

A new species of *Cheletonella* Womersley (Prostigmata: Cheyletidae) from Iran and a key to the species

Safoura Salarzahi^a, Jalil Hajizadeh^a, Edward A. Ueckermann^b

^a Department of Plant Protection, College of Agricultural Sciences, University of Guilan, Rasht, Iran.

^b School of Environmental Sciences and Development, North-West University, Potchefstroom Campus 2520, South Africa.

Original research

ABSTRACT

A new species, *Cheletonella iraniensis* n. sp. (Acariformes: Prostigmata: Cheyletidae) is described based on adult females from Rasht, Guilan Province, Northern Iran. Additionally, a key to the world species (females) of the genus *Cheletonella* Womersley is provided.

Keywords *Cheletonella*; Cheyletidae; Iran; Guilan; key; new species; taxonomy

Zoobank <http://zoobank.org/39C94FD9-1D1D-42E2-912A-02505D1A864A>

Introduction

The family Cheyletidae presently includes over 440 species in 75 genera (Zhang *et al.*, 2011; Bochkov and Abramov 2016). Cheyletid mites have a cosmopolitan distribution and they occur on all the continents (Gerson *et al.*, 1999; Bochkov and Fain, 2001). About 78% of cheyletid species are predators, the remaining species are permanent parasites of mammals and birds. Sometimes they cause allergies and papular dermatitis in humans having close contact with infested pets (Keh *et al.*, 1987; Gerson *et al.*, 1999; Bochkov and Fain, 2001; Dogan *et al.*, 2011). The predatory species occupy a wide variety of habitats including plants, soil-litter, tree bark, stored products and colonies and galleries of insects or ephemeral substrates requiring dispersal by phoresy on insects or vertebrates. Cheyletid mites have also been collected from arthropod and bird nests, caves, and bat roosts in association with beetles, bugs, bees, flies, scorpions, millipedes, lizards (Summers and Price, 1970; Laing, 1973; Hughes, 1976; Fain and Bochkov, 2001; Bochkov and Oconnor 2004; Gerson *et al.*, 2003; Krantz and Walter, 2009; Fuangarworn and Lekprayoon, 2010; Skoracki *et al.*, 2012). Cheyletid mites are mainly free-living predators that feed on various micro-arthropods, particularly on herbivorous, fungivorous, and saprophagous acaroid mites (Zdarkova, 1979). A few species however can be beneficial as biological control agents controlling acaroid mites (Acari: Acaridae), which are serious pests damaging agricultural stored food (Gerson and Smiley, 1990; Bochkov and Fain, 2001; Fain and Bochkov, 2001).

The genus *Cheletonella* was established by Womersley in 1941 with *Cheletonella vespertilionis* as the type species. Four species were previously described in this genus, namely, *Cheletonella vespertilionis* Womersley, 1941 from a bat in Australia, *C. caucasica* Volgin, 1955 from a gray hamster and sparrow's nest in Russia, *C. pilosa* Tseng, 1977 from wheat in Taiwan of China and *C. hoffmannae* Smiley, 1996 from the brown bat's guano in the USA (Xia *et al.*, 1999). Xia *et al.* (1999) described a fifth species *C. juglandis*, collected from the nut, *Juglans regia*, in China. Fain and Bochkov (2001) considered *C. juglandis* as a species inquirenda (requiring further investigation), because presented figure in the paper (Xia *et al.* 1999, page 150, figure 3) represents the anal region of deutonymph (last nymphal stage). *Cheletonella caucasica* described by Volgin (1955) in Russia was also considered a junior synonym of *C.*

Received 10 January 2019

Accepted 16 April 2019

Published 09 May 2019

Corresponding author

Jalil Hajizadeh:

hajizadeh@guilan.ac.ir

Academic editor

Faraji, Farid

DOI

10.24349/acarologia/20194323

© Copyright

Salarzahi S. *et al.*

Distributed under

Creative Commons CC-BY 4.0

OPEN  ACCESS

How to cite this article Salarzahi S. *et al.* (2019), A new species of *Cheletonella* Womersley (Prostigmata: Cheyletidae) from Iran and a key to the species. *Acarologia* 59(2): 188-195; DOI 10.24349/acarologia/20194323

vespertilionis by Fain and Bochkov (2001). Thus only three valid species of *Cheletonella* were recognized by Fain and Bochkov (2001) who provided a key based on female specimens. During taxonomic studies of cheyletid mites from Guilan Province, Northern Iran, a fourth new species of *Cheletonella* was discovered. Herein, we describe *C. iraniensis* n. sp., and provide an identification key to the known *Cheletonella* species of the world.

Materials and methods

This study was conducted in Rasht county, Guilan Province, Northern Iran, during the period 2016–2017. The mites were extracted from stored materials like rice flakes, barn and barley, by placing them in a Berlese/Tullgren funnel or directly collecting them under a stereomicroscope. Mites were cleared in Nesbitt's solution and mounted in Hoyer's medium on microscope slides. The mites were examined under 1000× magnification of an Olympus BX51 phase contrast and a differential interference contrast microscope (Olympus Optical Co; LTD; Japan). All drawings were prepared with the help of a 1.25X Olympus camera lucida (Olympus Optical Co; LTD; Japan). Body length measurements represent the distance between the anterior tip of the gnathosoma and the posterior margin of idiosoma; width was measured at the broadest point of the idiosoma. Leg measurements are from trochanter to pretarsus. In the description below, the idiosomal setation follows Grandjean (1939) as adapted for Prostigmata by Kethley (1990) and adapted for Cheyletidae by Skvarla *et al* (2014). The nomenclature for leg setae follows that of Grandjean (1944). All measurements are given in micrometers (μm). Type material were preserved as slide-mounted specimens and will be deposited in Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan, Iran. One female paratype will be deposited in the National Collection of Arachnida, Plant Protection Research Institute, Pretoria, South Africa.

Results

Subfamily: Cheyletinae Leach, 1815

Tribe: Cheyletini Leach, 1815

Genus: *Cheletonella* Womersley 1941

Type species: *Cheletonella vespertilionis* Womersley, 1941

Cheletonella iraniensis n. sp. (Figs 1-3)

Zoobank: 92164C11-8243-4A38-950E-52201E56BAAC

Diagnosis (female) — Dorsal shield with 15 pairs of lanceolate setae; propodosomal shield with one pair of dorsomedian setae *x1*; genitoanal area with two pairs of genital setae (*g1* and *g2*), three pairs of aggenital setae (*ag1*, *ag2* and *ag3*) and two pairs of pseudoanal setae, pseudoanal setae *ps1* barbed setaceous and *ps2* lanceolate barbed; chaetotaxy of coxa I-IV: 2-1-2-2; coxa I and IV each with 2 smooth setaceous setae.

Description. Female (n=5)

Dorsum (Fig. 1A) — Body (including gnathosoma) 560 (480–664) long; gnathosoma 151 (120–160) long, 144 (120–160) wide; idiosoma 450 (380–520) long, 313 (264–360) wide; dorsum of idiosoma with a large propodosomal shield, the rest of dorsum striated. Without hysterosomal shield. Eyes absent. Propodosomal shield squarish as long as wide 120 (100–140). Dorsum of idiosoma with fifteen pairs lanceolate setae, ten pairs marginal, four pairs dorsomedian and one pair humeral. Propodosomal shield with one pair of dorsomedian setae *x1* 25 (22–32) long, and four pairs rather large marginal setae (*vi*, *ve*, *sci*, *x2*). Setae *hm* also

lanceolate situated ventrally. Setae *sce* 38 (36–42) long, situated off propodosomal shield on dorsal membrane of propodosoma between setae *x2* and *hm*. Hysterosomal membrane bearing three pairs of lanceolate dorsomedian setae *c1* 24 (22–31) long, *d1* 26 (24–33), *e1* 25 (24–33) and three pairs of lanceolate barbed setae (*c2*, *d2*, *e2*) laterally and two pairs of lanceolate barbed setae (*fl*, *hl*) situated near posterior margin. Lengths of setae: *vi* 46 (40–48), *ve* 37 (34–39), *sci* 50 (48–52), *x1* 25 (22–32), *x2* 37 (32–42), *hm* 60 (54–63), *c2* 42 (42–44), *d2* 38 (34–42), *e2* 42 (44–48), *fl* 38 (34–46), *hl* 36 (34–40). Distances between dorsal setae: *vi*–*vi* 93 (80–110), *ve*–*ve* 109 (95–120), *sci*–*sci* 128 (120–150), *x1*–*x1* 88 (70–100), *x2*–*x2* 91 (85–100), *vi*–*ve* 19 (18–20), *ve*–*sci* 28 (26–30), *sci*–*x2* 79 (75–90), *x1*–*x2* 22 (20–26), *hm*–*hm* 296 (288–310), *sce*–*sce* 172 (160–188), *x1*–*sce* 40 (30–55), *c1*–*c1* 84 (80–90), *d1*–*d1* 79 (75–90), *e1*–*e1* 57 (44–75), *c2*–*c2* 104 (96–115), *d2*–*d2* 135 (120–160), *e2*–*e2* 93 (68–120), *hl*–*hl* 40 (35–46), *fl*–*fl* 70 (55–80), *x1*–*c1* 98 (88–104), *c1*–*d1* 62 (60–66), *d1*–*e1* 69 (66–74), *c1*–*c2* 39 (36–44), *d1*–*d2* 37 (34–40), *e1*–*e2* 34 (34–40), *e2*–*fl* 39 (36–44), *fl*–*hl* 13 (8–20).

Venter (Fig. 1B) — Ventral surface of idiosoma finely striate, bearing three pairs of setaceous intercoxal setae (*ic1*, *ic3*, *ic4*). Genitoanal area small with two pairs of genital setae (*g1* and *g2*), three pairs of aggenital setae (*ag1*, *ag2* and *ag3*) and two pairs of pseudoanal setae (*ps1* and *ps2*). All ventral setae setaceous, excluding genital setae *g1*–*g3* barbed, pseudoanal setae *ps1* barbed setaceous and *ps2* lanceolate barbed. Lengths of setae: *ic1* 24 (22–26), *ic3* 26 (24–28), *ic4* 24 (22–26), *g1* 14 (12–15), *g2* 15 (14–17), *ag1* 23 (20–26), *ag2* 22 (20–25), *ag3* 17 (15–19), *ps1* 17 (14–18), *ps2* 22 (20–24). Distances between ventral setae: *ic1*–*ic1*

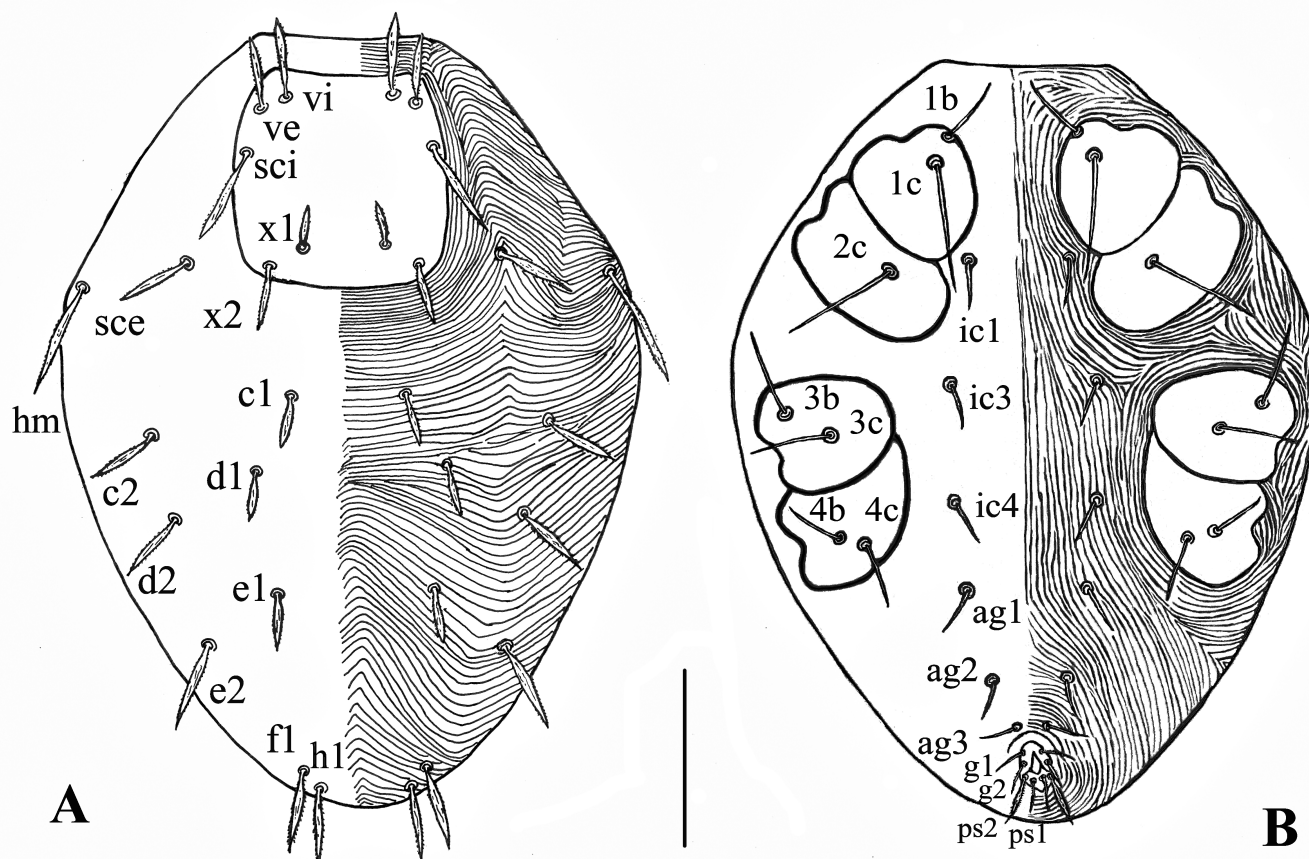


Figure 1 *Cheletonella iraniensis* n. sp. (Adult female): A – Dorsal view of idiosoma; B – ventral view of idiosoma. Scale bar: 100 μ m.

36 (30–40), *ic3–ic3* 64 (56–70), *ic4–ic4* 71 (66–80), *g1–g1* 10 (10–12), *g2–g2* 11 (12–13), *ag1–ag1* 42 (38–44), *ag2–ag2* 30 (26–32), *ag3–ag3* 13 (12–15), *ps1–ps1* 6 (6–8), *ps2–ps2* 10 (9–13), *ic1–ic3* 70 (64–78), *ic3–ic4* 65 (62–70), *ic4–ag1* 42 (40–46), *ag1–ag2* 50 (48–54), *ag2–ag3* 31 (28–36), *g1–g2* 7 (6–8).

Gnathosoma (Figs. 2A–B) — Peritremes M-shaped, composed of nine pairs of fairly strong chambers. Dorsum of gnathosoma with adoral setae *ao1* 17 (16–20) and pair of very small supracoxal setae *elcp* (measurement impossible). Venter of gnathosoma bearing subcapitular setae *n* 60 (56–62) and adoral setae *ao2* 10 (8–12). Palp 151 (130–200) long; palp femur with equal length and width 78 (60–100); palp setal formula as follows: trochanter without seta; femora with one barbed setaceous *dF* 80 (76–86) and three smooth setaceous *v'F* 40 (38–44), *v''F* 32 (30–38), *l''F* 15 (14–18); genua only with one barbed setaceous seta *dG* 39 (38–45); tibiae with three smooth setaceous setae *dTi* 30 (28–32), *l'Ti* 25 (24–26), *l''Ti* 29 (28–30); tibial claw 38 (32–46) long and with 2 basal teeth; tarsi with two comb-like eupathidia (*acm*, *sul*), outer comb (*sul*) about as long as claw, with 17 tines distributed throughout inner surface; inner comb (*acm*) almost straight, with approximately 20 tines, two smooth setaceous setae (*ul'*, *ul''*) and one solenidion (ω). Distance between *ao1–ao1* 23 (22–24), *ao2–ao2* 11 (10–12), *ao1–ao2* 7 (6–8), *n–n* 48 (46–50), *dF–dF* 105 (85–130), *dG–dG* 144 (120–190), *dTi–dTi* 146 (110–180), *v'F–v'F* 106 (104–114), *v''F–v''F* 124 (110–114), *v'F–v''F* 18 (20–22), *l''F–l''F* 180 (150–195), *v''F–l''F* 42 (38–46), *v'F–l''F* 34 (36–38), *dF–l''F* 40 (38–42), *l'Ti–l'Ti* 125 (90–160), *l''Ti–l''Ti* 165 (110–210), *l'Ti–l''Ti* 19 (16–20), *dTi–l'Ti* 10 (8–12), *dTi–l''Ti* 12 (10–14).

Legs (Figs. 3A–D) — All legs with barbed setaceous setae except dorsal setae on genua and femur III–IV which are lanceolate, barbed, of same structure as those on dorsal shield. Leg I–IV setal formulae: tarsus 9 + solenidion ωI (*tc'*, *tc''*, *a''*, *u'*, *u''*, *p'*, *p''*, *ft*, *vs*) – 7 + solenidion ωII (*tc'*, *tc''*, *u'*, *u''*, *p'*, *p''*, *vs*) – 7–7 (*tc'*, *tc''*, *u'*, *u''*, *p'*, *p''*, *vs*); tibia 5 (*l'T*, *l''T*, *v'T*, *v''T*, *dT*) – 4–4–4 (*l''T*, *dT*, *v'T*, *v''T*); genu – 2–2–2–2 (*dG*, *l'G*); femur 2–2–2–1; trochanter 1–1–2–1;

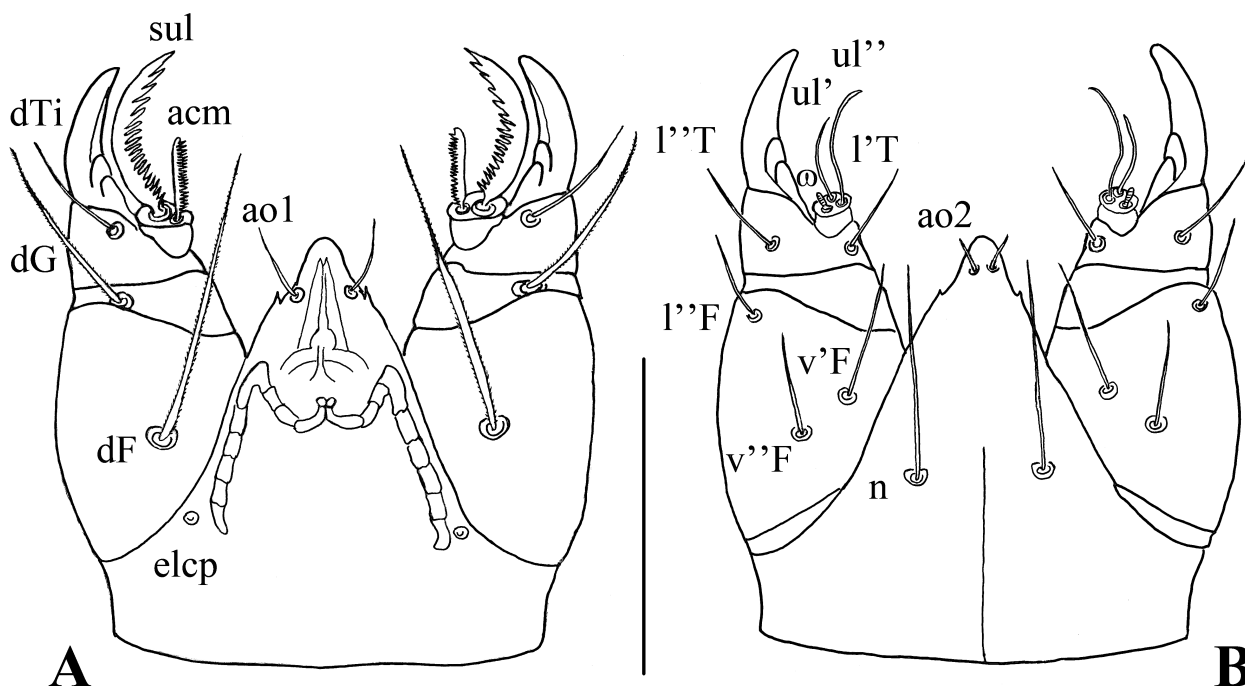


Figure 2 *Cheletonella iraniensis* n. sp. (Adult female): A – Dorsal view of gnathosoma; B – ventral view of gnathosoma. Scale bar: 100 μ m.

coxa 2-1- 2-2 smooth setaceous. Guard setae (*ft*) of solenidion (ω) 28 (26-30) long and about 2 times longer than solenidion 14 (13-16) long. Length of legs I-IV: 282 (260-320); 215 (196-240); 246 (228-280); 272 (248-300).

Remarks — The new species belongs to the tribe Cheyletini and genus *Cheletonella* because of the dorsal idiosoma plating restricted to a large propodosomal shield (Summers and Price, 1970). *Cheletonella iraniensis* can be distinguished from *C. pilosa* Tseng, 1977 by having 1) coxa I and IV each with 2 smooth setaceous setae, coxa formulae 2-1- 2-2 (vs. coxa formulae 1-1- 2-1; 2); 2) dorsum of idiosoma with 15 pairs setae (vs. dorsum of idiosoma with 12 pairs setae; 3) the presence of three pairs of dorsomedian setae *cl*, *dl* and *el* on hysterosomal membrane (vs. two pairs of dorsomedian setae on hysterosomal membrane; 4) legs with barbed setaceous setae (vs. legs with acicular and smooth setae; 5) pseudoanal setae *ps1* barbed setaceous and *ps2* lanceolate barbed (vs. pseudoanal setae *ps1* and *ps2* lanceolate; 6) outer comb of palptarsi with 17 tines and inner comb with approximately 20 tines (vs. outer comb of palptarsi with 15 tines and inner comb with approximately 24 tines; 7) femur of the palp with dorsal seta *dF* barbed and setaceous (vs. femur of the palp with dorsal seta acicular and smooth. *Cheletonella iraniensis* differs from *Cheletonella vespertilionis* Womersley, 1941 by having 1) dorsal setae of idiosoma lanceolate (vs. dorsal setae of idiosoma fan-shaped; 2) propodosomal shield with a dorsomedian setae *x1* (vs. propodosomal shield without a dorsomedian setae; 3)

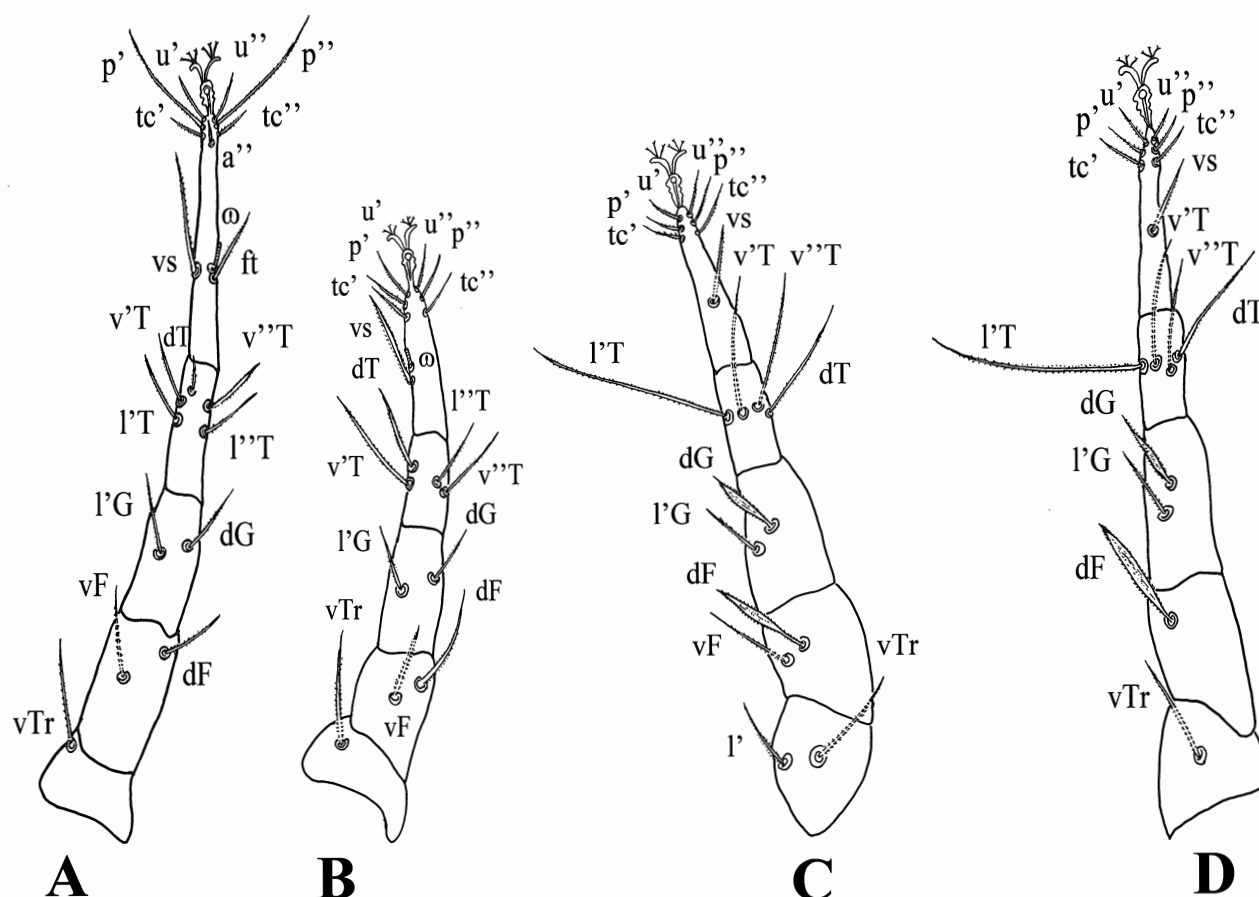


Figure 3 *Cheletonella iraniensis* n. sp. (Adult female): A – Leg I; B – Leg II; C – Leg III; D – Leg IV. Scale bar: 100 μ m.

three pairs of lanceolate dorsomedian setae *c1*, *d1* and *e1* on hysterosomal membrane (vs. four pairs of fan-shaped dorsomedian setae on hysterosomal membrane; 4) peritreme M-shaped (vs. peritreme U-shaped; 5) genitoanal area with two pairs of pseudoanal setae, *ps1* barbed setaceous and *ps2* lanceolate barbed (vs. genitoanal area with three pairs of pseudoanal setae, two pairs bifurcate distally; 6) peritreme M-shaped (vs. peritreme U-shaped; 7) tibial claw of the palp with 2 basal teeth (vs. tibial claw of the palp with 3 basal teeth; 8) genua I without solenidion σ (vs. genua I with solenidion σ ; 9) dorsal setae of palpfemur *dF* and palpgenua *dG* are barbed setaceous, differ from dorsal setae of idiosoma (vs. dorsal setae palpfemur *dF* and palpgenua *dG* are fan-shape, similar to dorsal setae of idiosoma. *Cheletonella iraniensis* differs from *C. hoffmannae* Smiley, 1996 by having 1) 15 pairs of lanceolate, barbed dorsal setae (vs. dorsum of idiosoma with 13 pairs of fan-shaped setae; 2) propodosomal shield with dorsomedian setae *c1* (vs. propodosomal shield without dorsomedian setae; 3) propodosomal shield smooth, without striae (vs. propodosomal shield with tuberculate striae; 4) peritreme M-shaped with 9 pairs of chambers (vs. peritreme U-shaped with 11 pairs of chambers; 5) tibial claw of the palp with 2 basal teeth (vs. tibial claw of the palp with 4 basal teeth; 6) outer comb of palptarsi with 17 tines and inner comb with approximately 20 tines (vs. outer comb of palptarsi with 14–18 tines and inner comb with approximately 21 tines; 7) palp femur with equal length and width, bearing four setae (vs. palp femur wider than long, bearing three setae; 8) dorsal seta of palpfemur barbed setaceous (vs. dorsal seta of palpfemur fan-shape; 9) palpgenua with a barbed setaceous seta (vs. palpgenua with two lanceolate and two? fan-shape setae; 10) tarsus of leg I with 9 setae + solenidion ωI (vs. tarsus of leg I with 8 setae + solenidion ωI ; 11) tibia of leg I with 5 setae, without solenidion (vs. tibia of leg I with 4 setae, with solenidion ϕI 12) genua of leg I with 2 barbed setaceous setae, without solenidion σ (vs. genua of leg I with 2 setae, one lanceolate and one fan-shape setae, with solenidion σ).

Etymology — The species name refers to the country of origin, Iran.

Type materials — Holotype and 7 paratype females were collected from samples of stored rice and decayed rice bran; 1 female paratype, decayed plant material; 3 female paratypes, livestock and poultry manure; 1 female paratype, birch and fig leaves; 2 female paratypes, soil; Khomam City (37° 23' 21" N 49° 39' 30" E, –17 m), 19 July 2017; 10 female paratypes, stored rice and decayed rice bran; 1 female paratype, livestock and poultry manure; Rasht County (37° 17' 0" N, 49° 35' 0" E, alt. –7 m), 9 August 2015; 1 June 2016; 3 July 2016; 3 September 2016; 4 March 2017; 7 March 2017; 1 female paratype, livestock and poultry manure; 2 female paratypes, stored rice and decayed rice bran; Lashtnesha City (37° 36' 44" N 49° 85' 78" E, alt. 24 m), 22 July 2016; 8 August 2017; 1 female paratype, decayed plant material; Khoshkebijar City (37° 28' 11" N 49° 77' 32" E, alt. –28 m), 8 August 2017; 2 female paratypes, stored rice and decayed rice bran; 1 female paratype, decayed plant material; 1 female paratype, livestock and poultry manure; Kuchesfahan City (37° 28' 11" N 49° 77' 32" E, alt. 0 m), 6 August 2016; 27 October 2016; 8 October 2017; 9 November 2017; 1 female paratype, decayed plant material; Sangar City (37° 10' 42" N, 49° 41' 38" E, alt. 31 m), 2 August 2016; 1 female paratype; were collected from bran and dust of rice warehouse; Emamzadeh Hashem Village (37° 01' 27" N 49° 37' 32" E, alt. 115 m), 2 November 2016. All specimens were collected by Safoura Salarzahi. The holotype and paratype females are deposited in Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan, Iran. One female paratype will be deposited in the National Collection of Arachnida, Plant Protection Research Institute, Pretoria, South Africa.

Key to the known species of the world

1. Dorsal idiosomal setae fan-shaped 2
- Dorsal idiosomal setae lanceolate 3
2. Palpal claw with 3 basal teeth, guard seta (ft) more than 1.3 times longer than solenidion ωI , peritremes with 9 links *C. vespertilionis* Womersley, 1941

— Palpal claw with 4 basal teeth, guard seta (ft) more than 2 times shorter than solenidion ω I, peritremes with 11 links *C. hoffmannae* Smiley, 1996

3. Idiosoma with 12 pairs of dorsal setae, coxa I and IV each with 1 smooth setaceous seta, coxal formulae 1-1- 2-1 *C. pilosa* Tseng, 1977

— Idiosoma with 15 pairs of dorsal setae, coxa I and IV each with 2 smooth setaceous setae, coxal formulae 2-1- 2-2 *C. iraniensis*

Acknowledgements

This project was partly supported by Department of Plant Protection, College of Agricultural Sciences, University of Guilan, Rasht, Iran and partly by the National Research Foundation of South Africa (UID) 85288, which are greatly appreciated. Any opinion, findings and conclusions or recommendations expressed in the material are those of the authors and therefore sponsors (University of Guilan and NFR) do not accept any liability in regard thereto.

References

- Bochkov A.V., Fain A. 2001. Phylogeny and system of Cheyletidae (Acari: Prostigmata) with special reference to their host-parasite associations. *Bull. Inst. R. Sci. Nat. Belg. Entomol.*, 71: 5-36.
- Bochkov A.V., Oconnor B.M. 2004. Phylogeny, taxonomy and biology of mites of the genera *Chelacheles* and *Neochelacheles* (Acari: Cheyletidae). *Invertebr. Syst.*, 18: 547-592. doi:10.1071/IS04013
- Bochkov A.V., Abramov V.V. 2016. To fauna of the free-living Cheyletidae (Acariformes: Cheyletoidea) of the European part of Russia. *Syst. Appl. Acarol.*, 21(3): 335-346. doi:10.11158/saa.21.3.8
- Dogan S., Jalaiean M., Kamali H. 2011. New records of two cheyletid mite species (Acari: Cheyletidae) from Iran. *Turk. J. Zool.*, 35(3): 1-2.
- Fain A., Bochkov A.V. 2001. A review of some genera of cheyletid mites (Acari: Prostigmata) with description of new species. *Acarian*, 9(1): 47- 95.
- Fuangularworn M., Lekprayoon C. 2010. Two new species of cheyletid mites (Acari: Prostigmata) from Thailand. *Zootaxa*, 2494: 59-68. doi:10.11646/zootaxa.2494.1.4
- Gerson U., Smiley R.L. 1990. *Acarine biocontrol agents: An illustrated key and manual*. Chapman and Hall Ltd. pp. 174.
- Gerson U., Fain A., Smiley R.L. 1999. Further observations on Cheyletidae (Acari), with a key to the genera of the Cheyletinae and a list of all known species in the family. *Bull. Inst. R. Sci. Nat. Belg. Entomol.*, 69: 35-86.
- Gerson U., Smiley R.L., Ochoa R. 2003. *Mites (Acari) for pest control*. Blackwell Science Ltd. pp. 539. doi:10.1002/9780470750995
- Grandjean F. 1939. Les segments post-larvaires de l' hysterosoma chez les oribates (Acariens). *Bull. Soc. Zool. Fr.*, 64: 273-284.
- Grandjean F. 1944. Observation sur les acarins de la famille des Stigmaeidae. *Arch. Sci. phys. natur.*, 26: 103-131.
- Hughes A.M. 1976. *The mites of stored food and houses*. London: Tech. Bull. Minist. Agric. Fish. Food, No. 9. pp. 400.
- Keh B., Lane R.S., Shachter S.P. 1987. *Cheyletiella blakei*, an ectoparasite of cats, as cause of cryptic arthropod infestations affecting humans. *West. J. Med.*, 146: 192-194.
- Kethley J. 1990. *Acarina: Prostigmata (Actiniedida)*. In: Dindal D.L. (Ed.). *Soil Biology Guide*. John Wiley and Sons, New York. pp. 667-756.
- Krantz G.W., Walter D.E. 2009. *A Manual of Acarology-3rd Edition*. Texas Tech University Press, Lubbock, USA. pp. 807.
- Laing J.E. 1973. Evaluating the effectiveness of *Paracheyletia bakeri* (Acarina: Cheyletidae) as a predator of the two spotted spider mite, *Tetranychus urticae*. *Ann. Entomol. Soc. Am.*, 66 (3): 641-646. doi:10.1093/aesa/66.3.641
- Skoracki M., Zabłudovskaya S.A., Bochkov A.V. 2012. A review of Prostigmata (Acariformes: Trombidiformes) permanently associated with birds. *Acarina*, 20(2): 67-107.
- Skvarla M., Fisher J.R., Dowling A.P.G. 2014. Redescription of *Paracaropsis travisi* (Baker, 1949) (Trombidiformes: Cheyletidae), with range expansion, Additional host records, and reevaluation of cheyletid chaetotaxy based on the sejugal furrow. *Acarologia*, 54(3): 335-345. doi:10.1051/acarologia/20142135
- Smiley R.L. 1996. New species of *Cheletonella* (Acari: Prostigmata: Cheyletidae) and a new key to the species. *An. Inst. Biol. Ser. Zool.*, 67(2): 239-244.
- Summers F.M., Price D.W. 1970. Review of the mite family Cheyletidae. *Calif. Univ. Publ. Entomol.*, 61: 1-153.

- Tseng Y.H. 1977. A contribution to the knowledge of Formosan cheyletid mites. Proc. Nat. Se. Council, 10 (2): 213-264.
- Volgin V.I. 1955. Acarina of the rodent fauna of the USSR Family Cheyletidae. Akad. Nauk SSSR Zool. Inst. Opredel. p. Faune SSSR, 59: 152-176.
- Womersley H. 1941. Notes on the Cheyletidae (Acarina, Trombidoidea) of Australia and New Zealand, with descriptions of a new species. Rec. S. Aust. Mus., 7(1): 51-64.
- Xia B., Zhu Z., Ye R. 1999. A new species of the genus *Cheletonella* (Acari: Cheyletidae) from China and a key to the species. Syst. Appl. Acarol., 4(4): 149-151. [doi:10.11158/saa.4.1.22](https://doi.org/10.11158/saa.4.1.22)
- Zhang Z.Q., Fan Q.H., Pesic V., Smit H., Bochkov A. V., Khaustov A.A., Baker A., Wohltmann A., Wen T.H., Amrine J.W., Beron P., Lin J.Z., Gabrys G., Husband R. 2011-Order Trombidiformes Reuter, 1909. In: Zhang Z.-Q. (Ed). Animal biodiversity: An outline of higher level classification and survey of taxonomic richness. Zootaxa, 3148: 129-138. [doi:10.11646/zootaxa.3148.1.24](https://doi.org/10.11646/zootaxa.3148.1.24)