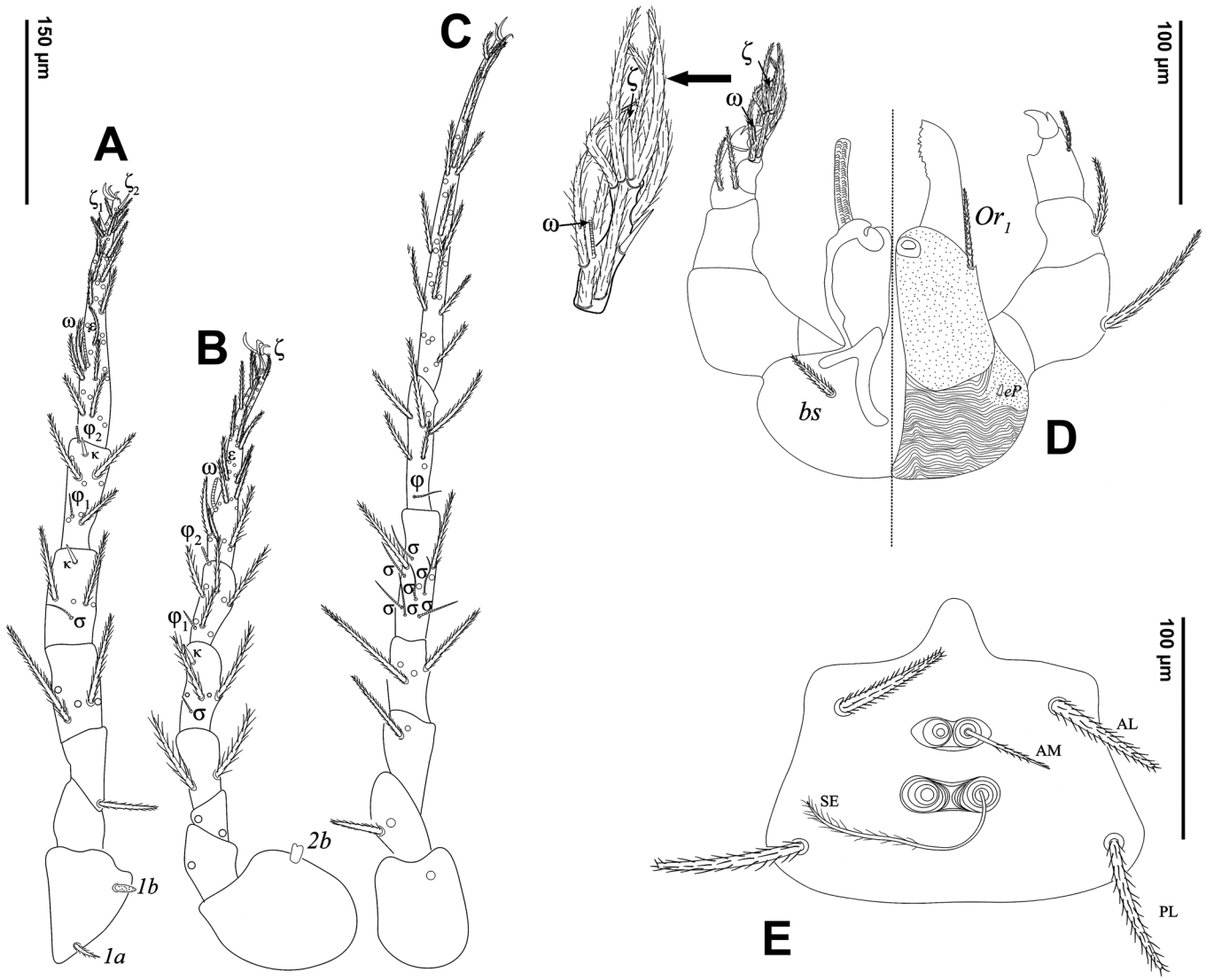

Figure 3. *Parawenhoekia aginapaica* (Haitlinger, 1999) (larva, Zagros Mountains, ZUTC15003a). **A.** Coxa–Tarsus I; **B.** Coxa– Tarsus II; **C.** Coxa– Tarsus III. **D.** Gnathosoma, left, dorsal view; right, ventral view; **E.** Scutum.

Dorsum (Fig. 2E). Dorsal idiosomal setae arrangement is not distinct due to idiosomal damage in all specimens but seems to be 6, 6, 6, 6, 6 and the ventral and dorsal view could not be separated clearly. Each seta barbed, blunt-ended, and arises from a small circular pointed plate.

Ventral. Ventral idiosomal setae are similar to dorsal ones but slightly smaller and thinner. Two sternalae (*3a*) between coxae III. Anus oval shaped, a pair of sclerites anal valves present with two setae [there is one seta each on the right and left valve but in one specimen there is only one seta on the left valve (abnormally)].

Coxala *1a* tapering; pointed and barbed, coxalae *1b* conical, thick, short, with fine barbs and pointed tip; coxalae *2b* thick and short, with fine barbs and bifid blunted tip (Figs 2C–D, 3A–3B). Coxala *3b* tapering, barbed and pointed. Each leg tarsus with two small lateral claws and a middle falciform empodium.

Legs (Fig. 3A–C). Leg segmentation formula: 7-7-7. Leg setal formula (Based on new materials): Leg I: Ta–1ω, 1ε, 2ζ, 37–41n; Ti– 2φ, 1κ, 8n; Ge– 1σ, 1κ, 4n; TFe– 5n; BFe– 1n; Tr– 1n; Cx– 2n (Fig 3A). Leg II: Ta–1ω, 1ε, 1ζ, 35–36n; Ti– 2φ, 8n; Ge– 1σ, 1κ, 4n; TFe– 4n; BFe– 2–3n; Tr– 1n; Cx– 1n (Fig 3B). Leg III: Ta– 34–37n; Ti– 1φ, 7n; Ge– 7–11σ, 4n; TFe– 4n; BFe– 2n; Tr– 1n; Cx–1n (Fig 3C). (see Table 2 for species collected from Cyprus).

Table 2. Chaetotaxy of *Parawenhoekia aginapacia* (Haitlinger, 1999) (present study, (ZUTC15003a–f); from Cyprus (g) and *Parawenhoekia seadi* Saboori, Pesic & Hakimitabar, 2008 (h)

Characters	a	b	c	d	e	f	g	h
Ta I	1ω, 1ε, 2ζ, 37n	1ω, 1ε, 2ζ, 37n	1ω, 1ε, 2ζ, 41n	1ω, 1ε,2ζ , 38n	1ω, 1ε, 2ζ, 38n	1ω, 1ε, 2ζ, 38n	1ω, 44n	1ω, 1ε, 2ζ, ~37n
Ti I	2φ, 1κ, 8n	2φ, 1κ, 8n	2φ, 1κ, 8n	2φ, 1κ, 8n	2φ, 1κ, 8n	2φ, 1κ, 8n	1φ, 1κ, 8n	2φ, 1κ, 8n
Ge I	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1κ, 4n	1σ, 1κ, 4n
Tfe I	5n	5n	5n	5n	5n	5n	5n	5n
Bfe I	1n	1n	1n	1n	1n	1n	1n	1n
Tr I	1n	1n	1n	1n	1n	1n	1n	1n
Cx I	2n	2n	2n	2n	2n	2n	2n	2n
Ta II	1ω, 1ε, 1ζ, 36n	1ω, 1ε, 1ζ, 35n	1ω, 1ε, 1ζ, 36n	1ω, 1ε, 1ζ, 36n	1ω, 1ε, 1ζ, 36n	1ω, 1ε, 1ζ, 36n	1ω, ~42n	1 ω, 1ε, 1ζ, ~29n
Ti II	2φ, 8n	2φ, 8n	2φ, 8n	2φ, 8n	2φ, 8n	2φ, 8n	1φ, 8n	2φ, 8n
Ge II	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1σ, 1κ, 4n	1κ, 4n	1σ, 1κ, 4n
Tfe II	4n	4n	4n	4n	4n	4n	4n	4n
Bfe II	2n	2–3n	2n	2n	2n	2n	2n	2n
Tr II	1n	1n	1n	1n	1n	1n	1n	1n
Cx II	1n	1n	1n	1n	1n	1n	1n	1n
Ta III	37n	35n	37n	34n	34n	35n	~29n	32n
Ti III	1φ, 7n	1φ, 7n	1φ, 7n	1φ, 7n	1φ, 7n	1φ, 7n	1φ, 7n	1φ, 7n
Ge III	7σ, 4n	7σ, 4n	10–11σ, 4n	10–11σ, 4n	11σ, 4n	11σ, 4n	8σ, 4n	1σ, 4n
Tfe III	4n	4n	4n	4n	4n	4n	4n	4n
Bfe III	2n	2n	2n	2n	2n	2n	2n	2n
Tr III	1n	1n	1n	1n	1n	1n	1n	1n
Cx III	1n	1n	1n	1n	1n	1n	1n	1n

Gnathosoma (Figs 2A & 3D). Cheliceral blades straight with serrated teeth on the ventral side except in the basal half. Oral setae (or_1) and *bs* (subcapitular) setae pointed, and barbed. Supracoxal seta (*eP*) cone-like and 5 long. Palpal setal formula: 0-B-B-BBB$_2$-7BN$\omega\zeta$. Palpfemur and palpgenu each with one barbed seta. Tibia with three barbed setae. Palptarsus with one solenidion, one eupathidium, seven barbed setae, and one nude seta (Fig. 3D). Palpal tibial claw with two pointed tines, of them one is shorter.

Key to species of *Parawenhoekia* of the world (larva)

There are no measurements and detailed leg chaetotaxy data for *P. dectici*. The holotype of *P. dectici* was not available and we could not check it. Saboori et al. (2020) and Hakimitabar and Saboori (2022) stated metric data and the number of normal and sometimes specialized setae on TFe-Ta are too variable to be used as criteria for taxonomic decisions. The new identification key is prepared to include *P. aginapaica*

1 Setae AL and PL stout and subequal. ..... ***P. seadi* Saboori, Pesic & Hakimitabar, 2008**
— Setae AL and PL setiform and PL longer than AL. **2**

2 Setae SE semi-equal with AM. ..... ***P. dectici* Paoli, 1937**
— Setae SE more than twice as long as AM. .....***P. aginapaica* (Haitlinger, 1999)**

DISCUSSION

Until now, only three species of *Parawenhoekia* have been described: *P. dectici* Paoli, 1937 from Italy on *Decticus loudoni* Ramme, 1933 (Orthoptera: Tettigoniidae); *P. aginapaica* (Haitlinger, 1999) from Cyprus on an unidentified Orthoptera and *P. seadi* Saboori, Pesic & Hakimitabar, 2008 from Montenegro on an unidentified grasshopper (Orthoptera: Acrididae) and *Dolycoris barbarum* (Linnaeus, 1758) (Heteroptera: Pentatomidae). It seems that the members of the genus are relatively rare, but certainly remain understudied in most regions. The original description of *Parawenhoekia aginapacia* was incomplete and

their drawings were unclear; especially those of the shape of the gnathosoma, the number of setae on palptarsus and leg segments; also type specimen is not in good condition (Mayoral et al., 2018). Our collected specimens are considerably similar to the type, but there are some differences, which could be due to insufficient data caused by describing the species based on one single specimen. The coxalae *2b* is bifurcate in all specimens not truncate; however, the viewing angle after slide fixation may have an effect on the final decision (comparing Fig. 2C with Fig. 2D); and our specimens show bifurcate and truncate even on different sides of one specimen. Dorsal and ventral setae are with a blunt tip, there are 7–11 solenidia on genu III with some abnormality. This could be a geographical variation but we could consider the habitat stresses as an influencing factor because there are abnormalities in the number of solenidia in Ge III on different sides of some specimens (Table 2) and also a specimen (ZUTC15003d) had three AL setae which are abnormal. The biometry of leg segments is similar to the original description, except for Ta I (192–209 vs. 166).

This is the first observation of the genus *Parawenhoekia* outside of the Mediterranean region. However, the host genus *Aiolopus* has a wide distribution and also occurs in many Mediterranean countries. Hence, the grasshopper host may play an important role in the spread of *P. aginapaica* outside of the Mediterranean region. Further, the Zagros Mountains have a continental climate somehow similar to the Mediterranean precipitation regime: warm and dry summers and cold and wet winters (Noroozi, 2020). This represents optimal habitat conditions for *Aiolopus*, whose preferred biotopes include marshlands, edges near streams, lakes, banks of rivers, coastal habitats, ponds, and salt marshes and they feed mainly on grasses around these regions (Beĭ-Bienko & Mischchenko, 1963; Hodjat & Tork, 2014). Saboori et al. (2008) already claimed that *Parawenhoekia* mites also generally like high relative humidity and live in semi-aquatic habitats. Our observation corresponds to these suggestions as the grasshopper host was found near a paddy field beside a riverbank (Fig. 1). This habitat, hence, may also be considered preferable for *P. aginapaica*.

Unfortunately, the location where the species was found is under severe damage caused by drought and water withdrawal. During the following year's sampling, the river was desiccated completely and the host species could not be collected anymore. Future monitoring would be important to clarify the conservation status of the species, which may be a victim of habitat destruction and climate change. Carlson et al. (2017) predicted that habitat loss due to climatic changes could be responsible for 5–10% of parasite species extinction by 2070 and these species might experience redistribution, range contract and extinction. Punčochář (2022) also mentioned the abundance of water mites found in 14 small watercourses in the Czech Republic in 2018 decreased to about half (47%) in comparison to 1964. Generally, more studies and surveys are needed to better understand the ecology, systematics, and distribution of this and other mites, as they represent an essential and diverse taxon, which deserves more attention.

AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: N. Kiany, M. Seiedy and M. Hakimitabar: designed the study; M. Seiedy provided resources, supplies, and lab space and oversaw the research; N. Kiany collected and identified the specimens and also designed them, then prepared a manuscript; M. Seiedy, M. Hakimitabar and M. Husemann re-examined the specimens and revised the manuscript; all authors agreed on the content of the final draft for submission. All authors contributed substantially in all aspects of the research. The authors read and approved the final version of the manuscript.

FUNDING

This work was supported by the University of Tehran.

AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the Zoological Museum, Faculty of Biology, University of Tehran, Iran, and are available from the curator, upon request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

ACKNOWLEDGMENTS

We are thankful to Dr. Mohsen Kiany for his cooperation during the fieldwork. We also thank Dr. Ahmad Reza Khosravi, Shiraz University for his help in identifying vegetation cover. The research was supported by the University of Tehran, which is greatly appreciated.

REFERENCES

Antonatos, S.A. & Emmanouel, N.G. (2014) A qualitative study of Eutrombidiidae and Erythraeidae, ectoparasites on Orthoptera, in two grassland areas of Attica–Greece. *International Journal of Acarology*, 40 (1), 23–30. https://doi.org/10.1080/01647954.2013.872186

Beĭ-Bienko, G.I.A. & Mischchenko, L.L. (1963) *Locusts and Grasshoppers of the U.S.S.R. and Adjacent Countries: (Saranchevye Fauny SSSR i Sopredel'nykh Stran)*. Parts 1 & 2. USSR Academy of Sciences Publ., Moscow-Leningrad. pp. 1–378 + 379–667. [in Russian] https://doi.org/10.5962/bhl.title.129470

Carlson, C.J., Burgio, K.R., Dougherty, E.R., Phillips, A.J., Bueno, V.M., Clements, C.F., Castaldo, G., Dallas, T.A., Cizauskas, C.A. & Cumming, G.S. (2017) Parasite biodiversity faces extinction and redistribution in a changing climate. *Science Advances*, 3 (9), 1–12. https://doi.org/10.1126/sciadv.1602422

Costa, S.G., Tolstikov, A., Saboori, A., Batista-Ribeiro, D., Noei, J., Harvey, M.S., Shaw, M.D., Klimov, P.B., Zhang, Z.-Q. & Pepato, A.R. (2024) A comprehensive molecular phylogeny of the terrestrial Parasitengona (Acariformes, Prostigmata) provides insights into the evolution of their metamorphosis, invasion into aquatic habitats and classification. *Molecular Phylogenetics and Evolution*, 199, 108147, 1–11. https://doi.org/10.1016/j.ympev.2024.108147

Dhooria, M.S. (2016) *Fundamentals of Applied Acarology*, Springer, Singapore, 470 p. https:/doi.org/10.1007/978-981-10-1594-6

Felska, M., Wohltmann, A. & Mąkol, J. (2018) A synopsis of host-parasite associations between Trombidioidea (Trombidiformes: Prostigmata, Parasitengona) and arthropod hosts. *Systematic and Applied Acarology*, 23 (7), 1375–1479. https://doi.org/10.11158/saa.23.7.14

Haitlinger, R. (1999) Three new species of larval Chyzeriidae associated with Orthoptera (Insecta) from Cyprus, Crete and Peru, with description of the new subfamily Perumaroptinae and three new genera *Napassenia*, *Cretessenia* and *Perumaropta* (Acari: Prostigmata). *Bollettino della Società Entomologica Italiana*, 131 (1), 3–13.

Haitlinger, R. (2003) Three new species of larval *Charletonia* Oudemans, 1910 (Acari: Prostigmata: Erythraeidae) and the first record of *Charletonia krendowskyi* (Feider, 1954) from Rhodes, Greece. *Systematic Parasitology*, 56 (1), 49–55. https:/doi.org/10.1023/A:1025595606154

Haitlinger, R. (2013) First record of *Leptus* (*Leptus*) *holgeri* (Acari: Prostigmata: Erythraeidae) from Vietnam, with redescription of the species. *Persian Journal of Acarology*, 2 (3), 341–351.

Hakimitabar, M. & Saboori, A. (2022) A review of *Charletonia* Oudemans (Trombidiformes: Erythraeidae) based on the larval stage. *Systematic and Applied Acarology* 27, 1035–1056. https:/doi.org/10.11158/saa.27.6.5

Hodjat S. H. & Tork M. (2014) A preliminary guide for Oedipodinae Walker, 1870 identification (Orthoptera, Acridoidea) In Iran. *Journal of Entomological Research*, 7 (3), 249–259.

Karimi Iravanlou, J., Kamali, K. & Talebi, A. (2000) Four new larvae of the genus *Eutrombidium* Verdun, 1909 (Acari, Prostigmata, Eutrombidiidae) Parasitic on short–horned grasshoppers (Orthoptera, Acrididae) from Varamin and Karaj, Iran. *Agricultural Science*, 10 (2), 63–77.

Key, K. (1994) Host relations and distribution of the Australian species of *Eutrombidium* (Acarina, Microtrombidiidae), a parasite of grasshoppers. *Australian Journal of Zoology*, 42 (3), 363–370. https://doi.org/10.1071/ZO9940363

Kiany, N., Seiedy, M., Hakimitabar, M. & Husemann, M. (2022) A contribution to the knowledge of *Charletonia nazeleae* (Acari: Erythraeidae). *Persian Journal of Acarology*, 11 (4), 651–661.

Kiany, N., Seiedy, M., Hakimitabar, M. & Husemann, M. (2023) A new species of *Eutrombidium* (Acari: Trombidiformes: Microtrombidiidae) found in a hotspot region of Iran, the Zagros Mountains. *Acarologia*, 63 (4), 1260–1270. https://doi.org/10.24349/20r3-f5dx

Kiany, N., Seiedy, M., Hakimitabar, M., Kiany, M. & Husemann, M. (2024) Two new species of *Leptus* (Trombidiformes: Erythraeidae) parasitizing acridid grasshoppers (Orthoptera: Caelifera: Acrididae) from the Zagros Mountains, Iran. *International Journal of Acarology*, 50 (3), 1–13. https://doi.org/10.1080/01647954.2024.2316938

Mąkol, J. & Wohltmann, A. (2012) An annotated checklist of terrestrial Parasitengona (Actinotrichida: Prostigmata) of the world, excluding Trombiculidae and Walchiidae. *Annales Zoologici*, 62, 359–562. https://doi.org/10.3161/000345412X656671

Mayoral, J., Welbourn, W. & Barranco, P. (2018) A revision of the Pteridopodinae (Acari: Parasitengonina: Chyzeriidae) with the description of a new genus from South Spain and key to the Pteridopodinae. *Systematic and Applied Acarology*, 23 (6), 1125–1137. https://doi.org/10.11158/saa.23.6.8

Nayeem, R. & Usmani, K. (2012) Taxonomy and field observations of grasshopper and locust fauna (Orthoptera: Acridoidea) of Jharkhand, India. *Munis Entomology & Zoology*, 7 (1), 391–417.

Noroozi, J. (2020) *Plant Biogeography and Vegetation of High Mountains of Central and South–West Asia.* Springer, Switzerland. 360 p. https://doi.org/10.1007/978-3-030-45212-4

Paoli, G. (1937) Studi sulle cavallette di Foggia (*Dociostaurus maroccanus* Thnb.) e sui loro oofagi (Ditteri Bombiliidi e Coleotteri Meloidi) ed Acari ectofagi (Eritreidi e Trombidiidi). *Redia*, 23, 27–206.

Punčochář, P. (2022) [2021] Changes in the fauna of water mites (Acari: Parasitengona: Hydrachnidia) in small streams of the Bohemian-Moravian Highlands between the years 1964 and 2018. *Acta Societatis Zoologicae Bohemicae*, 85, 34–4

Saboori, A., Pešić V. & Hakimitabar M. (2008) A new species of the genus *Parawenhoekia* (Acari: Chyzeriidae) from Montenegro. *Zootaxa*, 1756 (1), 62–68. https:/doi.org/10.11646/zootaxa.1756.1.3

Saboori, A., Hakimitabar, M., Khademi, N., Masoumi, H. & Katouzian, A.-R. (2020) *Leptus* Latreille (Trombidiformes: Erythraeidae) of the world: revised classification and keys. *Persian Journal of Acarology*, 9, 1–57.

Southcott, R.V. (1986) Australian larvae of the genus *Trombella* (Acarina, Trombidioidea). *Australian Journal of Zoology,* 34, 611–646. https://doi.org/10.1071/ZO9860611

Walter, D.E. & Krantz G.W. (2009) Collecting, rearing, and preparing specimens. In Krantz, G.W. & Walter, D.E. (ed.) *A Manual of Acarology*. 3rd Edition. Texas Tech University Press, Texas, pp 83–96.

Wohltmann, A., Gabryś, G. & Mąkol, J. (2007) Acari: Terrestrial Parasitengona inhabiting transient biotopes. Gerecke, R. (eds) *Süßwasserfauna von Mitteleuropa, Vol. 7/2-1 Chelicerata: Araneae/Acari I.* Springer Spektrum, Berlin, Heidelberg, pp. 158–240. https://doi.org/10.1007/978-3-662-55958-1_6

کشف جنس *Parawenhoekia* Paoli (Acari: Chyzeriidae) در منطقه آسیای غربی

نجمه کیانی[1]، مرجان سیدی[1*] ، مسعود حکیمی‌تبار[2*] و مارتین هوسمن[3]

۱ دانشکده زیست شناسی و مرکز قطب تبارزایی موجودات زنده، دانشکدگان علوم، دانشگاه تهران، تهران، ایران
۲ گروه باغبانی و گیاهپزشکی ، دانشکده کشاورزی، دانشگاه صنعتی شاهرود، شاهرود، ایران
۳ موزه ایالتی تاریخ طبیعی کارلسروهه، کارلسروهه، آلمان

* پست الکترونیک نویسندگان مسئول مکـاتبه: *mseyyedi@ut.ac.ir* و *hakimitabar@shahroodut.ac.ir*

| **تاریخ دریـافت:** ۰۱ مرداد ۱۴۰۳ | **تاریخ پذیرش:** ۱۶ شهریور ۱۴۰۳ | **تاریخ انتشار:** در حال چاپ |

چکیـده: در این مقاله به اولین گزارش *Parawenhoekia aginapaica* (Haitlinger, 1999) از ایران و همچنین اولین گزارش این جنس از قاره آسیا پرداخته می‌شود. نمونه‌های کنه از بدن ملخ زیرخانواده Oedipodinae جنس *Aiolopus* (Orthoptera: Acrididae) جمع‌آوری شد. جنس *Parawenhoekia* Paoli, 1937 تا به حال تنها از سه کشور ناحیه مدیترانه (ایتالیا، قبرس و مونته‌نگرو) گزارش شده؛ بنابراین یافته‌های ما دامنه‌ی پراکنش این گونه را افزایش می‌دهد. این مطالعه، داده‌های متریک و مریستیک جدیدی فراهم نموده و دانش کنونی ما در مورد گونه *P. aginapaica* را با بهره‌گیری از نمونه‌های جدید جمع‌آوری شده از استان فارس، شهرستان ممسنی، خومه‌زار افزایش می‌دهد. در مطالعه‌ی حاضر عکس‌ها و طراحی‌هایی به منظور نشان دادن ویژگی‌های مهم انجام شده، همچنین یک کلید به منظور شناسایی گونه‌های جنس *Parawenhoekia* در جهان فراهم گردیده است.

واژگـان کلیدی: ملخ، استان فارس، گزارش جدید، Parasitengona، Pteridopodinae