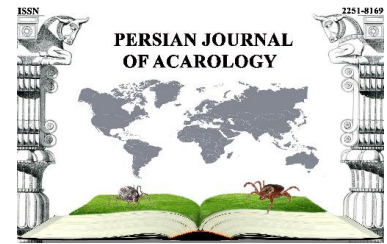




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Article

A new species of *Notallus* (Acari: Eriophyidae) on Lamiaceae from Iran

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ABSTRACT

One new species of eriophyoid mite, *Notallus phlomicosae* Lotfollahi & Bahirai **sp. nov.**, associated with *Phlomis fruticosa* L. (Lamiaceae) is described and illustrated from Lorestan province of Iran. It is the first record of a *Notallus* species on plants of Lamiaceae. In addition, a key to the known *Notallus* mite species worldwide, table of morphological comparison among them and figures of their prodorsal shield patterns are provided.

KEY WORDS: Anthocoptini; Lorestan; *Phlomis fruticosa*; Phyllocoptinae; Trombidiformes.

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INTRODUCTION

The genus *Notallus* was established based on *Notallus nerii* Keifer found on Common Oleander, Rosebay, *Nerium oleander* L. (Apocynaceae) in Haad Yai, Thailand (Keifer 1975; Keifer and Knorr 1978). It has also been found in Kenya (Abou-Awad and El-Banhawy 1991), Iraq (Jarjes *et al.* 1989), China (Kuang *et al.* 2005) and Iran (Ramazani *et al.* 2006; Gharezare *et al.* 2013; Delfan *et al.* 2015). Members of the genus are spindle shaped, with three ridges on opisthosoma with the central ridge extended up to the setae *f* region, having all usual opisthosomal and leg setae for Eriophyidae, and a large broad based frontal lobe over gnathosomal base (Amrine *et al.* 2003).

The second species, *Notallus pterocaryae* Kuang & Luo, 2005 was described from Chinese Motherwort, *Pterocarya stenoptera* C. DC. (Juglandaceae) in Linfen city, Shanxi province, China.

The third species, *Notallus pestehae* Lotfollahi, de Lillo & Haddad, 2014 was collected and described from Pistachio, *Pistacia vera* L. (Anacardiaceae) in Gogan, East Azerbaijan province, Iran.

This genus is characterized by both lateral and middorsal ridges beginning on the fourth dorsal semiannulus which separates this genus from the closest three ridged genera *Abacarus* Keifer, *Tegolophus* Keifer and *Neocymoptus* Lin, Jin & Kuang with all ridges starting on the first semiannulus (Keifer 1975; Amrine *et al.* 2003); they are clear in *N. nerii* and *N. pterocaryae*. However, in *N. pestehae* lateral ridges begin from the first dorsal semiannulus (Lotfollahi *et al.* 2014).

Here, a fourth *Notallus* species is collected in Lorestan province of Iran and described from *Phlomis fruticosa* L. (Lamiaceae). The genus *Phlomis* L. (Lamiaceae) comprises more than 100 species distributed mainly in the Mediterranean region and eastwards to the western Himalayas.

Phlomis fruticose, the Jerusalem Sage, is a shrubby species of dry and warm habitats (De Filippis 1972; Mabberley 1997). Until now, only *Aceria onychia* (Nalepa, 1914) was reported from *Phlomis* spp. (type species is *P. fruticosa* collected in Croatia). The aim of the present study is description and illustration of the second species collected on plants of genus *Phlomis*.

MATERIAL AND METHODS

In order to start survey on the eriophyoid mite fauna of Lorestan province (Iran), plants of the Jerusalem Sage (Lamiaceae) were sampled during summer 2018 in Khorramabad city. Eriophyoid mites were recovered from the plant material by means of a modified washing method developed by Monfreda *et al.* (2007). The mites were directly slide mounted in Hoyer's medium (see Krantz and Walter 2009 for compositions) without previous clarification and fibers interposed between slide and coverslip. Then, the slides were dried in oven (48 °C) for about four weeks.

The terminology and the setal notation in the morphological description of the mite follow mainly Lindquist (1996).

All morphological measurements were taken by means of a phase contrast microscope Olympus BX53, 1,000 magnification (oil immersion) according to Amrine and Manson (1996) as modified by de Lillo *et al.* (2010), and are given in micrometers. The following modifications were used: dorsal semiannuli were counted from the first semiannulus behind the rear margin of the prodorsal shield; ventral semiannuli were counted from first complete annulus after coxae II; coxigenital semiannuli were counted medially from the coxal region to the anterior margin of the external genitalia and were not included in the ventral semiannuli count. Measurements and means are rounded off to the nearest integer when required except for the characters with very short length. Measurements refer to the length of the morphological trait unless otherwise specified and are given in micrometers. In the female description, the holotype measurements are followed by range values, in parentheses, of the studied population (*i.e.* holotype and paratypes); for males and immature stages, only the range values are given. The mean values of the paratypes are reported in the few cases in which the measurements of the holotype could not be taken, due to the slide mounting position of the specimens and were marked by an asterisk (*) in the description.

Line drawings were hand-drawn through a *camera lucida* according to de Lillo *et al.* (2010) and the abbreviations labelling schematic drawings in Fig. 1 follow mainly Amrine *et al.* (2003).

The genus classification follows Amrine *et al.* (2003); comparisons were made with new genera described since that publication.

Host plant names and their synonymies are in accordance with "*The Plant List on-line database*" (2013).

Type materials are deposited at the Acarology Laboratory, Department of Plant Protection, Faculty of Agriculture, Azarbaijan Shahid Madani University, Tabriz (Iran).

Family Eriophyidae Subfamily Phyllocoptinae Tribe Anthocoptini

Notallus phlomicosae Lotfollahi & Bahirai sp. nov. (Fig. 1)

Description

Female (measured specimens n = 8)

Body fusiform, 211* (175–229, excluding gnathosoma), 52 (51–57) thick, 41 (no range available) wide. **Gnathosoma** projecting obliquely downwards, chelicerae 28 (26–34), palp 25 (25–

38), palp coxal setae *ep* 2.5 (2.5–5), dorsal palp genual setae *d* 6 (5–6), unbranched. **Prodorsal shield** 50* (44–55) including frontal lobe, 39 (no range available) wide, sub-rhomboidal; broad-based and distally acuminate frontal lobe, 13* (10–15), over gnathosomal base. Shield pattern distinct, consisting of a short median line on posterior $\frac{1}{3}$ of prodorsal shield, admedian lines extended on more than posterior $\frac{2}{3}$ of prodorsal shield, connected to median line by a pair of transverse lines one at near the posterior margin and one at the anterior end of median line; one short transverse line extended from admedian lines toward lateral sides; short submedian lines on lateral sides of the prodorsal shield connected to one transverse line on their outside; two distinct close chambers delimited between lines. Tubercles of scapular setae *sc* on rear shield margin, 21 (no range available) apart, setae *sc* 50 (35–52), apex truncate with slight knob, directed backward, divergently. **Legs** with all usual segments and setae. Leg I 29 (27–31), femur 9 (7.5–9.5), genu 4 (4–6.5), tibia 5 (4–6), tarsus 6 (6–7), tarsal solenidion ω 10 (9–10) distally a few enlarged and rounded, empodium simple, 6 (5–6), 4-rayed; femoral setae *bv* 13 (11–14), genual setae *l''* 21 (20–21), paraxial tibial setae *l'* 6 (5–6), located in basal third of tibia, paraxial fastigial tarsal setae *ft'* 18 (15–18), antaxial fastigial tarsal setae *ft''* 22 (18–22), paraxial unguinal tarsal setae *u'* 3 (3–5). Leg II 26 (25–31), femur 8 (6–9.5), genu 4 (4–5), tibia 4 (3.5–5.5), tarsus 6 (5–7), tarsal solenidion ω 10 (9–11) distally rounded, empodium simple, 6 (5–6), 4-rayed; femoral setae *bv* 14 (13–17), genual setae *l''* 9 (7–9), paraxial fastigial tarsal setae *ft'* 4.5 (4–5), antaxial fastigial *ft''* 22 (20–22), paraxial unguinal tarsal setae *u'* 3 (3–4.5). **Coxisternal region** – Prosternal apodeme 6 (no range available), anterior setae on coxisternum I *lb* 10 (9–10), 8 (8–9) apart; proximal setae on coxisternum I *la* 28 (23–32), 6 (6–7) apart; proximal setae on coxisternum II *2a* 48 (35–48), 17 (15–17) apart; 3 (3–4) microtuberculate semiannuli between coxae and genital coverflap plus three broken transversal rows of lined granules at the base of the coverflap. Coxae with sparse dashes and dots. **External genitalia** 10 (no range available), 18 (no range available) wide, coverflap with 10 (no range available) longitudinal striae; setae *3a* 22 (18–22). **Opisthosoma** with 32 (27–33) dorsal semiannuli provided with three dorsal ridges; median ridge from third dorsal semiannulus extended up to 29 (22–30) semiannulus, lateral ridges from first dorsal semiannulus extended up to 21 (15–22) semiannulus; 65 (53–66) narrow ventral semiannuli. **Microtubercles** – No microtubercles visible on the dorsal semiannuli except on central part and lateral ridges of two first dorsal semiannuli with circular microtubercles and lateral ridges of third with faint elliptical microtubercles; circular, on posterior margin of ventral semiannuli; spiny on the rear margin of the last four dorsal semiannuli and elongated and linear on last 5 (5–6) ventral semiannuli. Setae *c2* 19 (15–21) on ventral semiannulus 12 (9–12), setae *d* 52 (41–52) on ventral semiannulus 24 (19–24); setae *e* 17 (13–17) on ventral semiannulus 40 (31–40); setae *f* 20 (18–21) on ventral semiannulus 60 (47–60); 5 (5–6) annuli posterior to setae *f*. Setae *h2* 54 (39–58) apically very fine, *h1* 3.5 (2.5–3.5).

Male (measured specimens n = 1) – Similar in shape and prodorsal shield arrangement to female. **Body** smaller than female, 177, 45 thick; palp genual setae *d* 5; prodorsal shield 48; setae *sc* 29, 19 apart. **Opisthosoma** with 27 dorsal semiannuli and 60 ventral semiannuli; 4 semiannuli between coxae and genitalia, with microtubercles similar to that of female. Setae: *lb* 12, *la* 20, *2a* 31, *c2* 21, *d* 64, *e* 16, *f* 32, *h1* 2.5, *h2* 47. Male genitalia 14 wide, setae *3a* 17, 11 apart.

Type host plant

Phlomis fruticosa L. (Lamiaceae), Jerusalem Sage.

Type locality

Faculty of Agriculture campus, Lorestan University, Khorramabad, Lorestan, Iran (33° 25' 45.2" N, 48° 15' 34.5" E), 1150 m above sea level, coll. F. Bahirai, 30 August 2018.

Type material

Holotype female circled with black ink among two females and one male mounted on one slide

(PF-IL-KD18B-1). Further paratypes: two females mounted on one slide (PF-IL-KD18B-2) and four females mounted singly on separate microscope slides (PF-IL-KD18B-3-6).

Relation to the host plant

Vagrant; no apparent damage was observed.

Etymology

The specific epithet is in genitive case and comes from the combination of the genus *Phlomi-* and the end of the species name *-cosae* of the type host plant.

Table 1. Morphological comparison among known *Notallus* species worldwide.

Character	<i>N. nerii</i>	<i>N. pterocaryae</i>	<i>N. pestehae</i>	<i>N. phlomicosae</i> sp. nov.
Setae <i>sc</i>	22 long, apex with slight knob.	17 long	42 (37–45) long, apex with slight knob.	50 (35–50) long, apex with slight knob.
Setae <i>c2</i> length	11	12	13 (11–15)	19 (15–21)
Setae <i>d</i> length	40	35	50 (43–51)	52 (41–52)
Setae <i>e</i> length	12	10	13 (13–15)	17 (13–17)
Setae <i>f</i> length	-	17	20 (15–23)	20 (18–21)
Setae <i>h1</i> length	4	absent	very minute about 1	3.5 (2.5–3.5)
Setae <i>3a</i> length	15	-	52 (43–52),	22 (18–22)
Number of dorsal semiannuli	31–32	21 (according to the drawing)	22 (21–23)	32 (27–33)
Median ridge begins from	forth dorsal semiannulus	forth dorsal semiannulus	forth dorsal semiannulus	third dorsal semiannulus
Lateral ridges begin from	forth dorsal semiannulus	forth dorsal semiannulus	first dorsal semiannulus	first dorsal semiannulus
Number of annuli after setae <i>f</i>	5–6	4	5	5 (5–6)
Coxae ornamentation	almost no ornamentation	no ornamentation	with sparse dashes in part lined	with sparse dashes and dots
Genital coverflap ornamentation	with about 6 weak longitudinal striae	with 8–12 longitudinal striae	with 14 (12–14) longitudinal striae	with 10 longitudinal striae
Empodium rays number	4	7	4	4

Differential diagnosis

Notallus phlomicosae sp. nov. is morphologically distinct from the other *Notallus* species worldwide (Table 1). The prodorsal shield of the new species has a reticulated pattern (Fig. 1-AD). On the contrary, the prodorsal shield of *N. pterocaryae* is smooth (Fig. 2-a). That of *N. nerii* is almost obscure with stronger admedian lines converging at rear shield center and submedian lines converging from dorsal tubercles (Fig. 2-b). Finally, that of *N. pestehae* is composed of a faint short median line on posterior ¼ of prodorsal shield, complete admedian lines close together in the middle of the prodorsal shield, and short submedian lines on posterior ⅔ of the prodorsal shield, connected to admedian lines with a pair of transverse lines (Fig. 2c). However, few similarities of the new species with *N. pestehae* have been found in the beginning of the lateral ridges from the first dorsal semiannulus, empodium four rayed and the length of setae *d*, *e* and *f*. Lateral ridges in *N. nerii* and *N. pterocaryae* begin from the forth dorsal semiannulus. The median ridge of *N. nerii*, *N. pterocaryae* and *N. pestehae* begins from the forth dorsal semiannulus whereas it begins from the third dorsal semiannulus in *N. phlomicosae* sp. nov.

Remarks

This is the first record of a *Notallus* species on plants of the family Lamiaceae.

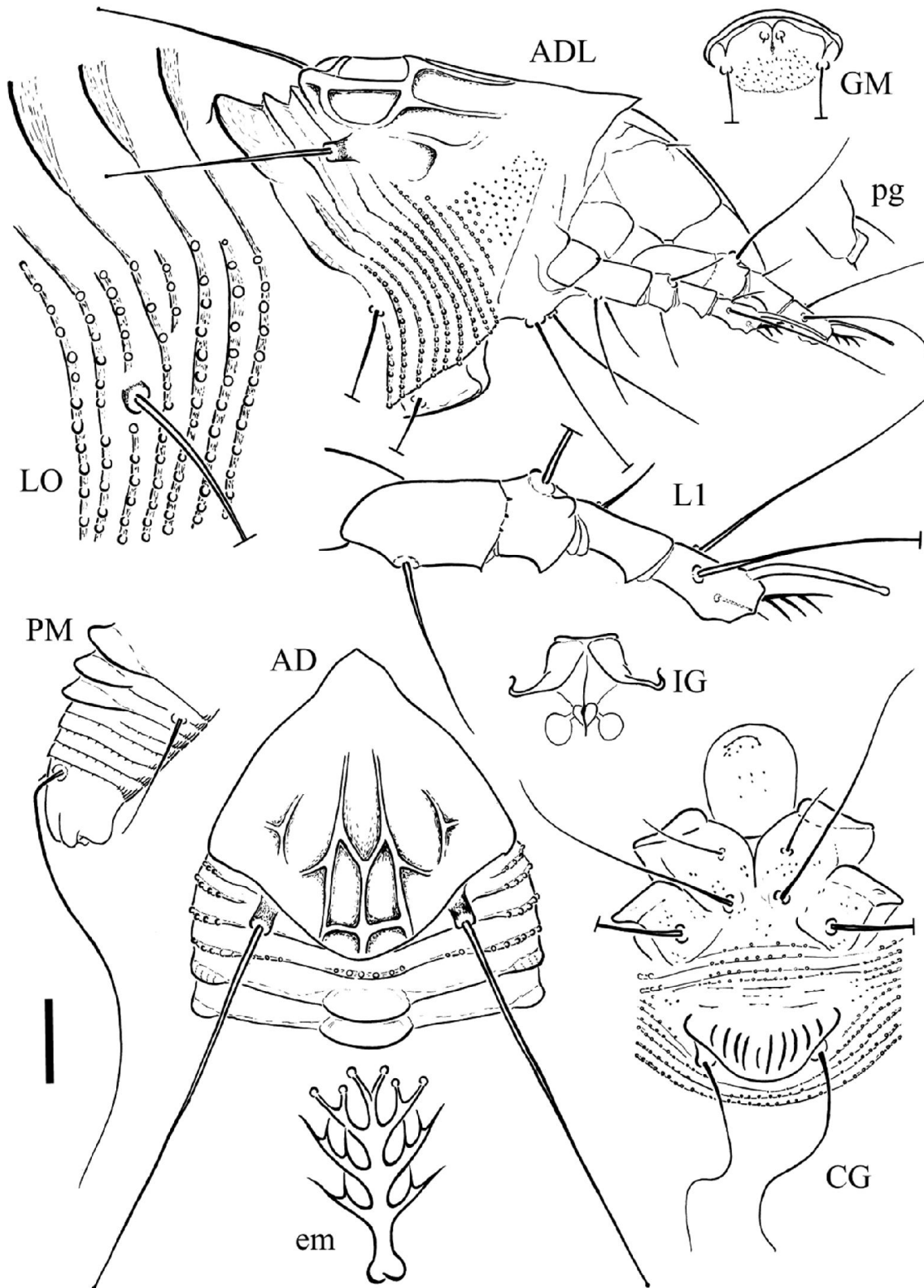


Figure 1. Schematic drawings of *Notallus phlomicosae* sp. nov. – AD = Prodorsal shield; ADL = Dorso-lateral view of female anterior body region; CG = Female coxigenital region; em = Empodium; GM = Male genital region; IG = Internal female genitalia; LO = Lateral view of annuli; L1. Leg I; pg = palp genua; PM = Lateral view of posterior opisthosoma. Scale bar: 10 μ m for AD, ADL, CG, GM, IG, pg, PM; 5 μ m for LO, L1; 2.5 μ m for em.

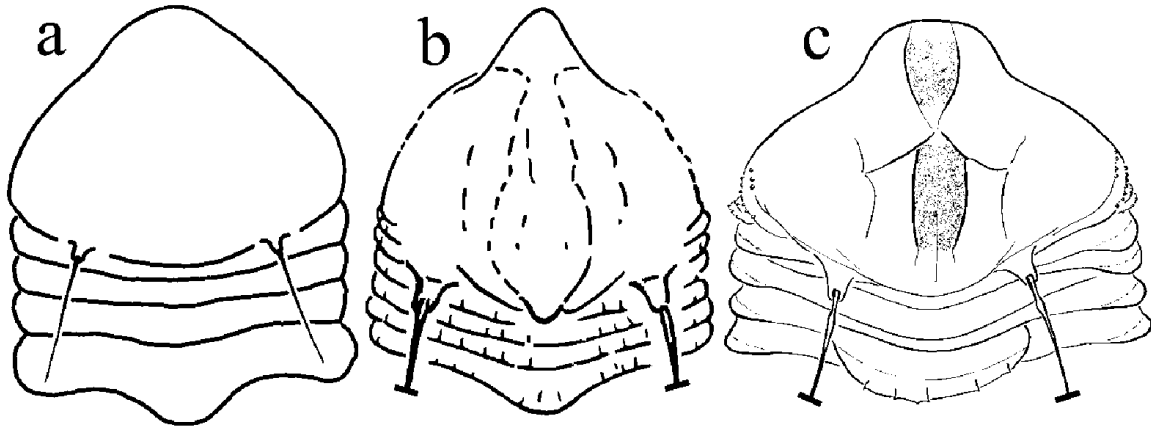


Figure 2. Schematic drawings of the prodorsal shield of *Notallus* species – a. *Notallus pterocaryae* Kuang & Luo, 2005 (redrawn from Kuang and Luo 2005); b. *Notallus nerii* Keifer, 1975 (redrawn from Keifer 1975); c. *Notallus pestehae* Lotfollahi, de Lillo & Haddad, 2014 (from Lotfollahi *et al.* 2014).

Key of the known *Notallus* species worldwide

1. Prodorsal shield smooth; empodium simple 7-rayed *N. pterocaryae*
 – Prodorsal shield ornamented; empodium simple 4-rayed 2
2. Prodorsal shield design almost obscure: without median line, stronger admedian lines converging at rear shield center, lateral lines converging from dorsal tubercles *N. nerii*
 – Prodorsal shield design almost distinct with short median line, admedian lines extended on more than basal third of prodorsal shield not converge at rear shield center 3
3. Prodorsal shield with a faint short median line on posterior ¼ of prodorsal shield not connected to complete admedian lines *N. pestehae*
 – Prodorsal shield with a distinct short median line on posterior ⅓ of prodorsal shield connected to admedian lines by a pair of transverse lines one at near the base and one at the end of median line *N. phlomicosae* sp. nov.

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REFERENCES

Abou-Awad, B.A. & El-Banhawy, E.M. (1991) New mites of the family Eriophyidae from Kenya (Acari: Eriophyoidea). *Acarologia*, 32(4): 329–333.

Amrine, J.W. Jr. & Manson, D.C.M. (1996) Preparation, mounting and descriptive study of eriophyoid mites. In: Lindquist, E.E., Sabelis, M.W. & Bruin, J. (Eds.), *Eriophyoid mites: Their biology, natural enemies and control*. World Crop Pests, Vol. 6, Amsterdam, The Netherlands, Elsevier Science Publishers, pp. 383–396.
[http://dx.doi.org/10.1016/s1572-4379\(96\)80023-6](http://dx.doi.org/10.1016/s1572-4379(96)80023-6)

Amrine, J.W. Jr., Stasny, T.A.H. & Flechtmann, C.H.W. (2003) *Revised keys to world genera of Eriophyoidea (Acari: Prostigmata)*. West Bloomfield, Michigan, USA: Indira Publishing House, 244 pp.

- De Filippis, R.A. (1972) Diapensiaceae to Myoporaceae In: Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.M., Walters, S.M. & Webb, D.A. (Eds.), *Flora Europaea*, Vol. 3. Cambridge University Press, Cambridge, pp. 144–145.
- de Lillo, E., Craemer, C., Amrine, J.W. Jr. & Nuzzaci, G. (2010) Recommended procedures and techniques for morphological studies of Eriophyoidea (Acari: Prostigmata). *Experimental and Applied Acarology*, 51(1-3): 283–307.
<http://dx.doi.org/10.1007/s10493-009-9311-x>
- Delfan, A., Jafari, S. & Shakarami, J. (2015) Fauna of a part of eriophyoid mites of Khoramabad region, Lorestan province. *Journal of Entomological Research*, 7(2): 143–159.
- Gharezade, M., Kamali, H. & Shirdel, D. (2013) Mite fauna of the superfamily Eriophyoidea (Acari: Prostigmata) associated with landscape plants and trees in Mashhad city, Iran. *Abstract book of the 2nd International Persian Congress of Acarology, Karaj, Iran*, 29–31 August 2013, p. 68.
- Jarjes, S.J., Al-Mallah, N.M. & Abdulla, S.I. (1989) Insects and mites pests survey on rose-bay shrubs in Mosul region with some ecological and biological aspects of (*Nipaecoccus viridis* New.) and (*Parlatoria crypta* M.) on rose-bay shrubs. *Mesopotamia Journal of Agriculture*, 21(3): 29.
- Keifer, H.H. (1975) *Eriophyid studies C-10*. Agricultural Research Service. United States Department of Agriculture, 24 pp.
- Keifer, H.H. & Knorr, L.C. (1978). Eriophyid mites of Thailand. *Plant Protection Service Technical Bulletin, Bangkok, Thailand*, 38: 1–36.
- Walter, D.E. & Krantz, G.W. (2009) Collecting, rearing, and preparing specimens. In: Krantz, G.W. & Walter, D.E. (Eds.), *A Manual of Acarology*, 3rd Edition. Lubbock: Texas Tech University Press, pp. 83–96.
- Kuang, H-Y., Luo, G-H. & Wang, A-W. (2005) *Fauna of eriophyid mites from China (II) (Acari: Eriophyoidea)*. China Forestry Publication House, Beijing, China, 176 pp.
- Lindquist, E.E. (1996) External anatomy and notation of structures. In: Lindquist E.E., Sabelis M.W. & Bruin J. (Eds), *Eriophyoid mites: Their biology, natural enemies and control*. World Crop Pests, Vol. 6, Amsterdam, The Netherlands: Elsevier Science Publishers. pp. 3–31.
[http://dx.doi.org/10.1016/S1572-4379\(96\)80003-0](http://dx.doi.org/10.1016/S1572-4379(96)80003-0)
- Lotfollahi, P., de Lillo, E. & Haddad Irani-Nejad, K. (2014) Three new species from the subfamily Phyllocoptinae (Acari, Trombidiformes, Eriophyidae) in Iran. *ZooKeys*, 426: 17–27.
<https://doi.org/10.3897/zookeys.426.8087>
- Mabberley, D.J. (1997) *The Plant-Book*. Cambridge University Press, Cambridge, XVI + 858 pp.
- Monfreda, R., Nuzzaci, G. & de Lillo, E. (2007) Detection, extraction, and collection of eriophyoid mites. *Zootaxa*, 1662: 35–43.
- Nalepa, A. (1914) Neue Gallmilben aus Dalmatien. *Marcellia*, 13(6): 181–184.
- Ramazani, L., Mosaddegh, M. S., Shishehbor, P. & Kamali, K. (2006) Seven new records of eriophyoid mites on weeds from Iran. *Abstract book of the 17th Plant Protection Congress of Iran, Karaj, Iran*, p. 185.
- The Plant List (2013) Version 1.1. Available from: <http://www.theplantlist.org/> (Accessed 26 January 2019).

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گونه جدیدی از جنس *Notallus* (Acari: Eriophyidae) روی *Lamiaceae* از ایرانفرشته بحیرایی^۱، شهریار جعفری^{۱*}، پریسا لطف‌الهی^۲ و جهانشیر شاکرمی^۱۱. گروه گیاهپزشکی، دانشکده کشاورزی، دانشگاه لرستان، خرم‌آباد، ایران؛ رایانامه‌ها: *jafari.s@lu.ac.ir* *fbahirai@yahoo.com**shakarami.j@lu.ac.ir*۲. گروه گیاهپزشکی، دانشکده کشاورزی، دانشگاه شهید مدنی آذربایجان، تبریز، ایران؛ رایانامه: *prslotfollahy@yahoo.com*

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چکیده

گونه‌ای جدید از کنه‌های اریوفیوئید، *Notallus phlomicosae* Lotfollahi & Bahirai **sp. nov.** در ارتباط با *Phlomis fruticosa* L. (*Lamiaceae*) در استان لرستان ایران توصیف و ترسیم شد. این نخستین گزارش گونه‌ای از جنس *Notallus* روی گیاهان خانواده *Lamiaceae* است. افزون بر آن، کلیدی برای تمامی گونه‌های شناخته شده *Notallus* در جهان، جدول مقایسه ریخت‌شناسی و تصاویری از صفحه‌ی پرودرسالی آنها آمده است.

واژگان کلیدی: Anthocoptini؛ لرستان؛ *Phlomis fruticosa*؛ Phyllocoptinae؛ Trombidiformes.

اطلاعات مقاله: تاریخ دریافت: ۱۳۹۷/۱۱/۱۲، تاریخ پذیرش: ۱۳۹۷/۱۲/۱۰، تاریخ چاپ: ۱۳۹۸/۱/۲۶