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## A new species of the genus *Indutolaelaps* (Mesostigmata: Leptolaelapidae) from Iran

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**A b s t r a c t :** A new species *Indutolaelaps jiroftensis* nov.sp. is described based on the morphology of adult females collected from soil and litter in Jiroft, Kerman Province, Iran. Illustrations for substantiation are provided.

**K e y w o r d s :** Eviphidoidea, soil mites, taxonomy, Iran.

### Introduction

Leptolaelapidae (Mesostigmata) consists of a mite group living mainly in the soil and litter. Despite the scarce information available on their feeding behaviour, few species were reported to feed on dead arthropods and on nematodes (BEAULIEU & WALTER 2007; CLARK & HAWKE 2011).

BEAULIEU et al. (2011) listed 48 species in 12 genera in the family Leptolaelapidae. Mites of this family are mostly known from the southern hemisphere (KARG 1983, 1997, KARG & SCHORLEMMER 2013). KARG (1997) described in Leptolaelapidae the genus *Indutolaelaps* with only one species, *I. squamosus* KARG, from New Caledonia.

No member of the Leptolaelapidae has been reported from Iran. The objective of this paper is to describe a new species of the genus *Indutolaelaps* from Iran, as well as to provide a discussion about historic and distribution of Leptolaelapidae mites.

### Material and methods

Soil and litter samples were collected from sites of natural ecosystems of Jiroft city, Kerman Province, South-East of Iran during 2011. The samples were taken to a laboratory where mites were extracted using modified Berlese-Tullgren funnels. The extracted mesostigmatid mites were cleared with Nesbitt's solution, mounted in Hoyer's medium on microscopic slides and later separated in families. Leptolaelapidae mites were examined under an Olympus BX51 phase contrast and a differential interference contrast microscope (Olympus Optical Co., Ltd, Tokyo, Japan) at 100× magnification and compared with the original descriptions and redescrptions of mites of this family, leading to the conclusion that the one species collected was still undescribed.

Taxonomically relevant structures were illustrated with the use of an Olympus camera Lucida (Olympus Optical Co., Ltd) attached to a microscope while the measurements were done with a graded eyepiece. For each structure, the mean and the corresponding range (for variable measurements) are given in micrometers. Setal nomenclature used in this article follows that of LINDQUIST & EVANS (1965) for the dorsal and ventral surface of the idiosoma and EVANS (1963) for leg chaetotaxy.

## Result

### Family *Leptolaelapidae* KARG

#### *Indutolaelaps* KARG, 1997: 210

Type species: *Indutolaelaps squamosus* KARG, 1997, by original designation.

**Diagnosis** (adult female according to KARG, 1997): Genus *Indutolaelaps* is characterized by the apotele of palp 3-tined; epistome with an anteromedian extension, wider at the base and acute distally; dorsum of idiosoma with 45-50 pairs of aciculate and smooth setae; genital, ventral and anal shields fused, forming genitoventrinal shield; pretarsus I about half as long as other pretarsi.

#### Description of *Indutolaelaps jiroftensis* nov.sp.

**Diagnosis** (adult female): Epistome with anteromedian extension and remaining anterior margin serrated, dorsum of idiosoma with 44 pairs of setae, of which 32 pairs on dorsal shield and 12 pairs on unsclerotised cuticle laterad of dorsal shield, two pairs of presternal plates, genitoventrinal shield with four pairs of setae in addition to circum-anal setae and unsclerotised cuticle laterad of genitoventrinal shield with seven pairs of setae.

#### Female (five specimens measured)

Dorsal idiosoma (Fig. 1): Idiosoma 561 (530-600) long and 298 (280-300) wide at widest level. Podonotal and opisthonotal shields totally fused. Podonotal region smooth; with 20 pairs of setae (s1, r1 and r4 absent) and four pairs of distinguishable lyrifissures (posterolaterad of z1, anteromedial of s2, medially of and about in transverse line with s3, anteromedial of z6). Unsclerotised cuticle laterad of podonotal shield with a pair of setae (r5). Opisthonotal region striate in middle; with 12 pairs of setae (J1-J5, Z1-Z4 and S1-S3) and six pairs of distinguishable lyrifissures (posteromedial of S2, anteromedial of J3, posterolaterad of J3, posteromedial of S3, anterolaterad of Z4, anterolaterad of J5). Unsclerotised cuticle laterad of opisthonotal shield with 11 pairs of setae (Z5, S4, S5, R1-R5 and UR3-UR5). Measurements of setae: j1 27 (23-30), j2 38 (37-40), j3 44 (42-45), j4 40 (38-42), j5 48 (45-50), j6 42 (38-45), J1 42 (40-45), J2 38 (37-39), J3 38 (37-39), J4 40 (39-41), J5 44 (38-48), z1 32 (29-37), z2 38 (37-40), z3 43 (42-45), z4 44 (43-45), z5 44 (43-45), z6 41 (38-42), Z1 41 (40-42), Z2 39 (38-40), Z3 40 (38-42), Z4 42 (38-45), Z5 44 (42-45), s2 42 (38-45), s3 40 (38-42), s4 46 (43-48), s5 46 (43-48), s6 42 (38-45), S1 37 (33-40), S2 38 (37-40), S3 39 (38-40), S4 42 (40-44), S5 42 (40-44), r2 45

(43-47), r3 49 (48-45), r5 38 (37-39), r6 38 (37-40), R1 38 (37-42), R2 41 (38-43), R3 43 (42-45), R4 42 (38-43), R5 41 (38-44), UR3 38 (37-40), UR4 39 (37-42), UR5 42 (40-44). All dorsal idiosomal setae aciculate and smooth.

Ventral idiosoma (Fig. 2): Base of tritosternum 22 (21-25) long and 8 (7-10) wide proximally; laciniae 117 (100-130), separated for about 70% of their total length, pilose (Fig. 5). With two pairs of presternal plates. Sternal shield striate between st1 and st2, smooth elsewhere; approximately 213 (205-218) long at mid-line and 111 (105-113) wide at widest level; anterior margin slightly concave and posterior margin convex; with four pairs of setae and three pairs of lyrifissures. Endopodal shield fused with and distinctly more sclerotised than sternal shield. Genital, ventral and anal shields fused, forming genitoventrianal shield; slightly striate anterior and between st5; approximately 241 (237-250) long and 136 (130-138) wide at widest level; not fused with opisthotal shield; with four pairs of setae (st5, Jv1, Jv2 and Zv1) in addition to circum-anal setae, lyrifissures and pores not distinguishable. Unsclerotised cuticle laterad of genitoventrianal shield with seven pairs of setae (Jv3-Jv5 and Zv2-Zv5). Peritreme extending anteriorly to level of region between coxae I and II. Peritrematic shield broad, fused anterolaterally with dorsal shield and totally fused with exopodal shield (distinctly more sclerotized); with three pairs of lyrifissures posterior to stigma. Exopodal shield distinctly more sclerotised than surrounding shield posterior to coxa IV. With an elliptical metapodal platelet. Measurements of setae: st1 38 (37-39), st2 36 (35-37), st3 41 (38-43), st4 52 (50-55), st5 36 (35-38), Jv1 40 (37-42), Jv2 38 (37-39), Jv3 37 (33-40), Jv4 41 (40-42), Jv5 40 (38-42), Zv1 40 (39-42), Zv2 38 (37-39), Zv3 39 (38-40), Zv4 42 (40-45), Zv5 39 (37-40), para-anal 24 (23-25), post-anal 17 (15-18). All ventral idiosomal setae aciculate and smooth.

Gnathosoma: Fixed cheliceral digit 102 (100-105) long, with four teeth in addition to apical tooth and a setiform *pilus dentilis* (Fig. 3); movable cheliceral digit 94 (90-95) long, with two teeth in addition to apical tooth; antiaxial and dorsal lyrifissures as well as dorsal seta distinct. Arthrodial process of chelicera coronet-like. Palp chaetotaxy (trochanter to tarsus): 2-5-6-14-15; apotele 3-tined (Fig. 4); setae aciculate and smooth. Epistome with an anteromedian extension wider at the base and acute distally; anteromedian extension and remaining anterior margin of epistome serrated (Fig. 6). Margins of deutosternum not distinct; deutosternal denticles in nine rows, with 10-16 denticles each, except second and eighth rows smooth; rows roughly transverse, except eighth row shaped as an inverted "V" (Fig. 7). Internal malae totally separated from each other, each bifurcate and fimbriate. Corniculus horn-like, about 2.7 times as long as its basal width. Seta h3 about in longitudinal line with h1 and in transversal line and mediad to h2. Measurements of setae: h1 61 (58-63), h2 37 (33-40), h3 38 (37-40), sc 25 (25-25); all setae aciculate and smooth.

Legs (Figs 8-12): Lengths: I: 604 (580-620); II: 500 (500-500); III: 428 (420-450); IV: 602 (570-610). Numbers of setae on legs I-IV: coxae: 2, 2, 2, 1; trochanters: 6, 5, 5, 5; femora: 12, 10, 5, 6; genua: 12, 11, 8, 8; tibiae: 12, 11, 9, 8; tarsi II-IV: 18, 18, 17. Pretarsi I-IV similar in shape, with an elongate ambulacral stalk, a pair of strong claws and three rounded pulvillar lobes (Fig 12); pretarsus I about half as long as other pretarsi.

Spermatheca: Not distinguishable.

A d u l t M a l e : Not found.

**Material examined:** From Jiroft (28°40'41"N, 57°44'26"E; altitude 690 m above sea level), Kerman Province, Iran: holotype female from soil and litter at the base of *Phoenix dactylifera* L. (Arecaceae), 15 July 2011; eight paratype females from soil and litter at the base of *Medicago sativa* L. (Fabaceae), 16 July 2011; five paratype females from soil and litter at the base of *Citrus sinensis* (L.) Osbeck (Rutaceae), 3 September 2011; 28 paratype females from soil and litter at the base of *P. dactylifera*, 1 September 2011. All types collected by N. Balooch-Shahriari. The holotype female and 25 paratype females deposited at Collection of Acarology Laboratory, University of Guilan, Iran and 16 paratype females deposited at Departamento de Entomologia e Acarologia, Escola Superior de Agricultura "Luiz de Queiroz" (ESALQ), Universidade de São Paulo (USP), Piracicaba, State of São Paulo, Brazil.

**Etymology:** The epithet *jirofti* refers to "from Jiroft", city where the type specimens were collected.

**Remarks:** *Indutolaelaps jiroftensis* nov.sp. is similar to *Indutolaelaps squamosus* Karg, 1997 but the latter has epistome with anteromedian extension and remaining anterior margin smooth, dorsum of idiosoma with 50 pairs of setae, all dorsal idiosomal setae inserted in the dorsal shield, one pair of presternal plates, genitoventrianal shield with six pairs of setae in addition to circum-anal setae and unsclerotised cuticle laterad of genitoventrianal shield with two pairs of setae.

## Discussion

KARG (1978) created a new subfamily Leptolaelapinae, containing only the genus *Leptolaelaps* BERLESE, and placed it together with two other subfamilies, Macrochelinae VITZTHUM and Pachylaelapinae VITZTHUM in the family Macrochelidae VITZTHUM. KARG (1983) elevated Leptolaelapinae to family rank, Leptolaelapidae, and included the genera *Australocheles* KARG, *Ayersacarus* HUNTER, *Cerambylaelaps* COSTA, *Evansolaelaps* MARAIS & LOOTS and *Leptolaelaps* in this family. KARG (1997) included more six genera in the family, *Cosmetolaelaps* WOMERSLEY, *Hunteracarus* COSTA, *Paradoxiphis* BERLESE, *Stevacarus* HUNTER and two new genera, *Indutolaelaps* KARG and *Pulchraplaga* KARG. The genus *Indutolaelaps* was described with only one species, *Indutolaelaps squamosus* KARG. BEAULIEU et al. (2011) listed 48 species in 12 genera in the family Leptolaelapidae. In 2012, CLARK in CLARK & HAWKE (2012) described a new genus, *Prestacarus* CLARK.

LINDQUIST et al. (2009) suggested that due to the considerable morphological diversity between these genera, this group is polyphyletic with mixed Eviphidoidea and Demanysoidea affinities. For this reason, they have not been formally included as a family for these authors.

KARG & SCHORLEMMER (2013) discussed that the family status of Leptolaelapidae was based on synapomorphies and on the particular area of their distribution in the Gondwanian supercontinent on the southern area of earth during the Jurassic and Cretaceous period. When this supercontinent started to split, ancestral groups of species were separated and spread across parts of the Gondwanian supercontinent and due to this separation and new ecological conditions, new genera were developed, forming currently this family. Known species of this family were found mainly in soil and litter, distributed geographically over the southern parts of South America and Africa, over Australia, Malaysia, New Zealand and subantarctic islands to the Antarctic (KARG 1983, 1997), which belong to the former Gondwanian supercontinent.

The genus *Indutolaelaps* was described with only one species, *I. squamosus* KARG, from New Caledonia. *Indutolaelaps jiroftensis* nov.sp. is the second known species of the genus and the first of the family found outside of the Gondwanan distribution. This discovery can probably be explained by human activities, however all samples with *I. jiroftensis* nov.sp. were collected from soil under plants originating from Asia, outside of the Gondwanan distribution. However, this pattern of distribution of Leptolaelapidae only on Gondwanian regions could be influenced by the reduced effort dedicated to the study of this mite group.

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We wish to thank Professor Bruce Halliday (CSIRO Entomology, Canberra, Australia) for review of this paper and for his helpful comments and guides and Dr. JM Clark (Canterbury Museum, Christchurch, New Zealand) for sending us related papers.

### Zusammenfassung

Eine neue Art aus der Familie der Leptolaelapidae, *Indutolaelaps jiroftensis* nov.sp., wird basierend auf der Morphologie von adulten Weibchen beschrieben. Aufgesammelt wurde das Material aus dem Boden in Jiroft, Provinz Kerman, Iran. Zur Veranschaulichung werden Illustrationen beigelegt.

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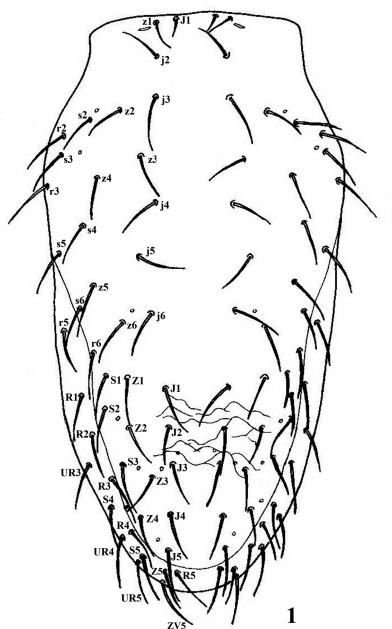
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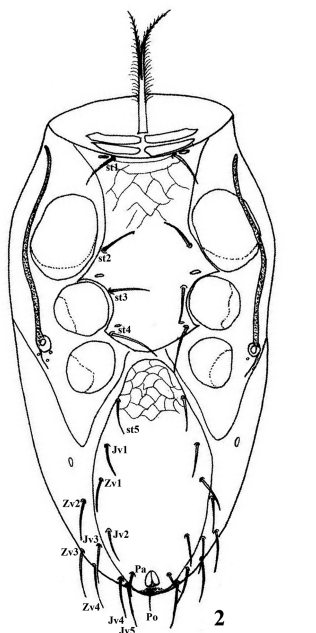
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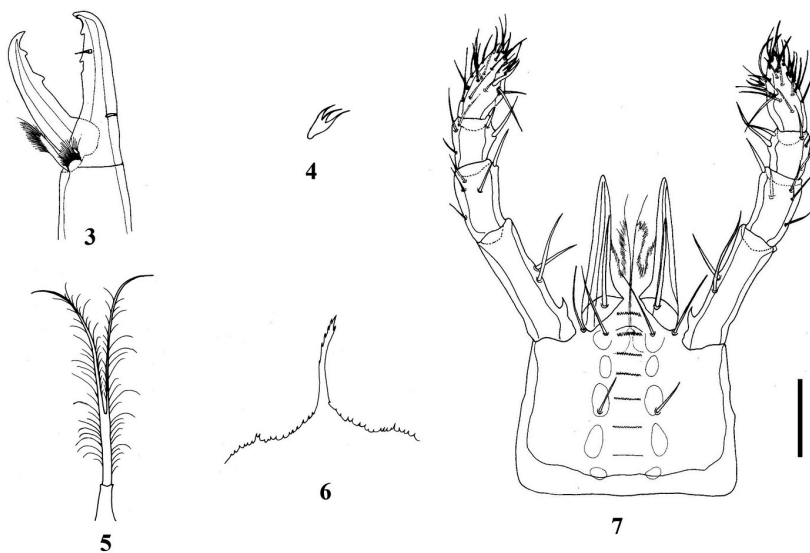
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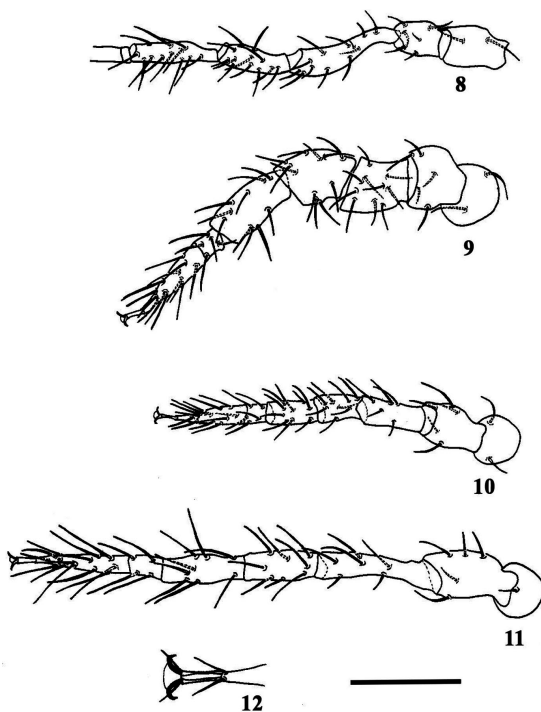
**Fig. 1:** *Indutolaelaps jiroftensis* nov.sp. (female). Dorsal view of idiosoma. Scale bar: 100  $\mu$ m.



**Fig. 2:** *Indutolaelaps jiroftensis* nov.sp. (female). Ventral view of idiosoma. Scale bar: 100  $\mu$ m.



**Figs 3-7:** *Indutolaelaps jiroftensis* nov.sp. (Female). (3) Chelicera; (4) Apotela; (5) Tritosternum; (6) Tectum; (7) Hypostome. Scale bars: 45  $\mu$ m for (3), (5); 50  $\mu$ m for (4); 35  $\mu$ m for (6), (7).



**Figs 8-12:** *Indutolaelaps jiroftensis* nov.sp. (Female). (8) Leg I; (9) Leg II; (10) Leg III; (11) Leg VI; (12) Pretarsus of leg IV. Scale bars: 100  $\mu$ m for (8), (9), (10), (11); 12 not scaled.



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