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Association of *Aceria cernuus* (MASSE, 1927) (Acari: Eriophyidae) with *Dolicolepta micrura* (BAGNALL, 1914) (Thysanoptera: Phlaeothripdae) on two species of *Zizipus*

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A b s t r a c t : The present research deals with a gall-forming eriophyoid mite, *Aceria cernuus* (Acari: Eriophyidae), on lotus trees, *Ziziphus nummularia* and *Z. spina-christi* (Rhamnaceae) which were collected in Larestan, Fars province, in the south of Iran. These gall-forming mites were obtained from twigs, leaves and petiole of this spiny trees. In the galls, these eriophyoid mites were associated with *Dolicolepta micrura* (BAGNALL, 1914) (Thysanoptera: Phlaeothripdae), a potential kleptoparasite of this mite.

K e y w o r d s : *Aceria cernuus*, *Dolicolepta micrura*, Eriophyidae, gall, kleptoparasite, *Ziziphus.*

Introduction

Eriophyoids have high potential as adventive mite species because of difficult detection due to their small size and easy distribution around the world (NAVIA et al. 2010). The importance of these mites are because of the direct damage to their hosts, their ability to transmit plant pathogens, and also the potential of them to use as biological agents for weed control (SKORACKA et al. 2010). Information on the behavior of these mites could be important to monitor pest populations or to develop better control methods (MICHALSKA et al. 2010). Furthermore, the potential risk of eriophyoid pests in the new environments can be evaluated by survey of their geographical distribution and their modes of dispersal (DE LILLO & SKORACKA 2010).

Eriophyoids have been reported on lots of hosts plants from different families which one of the hundreds of hosts is *Ziziphus* spp. (AMRINE & STASNY 1994). The genus *Ziziphus* MILL., 1768 (Rhamnaceae) commonly referred to jujubes comprises about 100 species of deciduous or evergreen trees and shrubs distributed in the tropical and subtropical regions of the world. Members of this genus can grow either as shrubs or trees with thorny branches and are used as a hedge to form defensive fences for animals (ABALAKA et al. 2010). *Ziziphus* species are multipurpose, they use as food, in medicine, and have other folkloric uses (NUHA-MOHAMMED 2015). This genus has small flowers; greenish and regular, shaft fruit, berry-like and freestone 2-4 (GHAHREMAN et al. 2007).

Several gall-making mites and insects have been reported on *Ziziphus* around the world (Table 1). ARBABI et al. (2002) has been recorded *Aceria cernuus* (MASSE, 1927) from Iran as *Eriophyes cernuus* without any data about its host. The objective of this study

was to report an eriophyoid species from Iran that is a gall-making agent on *Ziziphus nummularia* DC. and *Z. spina-christi* (L.) WILLD. Moreover, the association of these galls with a thrips species, *Dolicolepta micrura* (BAGNALL) has been investigated.

Materials and methods

During 2009-2013, in a faunistic survey on eriophyoid mites of Larestan (Fars province, southern Iran), some galls of twig, leaf and petioles of *Ziziphus nummularia* DC. and *Z. spina-christi* (L.) WILLD. (Rhamnaceae) were collected (Fig. 1). After opening the galls, some eriophyoid mites as well as thrips specimens were collected from the galls with a fine brush under binocular microscope. The mites were cleared in pure lactic acid and then mounted into Hoyer's medium (DE LILLO et al. 2009; JEPPSON et al. 1975; AMRINE & MANSON 1996). The slides were dried at approximately 40º C on a hot plate. Specimens were identified under a phase contrast microscope with 10× eyepieces using 100× oil immersion lens (BX51; Olympus Corporation, Tokyo, Japan). The eriophyoid mite specimens have been identified using available keys (Amrine et al., 2003; Massee 1927). Thrips specimens mounted on to the glass slides in Canada balsam according to a protocol by MOUND & KIBBY (1998). The specimens identified by a proper key (MINAEI & MOUND 2008). The materials were deposited in the Plant protection Department of Shiraz University, Fars province. All measurements are presented in micrometers (µm).

Results

The gall-forming eriophyoid mite, *Aceria cernuus* (MASSE, 1927), is collected, identified and illustrated from Iran as a new record for Larestan.

Aceria cernuus (MASSE, 1927)

Eriophyes cernuus MASSE (1927)

Material studied: 5♀♀, IRAN, Fars Province, Larestan, from jujube trees (*Ziziphus nummularia* DC. & *Ziziphus spina-christi* (L.) WILLD), 18.iix. 2009, 20.ix. 2009,1. vi. 2012, 7. i. 2012, 11. i. 2012, 14. i. 2012, 20. ix. 2012, 11. x. 2012, 4. xii. 2012, 23. x. 2013 (M. Majidi)

Diagnosis: Body of female mite spindle shaped, yellowish, 95 long, 50 wide Gnathosoma 14, projecting obliquely downwards, pedipalp seta d 4; Prodorsal shield 21 lenght, 37 wide, subtriangular without anterior lobe over cheliceral base, dorsal shield smooth, the pattern on sides of prodorsal shield composed of two short vertical lines, connected together with a transverse diagonal line, dorsal tubercles sc on rear shield margin with transverse basal axes, 20 apart, setae sc 18, directed postoriorly. Leg I 26.3, femur 5.3, seta (bv) 3.4; patella 2.6, seta (l″) 20; tibia 5.3, seta (l′) 8.3; tarsus 6, setae (ft′) 16, (ft″) 4.5; Unguinal seta (u′) 2; Claw 2; solenidion 6.6; empodium simple with 5 rayed. LegII 21, femur 4, seta (bv) 6.6; patella 5.3, seta (l″) 12; tibia 4; tarsus 6.6, setae (ft′) 14.4, (ft″) 4.7; Unguinal seta (u′) 2; Claw 6.6; solenidion 9; empodium simple with 5 rayed. Coxigenitalia area smooth, first coxal setae (1b) 11, tubercles 7 apart; second coxal setae (1a) 19, tubercles 7 apart; third coxal setae (2a) 30 tubercles 19 apart. Genitalia 10 length, 17 wide, female genital coverflap smooth; setae (3a) 24, 13 apart.Opisthosoma with about 60 narrow annuli; about 70 narrow and microtuberculateventeral annuli; lateral setae (c2) 24 on sternites 9; 1st venteral setae (d) 55 on

sternites 19, tubercle d 34 apart; 2nd venteral setae (e) 37, on sternites 36, tubercle 25 apart; 3rd ventral setae (f) 24, on sternites 5 from rear, caudal setae (h2) 45, accessory setae (h1) 8 (Fig. 2).

D i s t r i b u t i o n : Sudan (MASSE 1927), India (MUKHERJEE et al. 1994) and Iran (ARBABI et al. 2002)

Discussion

Aceria cernuus (MASSE, 1927) has been described for first time from galls of *Zizyphus* from Sudan (MASSE 1927) and it has recorded from Iran as *Eriophyes cernuus* without any knowledge of its host (ARBABI et al. 2002). This mite actually belongs to *Aceria*, In *Aceria* scapular seate are forward but in *Eriophyes* they are directed backward (AMRINE et al. 2003).

There is a probable competitive relationship between the eriophyoid mite, *Aceria cernuus* and *Dolicolepta micrura* thrips. In plant ecosystem, eriophyoids interact with other organisms in different ways. They compete with other herbivores and fungal pathogens (DE LILLO & SKORACKA 2010). Their feeding may have an antagonistic effect on predatory mites as frequently discovered (KASAI et al. 2005; NISHIDA et al. 2005). Sometimes eriophyoid feeding is beneficial for other organisms by making the host plant tissues more suitable to predators through their feeding (DE LILLO & SKORACKA 2010; SABELIS et al. 2008), be as food source for predatory mites and insects or by providing occupants for them; such as the association between gall-forming eriophyoids and some some tarsonemid mites due to the replacement or consumption of eriophyoid occupants. There are several reports on the presence of phytoseiid mites in eriophyoid galls; as seen *Neoseiulus hanselli* (CHANT & YOSHIDA-SHAUL) inside willow galls caused by *Aculus tetanothrix* (NALEPA) and *Carpinus tschonoskii* MAXIM in galls induced by *Acalitus* sp. The latter were observed preying on *Acalitus* sp. and reproducing in the galls (DE LILLO and SKORACKA 2010). It seems that the thrips, *Dolicolepta micrura* live in these galls as kleptoparasite as well as predator on leaves. In addition to Iran, this species is recorded from north Africa and southern Europe on *Acacia tortillas*, *Albizzi alebbekh* and *Zizyphus spina-christi* but with no biological data (MINAEI & MOUND 2008) and this survey revealed some biological aspect of the species. Parallely, the members of an Australian genus, *Koptothrips* BAGNALL live as kleptoparasites within the galls produced by various species of another genus, *Kladothrips* FROGGATT in Acacia trees (CRESPI et al. 2004). Further research is required to clarify whether the eriophyoid galls are beneficial for predator mites or insects as habitats.

According to existance of *Dolicolepta micrura* in all types of the galls, it can be concluded that it is a potential kleptoparasite of this mite. This probably invades the occupants produced by *Ziziphus* spp. to destroy the gall and use it to produce their own offspring.

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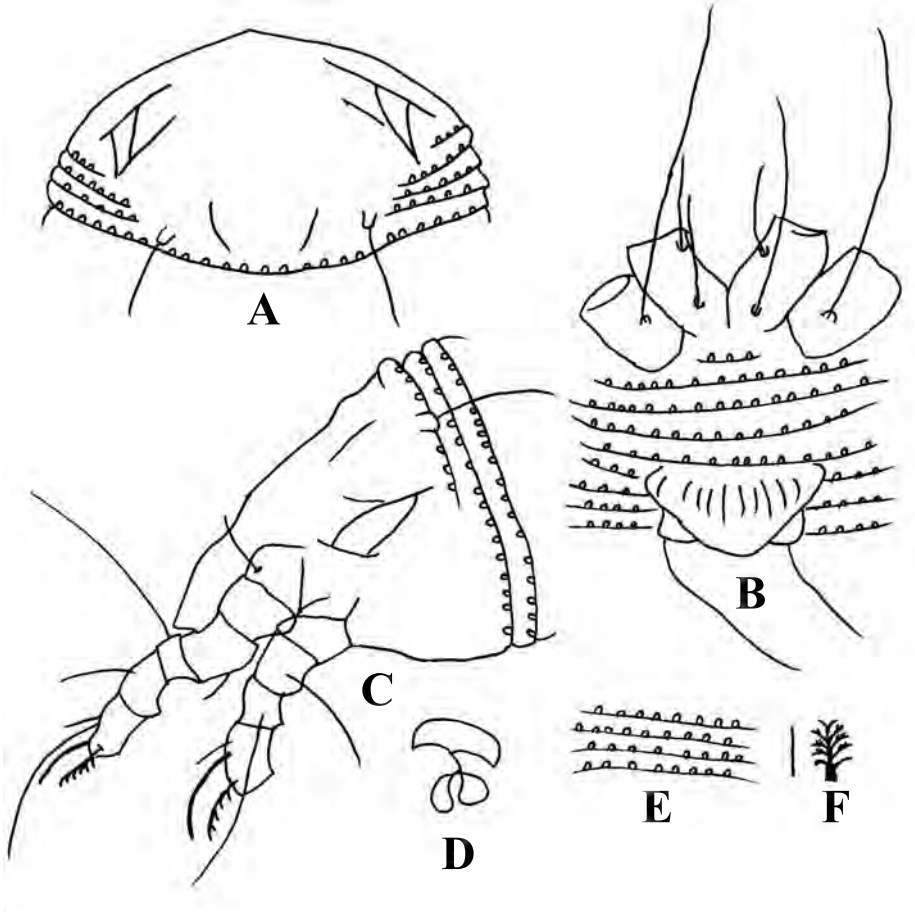

Fig. 1. *Aceria cernuus*; (**A**) prorodorsal shield, (**B**) coxigenital region, (**C**) leg I and II and lateral view of prodorsum, (**D**) internal female genitalia, (**E**) dorsal view of annuli, (**F**) empodium. Scale bar: 1 μm.

Fig. 2. View of the galls caused by *Aceria cernuus* on twig, leaf and petiole of *Ziziphus*.

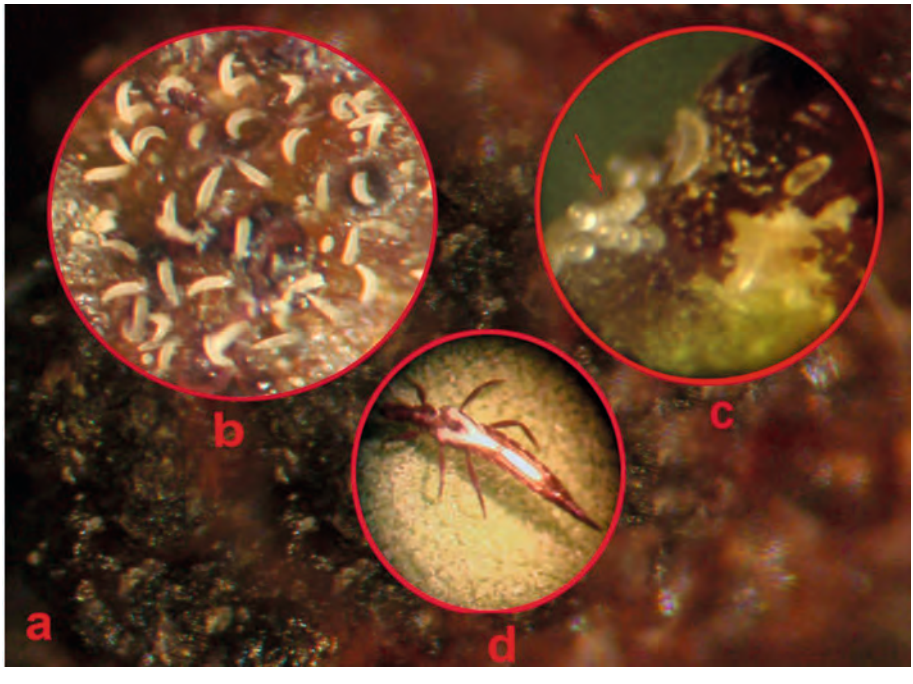

Fig. 3. close-up view of the gall (**a**); *Aceria cernuus* (**b**); eggs of *A. cernuus* (**c**) and *Dolicolepta micrura* (**d**).

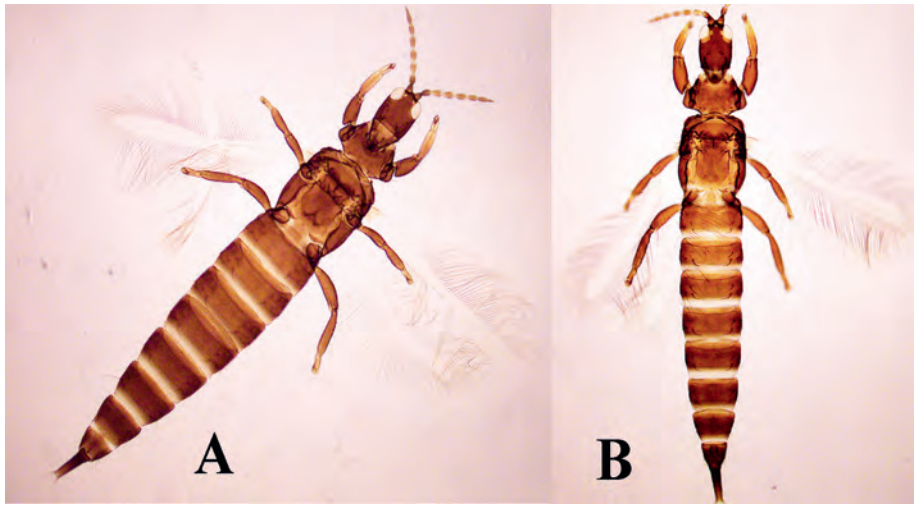

Fig. 4. Female (**A**) and male (**B**) of *Dolicolepta micrura*.

Tab. 1. Gall-forming agents on *Ziziphus* trees in the world.

Family	Scientific name	Year	Researcher	Country
Eriophyidae	*Aceria cernuus* (MASSE, 1927)	1927	MASSE	Sudan
Eriophyidae	*Aceria ghanii* (KEIFER, 1966)	1966	KEIFER	Pakistan
Tenuipalpidae	*Larvacarus transitans* (EWING, 1922)	1989	SHARMA & KUSHWAHA	India
Eriophyidae	*Eriophyes cernuus* (MASSEE, 1927)	1994	MUKHERJEE et al.	India
Eriophyidae	*Aceria ghanii* (KEIFER, 1966)	2001	CHARANASRI & KONGCHUENSIN	Thailand
Eriophyidae	*Eriophyes cernuus*	2002	ARBABI et al.	Iran (Sistan-Baluchestan and Hormozghan provinces)
Tenuipalpidae	*Larvacarus transitans* (EWING, 1922)	2006	SARWAR	Pakistan
Eriophyidae & Tenuipalpidae	*Eriophyes cernuus* & *Larvacarus transitans*	2011	SINGH & RAGHURAMAN	India
Cecidomyiidae	*Silvestriola spatulata* GROVER & BAKSHI, 1978 (SILVESTRINA)	2009	SHARMA	India
	Frauenfeldiella jamboolii GROVER, 1968	2009	SHARMA	India
	Phyllodiplosis jujubae GROVER & BAKSHI, 1978	2009	SHARMA	India
	Silvestriola jujubae CHANDRA, 1988	2009	SHARMA	India
Eriophyidae	*Aceria cernuus* (MASSE, 1927)	2009-2013	Present study	Iran (Fars province)