

A NEW SPECIES OF *LINOTETRANUS* (ACARIFORMES: TETRANYCHOIDEA: LINOTETRANIDAE) FROM THE SOUTHEAST OF IRAN

Mohammad KHANJANI¹, Elham MOHAMMADI², Hamzeh IZADI² and
Masoumeh KHANJANI¹

(Received 09 April 2012; accepted 25 July 2012; published online 21 December 2012)

¹ Department of Plant Protection, College of Agriculture, Bu Ali-Sina University, Hamedan, I. R. Iran.
mkhanjani@gmail.com (corresponding author), mh.khanjani86@gmail.com

² Department of Plant Protection, College of Agriculture, Vali-e-Aser University, Rafsanjan, Iran.
elham.mohammadi@yahoo.com, izadi@mail.vru.ac.ir

ABSTRACT — A new species *Linotetranychus eghbaliani* n. sp. was collected from soil under apricot and almond trees, in the vicinity of Rafsanjan, Kerman province. A key to all known species of the world is provided.

KEYWORDS — mite; phytophagous; Tetranychidae; soil; apricot; almond; Acari; Kerman

INTRODUCTION

The family Linotetranychidae Baker and Pritchard, currently contains four genera namely: *Afrolinotus* Meyer and Ueckermann, *Anoplopalpus* Meyer and Ueckermann, *Austrolinus* Beard and Walter and *Linotetranychus* Berlese (Khanjani *et al.*, 2011). Linotetranychid mites usually are colorless, slender and mostly inhabit soil (Bagheri *et al.* 2008). The genus *Linotetranychus* was described by Berlese (1910) and to date has 12 species, namely: *Linotetranychus achrous* Baker and Pritchard, 1953; *L. ramosus* Meyer and Ueckermann, 1997; *L. protractulus* Athias-Henriot, 1961; *L. cylindricus* Berlese, 1910; *L. amicus* Meyer and Ueckermann, 1997; *L. edenvillensis* Meyer and Ueckermann, 1997; *L. mirabebeensis* Andre, 1996; *L. annae* Meyer and Ueckermann, 1997; *L. niknami* Bagheri *et al.*, 2008; *L. anaticus* Doğan and Dönel, 2010; *L. iraniensis* Khanjani *et al.*, 2011 and *L. astragalus*

galusi Khanjani *et al.*, 2011. In this paper the thirteenth species is described from Iran.

MATERIALS AND METHODS

Mites were mounted directly on slides in Hoyer's medium (Krantz and Walter 2009). The slides were then dried in an oven 50°C, sealed with nail polish and examined under a means of phase contrast Olympus BX51 microscope 400-1000X magnification. Drawings were made with a camera lucida. Body width was measured at the broadest point of idiosoma, just before coxa III or at the level of setae c4-c4. The terminology and setal notations follow that of Lindquist (1985).

All measurements are given in micrometers (µm) and the measurements of paratype are given in brackets. Leg setal formulas are presented as the

number of tactile setae followed by number of sensory setae in parentheses.

FAMILY LINOTETRANIDAE BAKER AND PRITCHARD, 1953

Genus *Linotetranus* Berlese, 1910

Type species: *Linotetranus cylindricus* Berlese, 1910

Diagnosis — Eyes absent; Prodorsum with four pairs of setae (v_1 , v_2 , sc_1 and sc_2), opisthosomal dorsum with 17 or 18 pairs of setae (d_1 , e_1 and f_1 always present); palp five segmented, palptarsus with six phaners, palptibia with a claw and 1 or 2 setae, palpgenu with or without setae; palpfemur with 1 seta; coxa I with 2 setae, tibia II and IV with 4 setae, tarsus I with 2, tarsus II with 1 spindle-shaped solenidion distally, tarsi without forked setae.

Linotetranus eghbaliani n. sp. (Figs. 1-2)

Diagnosis — Setae v_1 bifurcate, palptarsus with one eupathidium and four simple setae, palptibia with two setae, palpgenu without setae; seate e_4 present, genital shields with three pairs of setae (g_{1-3}).

Material examined — Two females, holotype female collected from soil beneath apricot trees, *Prunus armeniaca* (L.) (Rosaceae) and one paratype female collected from soil under almond trees, *Amygdalus communis* (L.) (Rosaceae), Rafsanjan (29° 58' N, 55° 53' E and altitude 2600 m a.s.l), Kerman Province, Iran, 19, April 2010, Elham Mohammadi. The holotype female is deposited as slide-mounted specimens in the Collection of Acarology Laboratory, University of Bu-Ali Sina, Hamadan, Iran; one paratype female will be deposited in the mite collection of ARC-Plant Protection Research Institute, Pretoria, South Africa.

Description

Female (n = 2) — Idiosoma elongate. Dimensions: Length of body (including gnathosoma) 432 (405) (excluding gnathosoma 351 (322)); width 142 (145); length of leg I 147 (141); leg II 103 (102); leg III 93 (92); leg IV 93 (97).

Dorsum (Figure 1A) — Dorsal idiosoma reticulate and with 22 pairs of setae; all dorsal setae serrate; v_1 pinnate and bifurcate distally (Fig. 1B). Eyes absent. Caudal area anteriorely reticulate. Setae f_3 and h_2 is the longest seta on the dorsum. lengths of dorsal setae as follows (measurements of paratype in parentheses): v_1 17 (19), v_2 39 (38), sc_1 72 (79), sc_2 75 (79); hysterosoma with 18 pairs of setae: c_1 22 (23), c_2 48 (50), c_3 79 (86), c_4 89 (94), d_1 25 (24), d_2 57 (50), d_3 89 (87), e_1 13 (12), e_2 55 (60), e_3 71 (72), e_4 51 (47), f_1 17 (16), f_2 34 (32), f_3 124 (118), h_1 45 (41), h_2 132 (142), h_3 64 (63), h_4 43 (41);. Distances between setae: v_1 - v_1 4 (5), v_1 - v_2 28 (29), v_2 - v_2 39 (39), v_2 - sc_1 36 (37), sc_1 - sc_1 85 (85), sc_1 - sc_2 24 (24), sc_2 - sc_2 120 (115), c_1 - c_1 61 (60), c_2 - c_2 95 (99), c_1 - c_2 18 (21), c_2 - c_3 16 (16), c_3 - c_3 124 (130), c_3 - c_4 31 (35), c_4 - c_4 110 (105), d_3 - d_3 94 (88), c_1 - d_1 95 (89), d_1 - d_1 15 (16), d_1 - d_2 31 (29), d_2 - d_2 73 (78), d_2 - d_3 12 (10), d_3 - d_3 94 (88), d_3 - e_3 54 (50), e_1 - d_1 52 (51), e_1 - e_1 20 (20), e_1 - e_2 26 (26), e_2 - e_2 66 (69), e_2 - e_3 12 (10), e_3 - e_3 85 (84), e_3 - e_4 12 (13), e_4 - e_4 87 (89), e_1 - f_1 39 (37), f_1 - f_1 31 (34), f_1 - f_2 14 (13), f_2 - f_2 54 (55), f_2 - f_3 5 (6), f_3 - f_3 65 (69), f_1 - h_1 28 (30), h_1 - h_1 15 (13), h_1 - h_2 5 (6), h_2 - h_2 24 (24), h_2 - h_3 4 (4), h_3 - h_3 29 (37), h_4 - h_4 44 (43).

Venter (Figure 1C) — Ventral sculpturing reticulate-areolate. Area between setae $2a$ and $3a$ with transverse striae. Intercoxal area with four pairs of setae ($1a$, $2a$, $3a$, $4a$); setae $1a$ two times longer than $3a$ and $4a$; $2a$ serrate; two pairs aggenital setae (ag_{1-2}); ag_1 on posterior part of aggenital shield, ag_2 situated on integument. Genital shields with three pairs of setae (g_{1-3}), g_2 longer than others; Pseudanal shields with three pairs of setae (ps_{1-3}). Measurements of setae: $1a$ 86 (85), $1b$ 23(24), $1c$ 13 (14), $2a$ 63 (68), $2b$ 29 (28), $3a$ 45 (40), $3b$ 22 (21), $4a$ 43 (42), $4b$ 22 (21), ag_1 37 (32), ag_2 16 (20), g_1 8 (7), g_2 14 (21), g_3 7 (9), ps_1 11 (12), , ps_2 12 (14), ps_3 17 (15). Distances between setae: $1a$ - $1a$ 24 (24), $1a$ - $2a$ 34 (35), $2a$ - $2a$ 71 (74), $2a$ - $3a$ 78 (61), $3a$ - $3a$ 56 (55), $3a$ - $4a$ 115 (116), $4a$ - $4a$ 28 (25), ag_1 - ag_1 30 (29), ag_2 - ag_2 68 (64), g_1 - g_1 13 (14), g_1 - g_2 10 (9), g_3 - g_3 20 (21), g_2 - g_3 9 (9), g_2 - g_2 12 (15), ps_1 - ps_1 21 (21), ps_2 - ps_2 18 (19), ps_3 - ps_3 15 (13), ps_1 - ps_2 6 (7), ps_3 - ps_2 8 (8).

Gnathosoma (Figures 1D-F) — Palp five segmented; palp coxa longer than other segments. Palptarsus with four simple setae, one solenidion 3 (5) and one eupathidium 5 (5); tibia 8 (10) with two

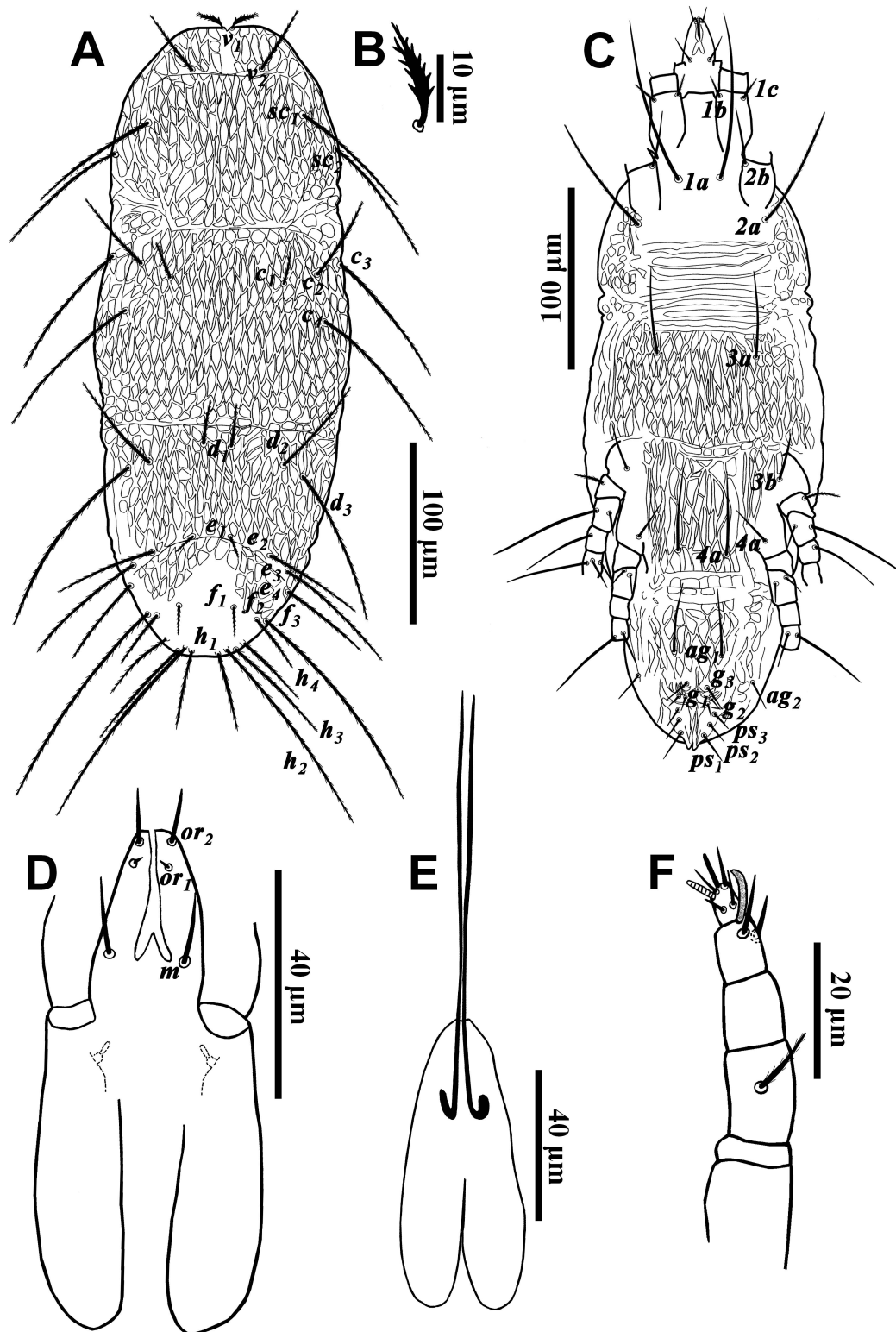


FIGURE 1: *Linotetranychus eghbaliani* n. sp. (female): A – Dorsal view; B – prodorsal seta v_1 ; C – Ventral view; D – Ventral infracapitulum; E – Chelicera; F – Palp.

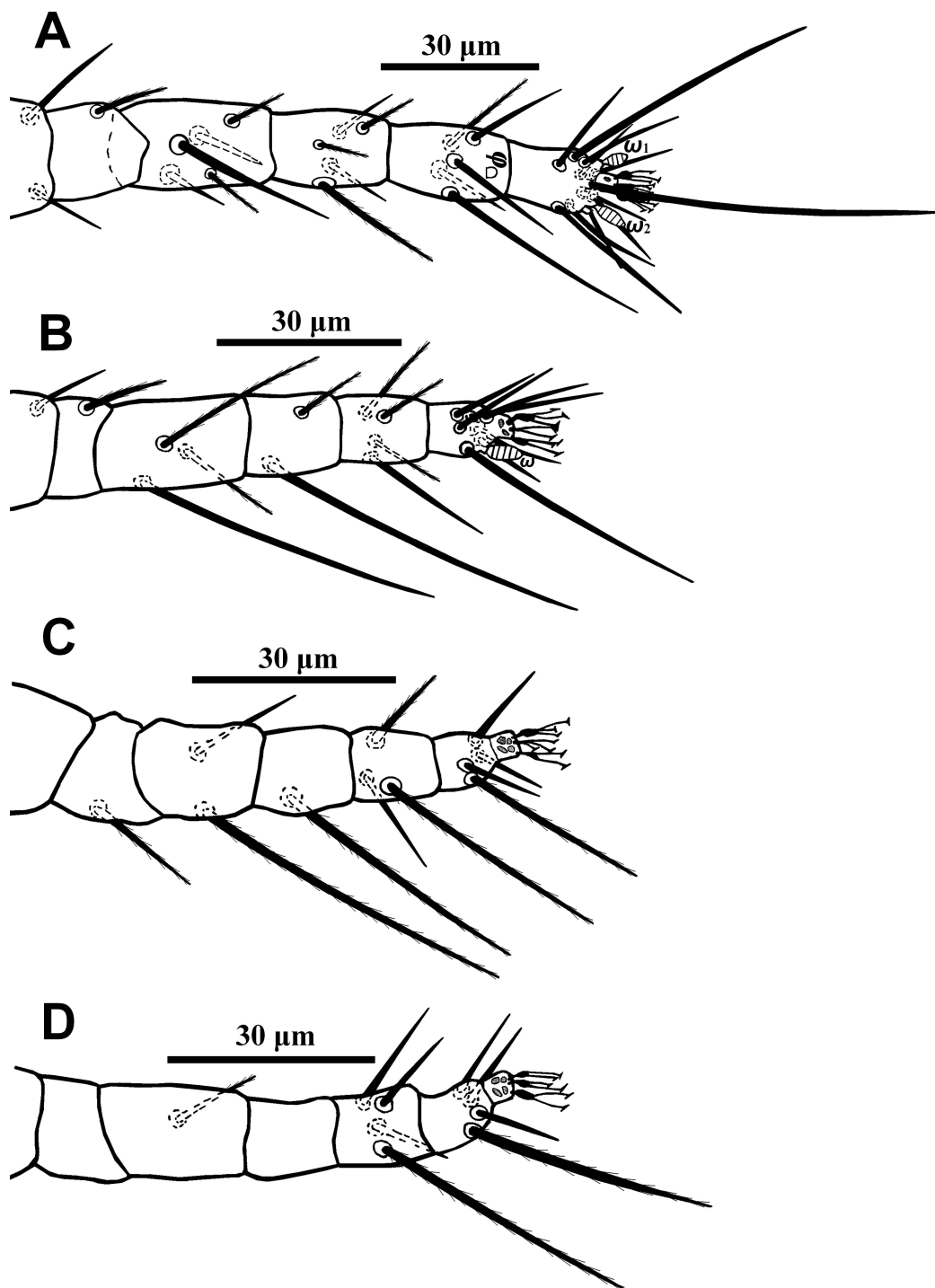


FIGURE 2: *Linotetranychus eghbaliani* n. sp. (female): A – leg I; B – leg II; C – leg III; D – leg IV.

setae and a dorsal claw; genua 10 (12) without setae; femora 12 (13) with one dorsal seta (Fig. 1F). Preoral setae or_1 3 (3), or_2 8 (10); hypostomal setae m 14 (18) (Fig. 1D). Length of chelicerae from the base to their tips 114 (121), stylophore as in figure 1E.

Legs (Figures 2A–D) — Setal formulae for legs I–IV: coxae 2-1-1-1; trochanters 1-1-1-0; femora 5-3-2-1; genua 5-2-1-0; tibiae 5[1φ 3 (3)]-4-3-4; tarsi 11(2ω)-7(1ω)-4-4; solenidia on tarsus I–II and tibia I spindle shape $I\omega_1$ 5(6), $I\omega_2$ 7(9), $II\omega$ 7(8).

Remarks — *Linotetranychus eghbaliani* **sp. nov.** resembles *L. anatolicus* Doğan and Dönel, 2010 in having the same dorsal and ventral pattern and palpgenu without seta. However it differs from the latter by: setae v_1 bifurcate instead of simple in *L. anatolicus*, setae h_2 longest dorsal setae in the former but f_3 longest in the latter; palptarsus with one eupathidium versus four eupathidia in *L. anatolicus* and setae e_2 55 (56) oppose to e_2 33 (27–35).

Also the new species closely resembles *Linotetranychus astragalusi* Khanjani *et al.*, 2011 from Iran, in having the same leg setal formula, dorsal pattern and palpgenu without setae; however it differs from *L. astragalusi* by: area between $1a$ – $2a$ with transverse striae (rectangular reticulations in *L. astragalusi*); caudal area anteriorly reticulate (smooth in *L. astragalusi*), setae v_1 bifurcate (simple in *L. astragalusi*) and there are some dorsal setal length differences: d_2 57 (50) vs. 28 (27) in *L. astragalusi*; e_2 29 (27) vs. 55 (56) in *L. astragalusi*, e_4 51 (47) vs. 28 (29) in *L. astragalusi*.

Male and immature stages — Unknown

Etymology — This species is named in honor of Dr. Amir Hosein Eghbalian, close friend of senior author at the department of Plant Protection, College of Agriculture, Bu-Ali Sina University, Hamedan, Iran.

Key to the world species of *Linotetranychus* Berlese based on adult females (modified from Beard and Walter (2004) and Khanjani *et al.*, 2011)

1. Posterior dorsal opisthosomal setae e_4 absent..... *L. achrous* Baker and Pritchard, 1953
— Posterior dorsal opisthosomal setae e_4

present..... 2

2. With 2 pairs of genital setae (g_{1-2}).....
..... *L. ramosus* Meyer and Ueckermann, 1997
— With 3 pairs of genital setae (g_{1-3})..... 3

3. Posterior dorsal opisthosoma with transverse striae *L. protractulus* Athias-Henriot, 1961
— Posterior dorsal opisthosoma smooth or with irregular striae..... 4

4. Palp tibia with 1 seta..... 5
— Palp tibia with 2 setae 6

5. Palp genu with 1 seta.....
..... *L. cylindricus* Berlese, 1910
— Palp genu without setae.....
..... *L. amicus* Meyer and Ueckermann, 1997

6. Genu I with 4 setae.....
..... *L. edenvillensis* Meyer and Ueckermann, 1997
— Genu I with 5 setae..... 7

7. Dorsal setae d_3 shorter than distance between d_3 – e_3 *L. mirabebeensis* André, 1996
— Dorsal setae d_3 longer than distance between d_3 – e_3 8

8. Palp genu without setae 9
— Palp genu with 1 seta 12

9. Setae f_3 are the longest dorsal setae; ventral setae $3a$ about as long as distance $3a$ – $3a$
..... *L. annae* Meyer and Ueckermann, 1997
— Setae h_2 or h_3 are the longest dorsal setae; ventral setae $3a$ shorter than distance $3a$ – $3a$ 10

10. Setae h_2 the longest dorsal setae; palp tarsus with 1 eupathidium..... 11
— Setae h_3 the longest dorsal setae; palp tarsus with 4 eupathidia... *L. anatolicus* Doğan and Dönel, 2010

11. Setae e_2 55 (56), setae v_1 bifurcate..... *L. eghbaliani* **n. sp.**

- Setae e_2 29 (27), setae v_1 simple.....
*L. astragalusi* Khanjani *et al.*, 2011
12. Palp tarsus with 4 eupathidia, e_2 63 – 66 (54);
 setae $h_3 < h_1$ *L. niknami* Bagheri *et al.*, 2008
 — Palp tarsus with 1 eupathidium; e_2 95 – 116 (104);
 setae h_3 subequal h_1
 *L. iraniensis* Khanjani *et al.*, 2011

ACKNOWLEDGEMENTS

This paper is a part of MSc thesis which was supported by University of Vali-e-Asr Rafsanjan, Iran. The authors wish to thank vice research of the president University for financial support of this project.

REFERENCES

- Andre H.M. 1996 — Two new mites of the rare families Barbutiidae and Linotetranaidae (Acari), from the Namib Desert — *Acarologia*, 36: 97-106.
- Athias-Henriot C. 1961 — Nouveaux acariens phytophages d'Algérie (Actinotrichida, Tetranychoidae: Tetranychidae, Linotetranaidae) — *Ann. de l'École Nat. d'Agric. d'Alger*, 3(3): 1-10.
- Bagheri M., Haddad Irani-nejad K., Kamali K., Khanjani M., Saboori A., Lotfollahi P. 2008 — A new species of *Linotetranus* (Acari: Prostigmata: Linotetranaidae) from Iran — *Zootaxa*, 1914: 65-68.
- Baker E.W., Pritchard A.E. 1953 — The family category of tetranychoid mites, with review of the new families Linotetranaidae and Tuckerellidae — *Ann. Entomol. Soc. Amer.*, 46(2): 243-258.
- Beard J.J., Walter D.E. 2004 — Cryptic false spider mites: a new genus, *Austrolinus* and a review of the family Linotetranaidae (Acari: Prostigmata: Tetranychoidae) — *Invert. Syst.*, 18: 593-606. doi:10.1071/IS02049
- Berlese A. 1910 — Acari nuovi-Manipulus V. Redia, 6: 199-234.
- Doğan S., Dönel G., Bal D. A., Sezek F. 2010 — The first occurrence of the mite family Linotetranaidae (Acari: Tetranychoidae) in Turkey: *Linotetranus anatolicus* n. sp. — *Internat. J. Acarol.*, 36(1): 27-34. doi:10.1080/01647950903496571
- Khanjani M., Asali fayaz B., Khanjani M. 2011 — Two new species of *Linotetranus* (Parasitiformes: Tetranychoidae: Linotetranyidae) from Iran — *Zootaxa*, 2834: 47-56.
- Krantz G.W., Walter D. 2009 — A Manual of Acarology - 3rd ed. — Texas Tech University Museum Special Publication, Lubbock, TX, USA. 807 pp.
- Lindquist E.E. 1985 — Anatomy, phylogeny and systematics — 1.1.1. External anatomy. In: Helle, W., Sabelis M.W., (eds.), *World Crop Pest*, Vol. 1A. Spider mites, their biology, natural enemies and control. Amsterdam, Elsevier, p. 3-28.
- Meyer (Smith) M.K.P., Ueckermann E.A. 1997 — A review of the some species of the families Allochaetophoridae, Linotetranaidae and Tuckerellidae (Acari: Tetranychoidae) — *Internat. J. Acarol.*, 23(2): 67-92. doi:10.1080/01647959708683103

COPYRIGHT

 Khanjani M. *et al.* Acarologia is under free license. This open-access article is distributed under the terms of the Creative Commons-BY-NC-ND which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.