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Symbiotic ants (Hymenoptera: Formicidae) associated with aphids (Hemiptera: Aphididae) in Golestan province, Iran


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Introduction

Mutualistic interaction between aphids and ants is one of the classical examples of mutualism (Buckley, 1987; Holldobler, 1990; Keller & Gordon, 2010). There are numerous studies which focus on ant–aphid interactions, many of which indicate that ants are beneficial to aphids (Stadler & Dixon, 1999; Flatt & Weisser, 2000). Aphids provide honeydew (which is rich in carbohydrates) to ants and in return gain protection against natural enemies (e.g. Sudd, 1987; Dixon, 1998; Renault et al., 2005; Stadler & Dixon, 2008). Several lines of evidence show that ant attendance improves aphid reproductive performance and promotes developmental rates, and colony growth (Flatt & Weisser, 2000; Fischer et al., 2001; Stadler & Dixon, 2008; Mehrparvar et al., 2013).

Although aphids and ants are two important groups of insects but there are very few reports on the ant fauna associated with aphids in Iran (e.g. Shiran et al., 2013; Mortazavi et al., 2015). In spite of the fact that Iran is a large country which placed among three distinct realms i.e. the Palearctic, Afrotropical and the Oriental and has rich and diverse fauna and flora, but so far ant fauna has been poorly investigated. According to the recent studies on ant fauna of Iran (Ardeh, 1994; Paknia & Kami, 2007; Paknia et al., 2008; Firouzi et al., 2011; Hossein Nezhad et al., 2012; Shiran et al., 2013; Mortazavi et al., 2015; Hosseini et al., 2015), the number of ant species reported from Iran has reached over 219 species. Since the majority parts of Iran have not been explored, more new associations are expected to be discovered by further surveys in various parts of this country. The
aim of this study was to investigate the ant-aphid associations in Golestan province, North-East of Iran to contribute to the knowledge of myrmecophilous aphids and their mutualistic ant partners.

**Material and Methods**

This study was carried out from March 2013 to July 2014, weekly in Golestan province, Iran (Fig. 1). Aphids and their associated ants were collected on different host plants using hand or fine paintbrush, and preserved in 75% ethanol. Ant associations with aphids were approved in three ways by monitoring: a) ant antennation for stimulating aphids to secrete honeydew droplets, b) honeydew collection by ants and c) ants trail for honeydew collecting followed and measured from nest to aphids' colony for some colonies. After ants were transferred to the laboratory, samples were identified to the genus level using identification keys provided by Bolton and Ficken (1994) and Collingwood (1978). For confirmation, the samples were sent to Sandor Csoz (Hungarian Natural History Museum), Kadri Kiran (Trakya University, Turkey) and Mostafa Sharaf (King Saud University, Saudi Arabia). Microscopic slides of aphids were prepared from healthy samples using boiling with Canadabalsam method and then were identified to species level by the last author. Host plant species were identified by plant research Institute of Ferdowsi University of Mashhad.

Ant specimens are deposited in the insect collection of Department of Plant Protection, Faculty of Agriculture, Ferdowsi University of Mashhad, Mashhad, Iran. Aphid samples are deposited in Aphid Collection of Aphidology Research Group, Institute of Science and High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran.

**Results**

In this study, a total of 11 ant species belonging to two subfamilies (Formicinae and Myrmicinae) were collected associated with 12 aphid species belonging to two subfamilies (Aphidinae and Lachninae), from 19 host plants.

**Family Formicidae**

**Subfamily Formicinae**

*Formica clara* Forel 1889

**Material examined:** Golestan province, Gorgan, Khatir abad, 55 m.a.s.l., associated with *Aphis fabae* Scop on *vicia faba* L. (Fabaceae) (♀, 03.IV.2013, leg. S. M.; Khatir abad, 55 m.a.s.l., associated with *Pterochlorus persicae* Kholidk on *Prunus domestica* L. (Rosaceae) (♀, 08.VIII.2013 leg. S. M.

**Distribution in world:** Submeridional and meridional zones of Palaearctic, Northern parts of European range (Seifert, 1997; Seifert, 2007).

**Distribution in Iran:** Mazandaran (Gholami et al., 2012).

**Remark:** Body is medium-sized, whole body is dark brown. This species was collected from a temperate and humid climate with dense vegetation. This is a new record for Golestan province.

*Formica persica* Seifert & Schultz, 2009

**Material examined:** Golestan province, Ali abad, 119 m.a.s.l., associated with *Aphis ruborum* Borner on *Rubus fruticosus* L. (Rosaceae) (♀, 15.XI.2013 leg. S. M.; Gorgan, 134 m.a.s.l., associated with *Aphis spiraeola* Patch on *Citrus sinensis* L. (Rutaceae) (♀, 26.VII.2014, leg. S. M.

**Distribution in world:** This species has hitherto only been known from the North Iranian region of the Alburz Mountains (Seifert & Schultz, 2009).

**Distribution in Iran:** Mazandaran (Seifert & Schultz 2009, Gholami et al., 2012), Golestan (http://www.antweb.org/ir).
**Figure 1.** Distribution of sampling localities in Golestan province (The number correspond to map codes). 1) Gorgan (36°50'52.8534" N, 54°25'56.8158" E); 2) Aqqala (36°51'42.5412" N, 54°25'7.2756" E); 3) Khatir Abad (36°50'28.6512" N, 54°21'43.448"E); 4) Hashem Abad (36°53'16.7562" N, 54°20'56.4786"E); 5) Daland (37°1'56.2326" N, 55°3'5.2554" E); 6) Old road (36°50'25.1592" N, 54°24'8.0526" E); 7) Ali Abad (36°54'21.9924" N, 54°52'15.1386" E); 8) Amir Abad (36°52'31.2774" N, 54°25'50.6382" E); 9) Shastkolah (36°49'43.1466" N, 54°23'32.211" E)

Remark: Body is medium-sized, color of thorax and all body appendages brown, gaster always dark brown. This species was collected from an area with Mediterranean temperate climate.

**Lasius brunneus** (Latreille 1798)

**Material examined:** Golestan province, Gorgan, 134 m.a.s.l, associated with *Rhopalosiphum nymphaeae* Linnaeus on *Prunus domestica* L. (Rosaceae) (8♀), 17.IV.2014, leg. S. M.; Gorgan, Hashem abad, 9 m.a.s.l, associated with *Aphis gossypii* Glover on *Gossypium hirsutum* L. (Malvaceae) (7♀), 12.VII.2014, leg. S. M.

Distribution in world: The northern border of its distributional range is Sweden and South to Anatolia (Seifert, 1992).

Distribution in Iran: Northwest parts of Iran (Paknia et al., 2008).

Remark: Body is medium-sized, color of head, mesosoma and gaster is brown, whole appendage light yellowish brown. This species was collected from an area with Mediterranean temperate climate. This is a new record for Golestan province.

**Lasius turcicus** Santchi 1921

**Material examined:** Golestan province, Gorgan, 135 m.a.s.l., associated with *Aphis spiraceola* on *Citrus aurantium* L. (Rutaceae) (6♀), 17.IV.2013, leg. S. M.

Distribution in world: Known from France (4°E) eastwards to the Iran (49°E). The sites on the Greek islands Kos Rhodos are very near to Asia Minor (Seifert, 1992).

Distribution in Iran: Mashhad (Ghasemi et al., 2000), Tehran (Alipanah et al., 2000), Northern parts of Iran (Paknia et al., 2008), Mazandaran (Gholami et al., 2012), Mashhad (Mortazavi et al., 2015). This species was also reported in association with *Acyrthosiphon gossypii* Mordvilko on *Lepidium draba* L. (Brassicaceae); *Chaitophorus billerislambersi* Pintera on *Populus alba* L. (Salicaceae); *Brachycaudus*
amygdalius Schout on Prunus armeniaca L. (Rosaceae); *Aphis craccivora* Koch on Kochia sp. L. (Amaranthaceae); *Aphis craccivora* Koch on Hibiscus syriacus L. (Malvaceae) (Mortazavi et al., 2015); *Icerya purchasi* Maskell on Citrus aurantium L. (Rutaceae) (Gholami et al., 2012); *Acyrthosiphon pisum* Harris on Rhamnus sp. L. (Rhamnaceae); *Anoecia corni* Fabricius on Cornus sanguinea L. (Cornaceae); *Aphis craccivora* Koach on Rumex patientia L. (Polygonaceae); *Aphis craccivora* Koach on Sonchus arvensis L. (Asteraceae); *Aphis craccivora* Koach on Trifolium sp. L. (Fabaceae); *Aphis fabae* Scopoli on Valeriana sp. L. (Valerianaceae); *Aphis sambuci* Linnaeus on Sambucus ebulus L. (Adoxaceae); *Aphis spiraecola* Patch on Erica sp. L. (Ericaceae); *Aphis craccivora* Koach on Malus sp. L. (Rosaceae); *Brassica oleracea* cardui Linnaeus on Sinapis sp. L. (Brassicaceae); *Chaetosiphon tetrarhodum* (Walker) on Rosa sp. L. (Rosaceae); *Chaitophorus salicti* Schrank on Salix sp. L. (Salicaceae); *Cinara pilicornis* Hartig on Picea sp. L. (Pinaceae); *Cinara pini* (Linnaeus) on Pinus sp. L. (Pinaceae); *Myzus feracior* (Fabricius) on Cerasus avium (L.) (Rosaceae); *Myzus lythri* (Schrank) on Lythrum salicaria L. (Lythraceae); *Neobetulaphis pusilla* Basu on Alnus glutinosa (L.) (Betulaceae); *Pterochloroides persicae* Cholokovskij on Persica vulgaris (L.) (Rosaceae); *Toxoptera aurantii* Boyer on Malus sylvestris (L.) (Rosaceae); *Toxoptera aurantii* Boyer on Citrus nobilis L. (Rutaceae) (Akyildirim et al., 2014).

**Remark:** Body is medium-sized, color of head and gaster is yellowish brown, mesosoma and whole appendage is light yellowish brown. This species was collected from a temperate and humid climate with dense vegetation. This is a new record for Golestan province. Also this species was observed in association with *Icerya purchasi* Maskell on Citrus aurantium L. (Rutaceae) in Gorgan.

**Plagiolepis taurica** Santschi 1920


**Distribution in world:** Central and Eastern Europe, Asia Minor (Moscaliuc, 2009).

**Distribution in Iran:** Northern parts of Iran (Paknia et al., 2008), Mazandaran (Gholami et al., 2012). This species was also reported in association with *Toxoptera aurantii* Boyer on Hypericum sp. (Hypericaceae) (Akyildirim et al., 2014).

**Remark:** Body is medium-sized, whole body color is dark or brownish dark, body appendages are yellowish brown. This species was collected from a temperate humid climate with dense vegetation. This is a new record for Golestan province.

**Subfamily Myrmicinae**

**Cardiocondyla sp.**

**Material examined:** Golestan province, Gorgan, Hashem abad, 9 m.a.s.l., associated with *Aphis gossypii* Glover on Gossypium hirsutum L. (Malvaceae) (6♀), 12.07.2014, leg. S. M.
Symbiotic ants (*Hymenoptera: Formicidae*) associated with aphids

Distribution in world: This species is mostly distributed in the old world tropics and subtropics, but a few of which occurs in the temperate zone. Some species are also found widely spreaded in North America and the Pacific Islands, as a result of human introduction (Okita et al., 2013).

Distribution in Iran: Southern, Southwest and Northwest parts (Seifert, 2003; Gahari & Collingwood, 2011; Mohammadi et al., 2012), Northern parts (Gahari et al., 2009) of Iran.

Remarks: This species was collected from a temperate humid with dense vegetation.

*Crematogaster subdentata* Mayr 1877

**Material examined:** Iran: Golestan province, Aqqala, 70 m.a.s.l., associated with *Rhopalosiphum maidis* Fitch on *Zea mays* L. (♀), 05.VII.2013, leg. S. M.; Aqqala, 05.VII.2013, 70 m.a.s.l., associated with *Aphis craccivora* Koch on *Amaranthus retroflexus* L. (Amaranthaceae) (10♀), leg. S. M.; Aqqala, 70 m.a.s.l., associated with *Aphis gossypii* Glover on *Solanum melongena* L. (Solanaceae) (8♀), 05.VII.2013, leg. S. M.; Ali abad, 204 m.a.s.l., associated with *Aphis ruborum* Bornor on *Rubus fruticosus* L. (8♀), 05.VII.2013, leg. S. M.; Aqqala, 70 m.a.s.l., associated with *Aphis spiraecola* Patch on *Eriobotrya japonica* L. (Rosaceae) (8♀), 15.XI.2013, leg. S. M.; Aqqala, 70 m.a.s.l., associated with *Melanaphis donacis* Passerini on *Phragmites australis* L. (Poaceae) (8♀), 15.XI.2013, leg. S. M.; Aqqala, 70 m.a.s.l., associated with *Aphis sola* Theobald and *Aphis fabae* Scopoli on *Romex acetosella* L. (Polygonaceae) (8♀), 15.XI.2013, leg. S. M.; Aqqala, 70 m.a.s.l., associated with *Aphis craccivora* Koch on *Phasaeolous vulgaris* L. (Poaceae) (8♀), 15.XI.2013, leg. S. M.

Distribution in world: Central Asia, Afghanistan, Caucasus, China (Collingwood & Heatwole, 2000). Distribution in Iran: Northern parts of Iran (Paknia et al., 2008), Mashhad (Ghahari et al., 2009), Mashhad (Mortazavi et al., 2015).

This species was also reported in association with *Aphis craccivora* Koch on *Vitis* sp. L. (Vitaceae), *Aphis craccivora* Koach on *Carduus pyneocephalus* L. (Asteraceae), *Aphis craccivora* Koach on *Morus alba* L. (Moraceae), *Aphis solanana* Theobald and *Aphis fabae* Scopoli on *Romex acetosella* L. (Polygonaceae) (8♀), 15.XI.2013, leg. S. M.; Aqqala, 70 m.a.s.l., associated with *Aphis craccivora* Koch on *Phasaeolous vulgaris* L. (Poaceae) (8♀), 15.XI.2013, leg. S. M. This species was also reported in association with *Aphis davletshinae* Hille Ris Lambers on *Althaea rosae* L. (Malvaceae); *Aphis umbrella* Bornor on *Malva parviflora* L. (Malvaceae); *Aphis gossypii* Glover on *Brassicae kaber* wheeler; *Aphis gossypii* Glover on *Althaea rosae* L. (Malvaceae); *Myzus persicae* Sulzer on *Cydonia sp.* L. (Rosaceae); *Aphis gossypii* Glover on *Miralalis jalaya* L. (Shiran et al., 2013).

Remark: Body is medium-sized, head color is brown, mesosoma and whole body appendages are yellowish brown. This species was collected from a temperate and humid climate with dense vegetation. This is a new record for Golestan province.

**Pheidole pallidula** (Nylander 1849)

**Material examined:** Golestan province, Gorgan, Khatir abad, 55 m.a.s.l., associated with *Aphis gossypii* Glover on *Lagenaria vulgaris* L. (Cucurbitaceae) (8♀), 08.VIII.2013, leg. S. M.; Khatir abad, 55 m.a.s.l., associated with *Aphis frangulae* Kaltenbach on *Citrullus colocynthis* L. (Cucurbitaceae) (8♀), 08.VIII.2013, leg. S. M.

Distribution in world: Albania, Bulgaria, former Yugoslavia, Greece, Turkey (Agosti & Collingwood, 1987), France, Spain and Portugal (Collingwood, 1978), Slovenia (Bracko, 2007).

Distribution in Iran: Tehran (Alipanah et al., 1995), Mashhad (Ghasemi et al., 2000), Northwest parts of Iran (Paknia et al., 2008), Mazandaran (Ghahari et al., 2009), Mazandaran (Gholami et al., 2012), Khozestan, Esfahan (Shiran et al., 2013).

This species was also reported in association with *Aphis davletshinae* Hille Ris Lambers on *Althaea rosae* L. (Malvaceae); *Aphis umbrella* Bornor on *Malva parviflora* L. (Malvaceae); *Aphis gossypii* Glover on *Brassicae kaber* wheeler; *Aphis gossypii* Glover on *Althaea rosae* L. (Malvaceae); *Myzus persicae* Sulzer on *Cydonia sp.* L. (Rosaceae); *Aphis gossypii* Glover on *Miralalis jalaya* L. (Shiran et al., 2013).

Remark: Body is medium-sized, head and prothorax is light reddish brown, gaster is dark reddish brown. This species was collected from an area with a semi-arid climate and sparse vegetation cover. This is a new record for Golestan province.
**Pheidole teneriffana** Forel 1893

**Material examined:** Golestan province, Gorgan, 135 m.a.s.l., associated with *Aphis gossypii* Glover on *Schefflera arboricola* L. (Araliaceae) (8♀️), 17.IV.2013, leg. S. M.


Distribution in Iran: Tehran (Alipanah et al., 1995), Fars (Paknia, 2007), Northern and Southern parts of Iran (Paknia et al., 2008), Khozestan, Esfahan (Shiran et al., 2013).

This species was also reported in association with *Aphis umbrella* on *Malva parviflora* L. (Malvaceae); *Aphis craccivora* Koach on *Solanum melogena* L. (Solanaceae); *Aphis craccivora* Koach on *Hedra helix* L. (Araliaceae) (Shiran et al., 2013).

Remark: Body is medium-sized, color of body is reddish to darker brown, with significantly darker head and gaster. This species was collected from a temperate and humid climate with dense vegetation. This is a new record for Golestan province.

**Tetramorium caespitum** (Linnaeus 1758)

**Material examined:** Golestan province, Gorgan, Khatir abad, 55 m.a.s.l., associated with *Aphis gossypii* Glover on *Citrullus lanatus* L. (Cucurbitaceae) (8♀️), 08.VIII.2013, leg. S. M.

Distribution in world: Bulgaria, Greece, Turkey, former Yugoslavia (Agosti & Collingwood, 1987), Slovenia (Bracko, 2007).

Distribution in Iran: Gilan (Crawley, 1920), Mazandaran (Paknia & Kami, 2007), Northern and Southern parts of Iran (Paknia et al., 2008), Mazandaran (Ghahari et al., 2009), Mazandaran (Gholami et al., 2012), Esfahan (Shiran et al., 2013), Neyshabur (Hosseini et al., 2015).

This species was also reported in association with *Aphis fabae* Scopoli on *Heracleum* sp. L. (Apiaceae); *Aphis farinose* Gmelin on *Salix* sp. L. (Salicaceae); *Aphis gossypii* Glover on *Sahvia verticillata* L.; *Macrosiphoniella sanborni* Gillette on *Anthemis* sp. L. (Asteraceae) (Akyildirim et al., 2014); *Aphis fabae* Scopoli on *Tamarix* sp. L. (Tamaricaceae) (Shiran et al., 2013).

Remark: Body is medium to large sized, head, mesosoma and gaster dark brown, whole body appendages light brown. This species was collected from a temperate and humid climate with dense vegetation. This is a new record for Golestan province.

**Tetramorium chefketi** Forel, 1911

**Material examined:** Golestan province, Gorgan, Khatir abad, 55 m.a.s.l., associated with *Aphis fabae* Scopoli on *Vicia faba* L. (Fabaceae) (3♀️), 15.IV.2014, leg. S. M.; Gorgan, Hashem abad, -9 m.a.s.l., associated with *Aphis gossypii* Glover on *Gossypium hirsutum* L. (Malvaceae) (6♀️), 12.VII.2014, leg. S. M.

Distribution in world: Southern Balkan peninsula, Southern part of Eastern Europe, Turkey, Caucasus, Middle Asia, Kazakhstan and Turkmenistan (Csosz et al., 2007).

Distribution in Iran: Tehran (Alipanah et al., 1995), Northern parts of Iran (Paknia et al., 2008), Mashhad (Mortazavi et al., 2015), Kashmar (Hosseini et al., 2015).

This species was also reported in association with *Aphis craccivora* Koch on *Fraxinus* sp. L. (Oleaceae) (Mortazavi et al., 2015); *Brachycerus cardui* Linnaeus on *Echium vulgare* L. (Boraginaceae); *Cinara pilicornis* Hartig on *Picea* sp. L. (Pinaceae) (Akyildirim et al., 2014).

Remark: Body is medium to large sized, whole body and appendages dark brown to black. This species was collected from a temperate and humid climate with dense vegetation. This is a new record for Golestan province.
**DISCUSSION**

Among the ant species identified in this study, the most frequent observed mutualistic ant species were *Crematogaster subdentata* and *Plagiolepis taurica*, respectively. *Crematogaster subdentata* was in association with eight aphid species on nine host plants. This ant was only collected in association with *A. craccivora* from Iran (Mortazavi et al. 2015), whereas in current work the *C. subdentata* ants were reported in association with 7 other aphid species including *R. maidis, A. gossypii, A. ruborum, A. spiracola, M. donacis, A. solanella, A. fabae*. The genus *Crematogaster* is a worldwide distributed myrmicine ant, collected in disturbed environment near human settlements (Bolton et al., 2006). The *C. subdentata* ant nest generally in the soil but like most species of *Crematogaster* is very dependent on quality and quantity of homoptera honeydew on trees and shrubs (Collingwood & Heatwole, 2000). It seems that diversity of this ant species enhanced with increases in size and geographical spread of human population and the diversity of plant species. To our knowledge, the *P. taurica* ant was not reported in association with any aphid species from Iran (Shiran et al., 2013; Mortazavi et al., 2015), but interestingly this ant species was found in association with five aphid species in Golestan province. This ant nests under the stones in forest and open spaces, and has a preference for sweet liquids such as homoptera honeydew and extrafloral nectar (Moscaliuc, 2009). This species was collected in all localities of current study. This indicates that it is a widespread species adapted to various climates and environmental conditions of Golestan province.

Numerous different factors might influence the relationship between mutualistic ants and myrmecophilous aphids such as density of aphids and ants, host plant species and its characteristics, environmental conditions as well as geographical distribution (Stadler & Dixon, 2005). However, the relationship between ants and aphids is not always mutualistic; in some cases ants prey upon aphids (Sudd, 1987; Billick et al., 2007). For example, the sycamore aphid *Drepanosiphum platanoides* (Schrank) is frequently preyed by the wood ant, *Formica rufa* (L.) (Skinner, 1980).

Tending by ants of an aphid species may cause the extinction of other competitor aphid species (Addicott, 1978a). Ant attendance also could have an effect on extinction of tending aphid populations, for example, Addicott (1978b) showed that the populations of three species of aphids of the genus *Aphis* tended by ants had lower extinction rates than untended populations of the same species. In another study, Tilles & Wood (1982) revealed that colonies of *Cinara* spp. infesting white fir were more likely to go extinct if not attended by ants. In general, mutualistic ants—aphids interactions could have a crucial impact on the community dynamics of aphids and potentially might alter the ongoing community processes.

There are a very few studies on mutualistic ants associated with aphids in Iran but see (Shiran et al., 2013; Mortazavi et al., 2015), so it is needed to investigate interactions between aphids and ants throughout Iran. It is expected that these preliminary results stimulate further studies in this context and provide a base for studies on different interactions between aphids and their attendant ants which have been ignored so far in Iran.

**Acknowledgments**

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LITERATURE CITED


Symbiotic ants (Hymenoptera: Formicidae) associated with aphids


First record of the genus *Sericothrips* (Thysanoptera: Thripidae) in Iran

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The genus *Sericothrips* Haliday is reported for the first time from Iran, based on the specimens collected on *Lotus* sp. and identified as *S. bicornis* (Karny). This is the third genus of subfamily Sericothripinae in Iran, and illustrations are provided to identify this species. The number of Thysanoptera genera now known from Iran is discussed, as well as the host associations of Iranian Sericothripinae.

**Key words:** Iran, genus, new record, Urmia, thrips.

**INTRODUCTION**

Thirteen families of insect order Thysanoptera or thrips are recognized, including 5 known only from fossils (Mound, 2011a). Of the eight living families, the members of family Thripidae have the most close association with plants. In this family, four subfamilies (Dendrothripinae, Panchaetothripinae, Sericothripinae, Thripinae) are recognized. Within Thripinae, most species feed on leaves or pollen although *Scolothrips* Hinds species exclusively prey on tetranychid mites on various plant leaves (Mound, 2011b; Minaei & Abdollahi, 2015) and *Frankliniella occidentalis* (Pergande), *F. schultzei* (Trybom) and *Thrips tabaci* Lindeman also sometimes feed on mites despite being important pest species (Mound & Teulon, 1995; Wilson et al., 1996). In two subfamilies Dendrothripinae and Panchaetothripinae, all species feed on leaves. The leaf-feeders are usually associated with young leaves, but some panchaetothripine species are associated with older leaves (Mound & Marullo, 2006). The species in the other subfamily, Sericothripinae, are associated with flowers and leaves (Mound & Tree, 2009). This subfamily (with 152 species) is the second largest one in comparison with Thripinae with 1690 species, the Panchaetothripinae with 135 species and the Dendrothripinae with 93 species (ThripsWiki, 2015).

Although 15 genera have been erected in this subfamily (Mound & Tree, 2009), currently only three genera are recognised for all 152 species. The species in *Hydatothrips* Karny and *Neohydatothrips* John are always fully winged, whereas *Sericothrips* Haliday includes all of the species in the group that are known to produce short-winged adults. However, the generic classification is thought to be a poor reflection of phylogeny, and *Sericothrips* appears to comprise species which show some level of wing-length reduction (Mound & Tree, 2009).

*Sericothrips* comprises eight species, seven of these being Palearctic or Nearctic in distribution (ThripsWiki, 2015) including *S. bicornis* (Karny) and *S. staphylinus* Haliday from Europe (zur Strassen, 2003) and one, *Sericothrips sativus* Hartwig from South Africa (Hartwig, 1952). Up to know, six species in the two genera *Hydatothrips* and *Neohydatothrips* are recorded from Iran (Minaei, 2016). In this paper, *Sericothrips bicornis* is recorded from the third genus, and the diagnosis characters are
illustrated. Furthermore, the number of Thysanoptera genera now known from Iran is discussed, also the host associations of Sericothripinae in Iran. Full nomenclatural information about Thysanoptera is available on the web (ThripsWiki, 2015).

**Material and Methods**

Thrips specimens discussed in this paper were collected into ethanol (70 %), and subsequently mounted onto slides in Hoyer's medium using a form of the protocol given in Mound and Kibby (1998) with some modifications. The photomicrographs were obtained using a Motic BA310 microscope with attached camera. Terminology follows Wang (2007) and Mound and Tree (2009). Most of the specimens are deposited in Department of Plant Protection, Shiraz University, Iran (PPSU).

**Results**

*Sericothrips Haliday, 1836: 444. Type-species *Sericothrips staphylinus* by monotypy.*

Usually micropterous, females rarely micropterous, Head transverse, wider than length, 3 pairs of ocellar setae present; antenna 8-segmented, segments III & IV each with a forked sense cone, segments V and VI with longitudinal sensorium; occipital apodeme present; pronotum reticulate, with a chitinized plate (blotch); mesosternum with spinula; metanotum with transverse rows of coarse microtrichia on posterior third. All femora and tibiae with closely spaced transverse rows of microtrichia. tarsi 2-segmented; first vein of forewing (if present) with a continuous row of setae, second vein with few distal setae or no setae, posterior fringe cilia wavy; abdominal tergites covered medially and laterally with microtrichia, major setae arising submarginally, posterior margins with complete microtrichial comb, median setae similarly placed and of equal size.

*Sericothrips bicornis* (Karny)

*Rhytidothrips bicornis* Karny, 1910: 50.

**Diagnosis:** Female microptera. Body generally brown, antennal segments I-II yellow, III shaded; abdominal tergites I–VI pale brown, antecostal ridges on terga II–VII dark brown, all tibiae and tarsi brownish yellow, distal part of femora yellow, major setae shaded (Fig. 1). Head wider than long; three pairs of ocellar setae present, ocellar setae III situated almost outside of ocellar triangle (Fig. 4); occipital apodeme very near to posterior margin of eyes; maxillary palps 3 segmented. Antennae 8-segmented (Fig. 3), segments I-III with microtrichia, III and IV each with forked sense cone. Pronotum wider than long, reticulate with a large blotch and thick setae (Fig. 5); metanotum with transverse band of microtrichia, median setae situated behind anterior margin (Fig. 7). Legs bearing microtrichia (Fig. 6). Abdominal tergites with dense rows of microtrichia; tergites I–VIII with posteromarginal comb complete medially (Fig. 8), median setae placed equidistant on terga I–VIII. Abdominal sternae without discal setae; sternae II–VI with setae on posterior margin, on VII situated anterior to margin.

Male microptera, similar to female but smaller (Fig. 2) with a small circular pore plate on abdominal sterna IV–VII (Fig. 9).

**Remarks.** *S. bicornis* is similar to *S. staphylinus* Haliday. However, transverse band of metanotal microtrichia (instead of the irregular group in *S. staphylinus*); also the relatively posterior position of the metanotal median setae (Fig. 7) are distinctive in *S. bicornis*.

**Material examined.** Iran. 3 females, 2 males, Urmia, West Azerbaijan province, from *Lotus sp.*, 6 June 2014. 37° 39', 31.09" N, 44° 59' 27.06" E (Mohammad Poorkashkooli).
FIRST RECORD OF THE GENUS *SERICOTHRIPS* IN IRAN

Figures 1–5. *Sericothrips bicornis* (1) female; (2) male; (3) Antenna (female); (4) Head (female); (5) Pronotum (female).
FIGURES 6–9. *Sericothrips bicornis* (6) fore leg (female); (7) mesonotum and metanotum (female); (8) Abdominal tergites 5-6 (female); (9) Abdominal tergites 5-7 (male).

DISCUSSION
According to Minaei (2013), 70 genera of Thysanoptera from 5 families have been recorded in Iran. At the same time, Mirab-balou (2013) listed 74 genera in his Iranian checklist. On the other hand, *Liophloeothrips* Priesner as well as *Florithrips* Bhatti were missing from Minaei’s checklist (Minaei, 2013), and *Hydatothrips* was not included because the paper reporting the genus was published simultaneously (Mirab-balou et al., 2013). Finally, in contrast to Mirab-balou (2013), the report of *Chaetanaphothrips* Priesner in Iran was rejected by Minaei (2013). So, if we consider 70 genera listed by Minaei (2013) together with *Florithrips*, *Hydatothrips* and *Liophloeothrips*, 73 genera have been reported until 2013. Furthermore, five other genera have been added after that checklist: *Iranodendrothrips* Alavi, Minaei and Fekrat (Alavi et al., 2014), *Eryngyothrips* Bhatti (Minaei et al., 2014), *Karnyothrips* Watson (Miramirkhani et al., 2014), *Nesothrips* Kirkaldy (Mirab-balou, 2014) and *Podothrips* Hood (Minaei, 2015). Considering the synonymy of *Ataliothrips* Bhatti with *Liothrips* Uzel (Minaei & Mound, 2014) and the record of *Sericothrips* in this paper, the number of thrips genera in Iran is now 78.

Many thrips species are highly dispersive in their behavior, thus adults land on a wide range plants, on which they cannot breed and may not even be able to feed (Mound, 2013). In addition, it seems
likely that host exploitation in Sericothripinae has involved capture of various unrelated plant species. Despite these, in Iran there is evidence that most species in this subfamily are in association with Fabaceae. Beside the report of S. bicornis in the present paper on Lotus (Fabaceae), Neohydatothrips tadzhicus as well as N. gracilicornis are usually collected on various species of Fabaceae especially Glycyrrhiza glabra and Medicago sativa although there are a few other plant families from which these species have been collected (Mortazawicha and Dern, 1977; Cheraghian, 1996; Minaei et al., 2002; Alavai and Kamali, 2003). Moreover, the present author usually collects N. tadzhicus (Pelikan) from Glycyrrhiza glabra in Fars province, south of Iran. Also, there are a few specimens of Neohydatothrips gracilicornis Williams in PPSU collected on Medicago sativa from East Azarbaijan. In Europe, this species is generally considered specific to Fabaceae such as Vicia cracca, but it has also been reported causing damage to the needles of Pinus in Italy and Spain (Marullo, 1990). Neohydatothrips gracilipes (Hood) was reported by Mirab-balou and Chen (2013) from Alborz province on Glycyrrhiza glabra, and Neohydatothrips ilamensis Mirab-balou, Jamali and Tong was collected on the flowers of Cicer arietinum (Fabaceae) from Ilam province (Mirab-balou et al., 2014). The fifth species of Neohydatothrips, N. abnormis (Karny) was collected on Astragalus sp. (Fabaceae) from Kohgiluyeh and Boyer-Ahmad province (Minaei, 2016). In contrast Hydatothrips abdominalis (Kurosawa) is recorded from Kurdistan province on Poaceae (Mirab-balou & Chen, 2013).

As the European species S. staphylinus was introduced to Hawaii and Australia for the biological control of the noxious weed, Ulex europaeus (Ireson et al., 2008), it seems that there is a possibility that some of the seven Sericothripinae species in Iran may have some use as biological control agents for weedy Fabaceae.

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LITERATURE CITED


A checklist of Iranian Deltocephalinae (Hemiptera: Cicadellidae)

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By using published records and original data from recent research, the first checklist for subfamily Deltocephalinae from Iran is presented. This study is based on a comprehensive review of literatures and the examination of some materials from our collection. The present checklist contains 184 species belonging to 74 genera. In addition, for each species, the known geographical distribution in Iran and in the world is reported.

Key words: leafhoppers, records, subfamily, distribution, Iran.

INTRODUCTION
Zahniser and Dietrich (2013) stated that currently Deltocephalinae contains 6683 valid species and 923 genera, making it the largest subfamily of Cicadellidae based on the number of described species. The subfamily is distributed worldwide, and it contains the majority of leafhoppers vectoring economically important plant diseases, some of which cause significant damage and economic loss”. Many species feed on herbaceous or woody dicotyledonous plants, while about 1/3 of the tribes specialize on grass and sedge hosts and are particularly diverse and abundant in grassland ecosystems (Dietrich, 2005). The history of the faunistic studies on leafhoppers in Iran is mainly based on Dlabola's investigations (1957; 1958; 1960; 1961; 1964; 1971; 1974; 1977; 1979; 1981; 1984; 1987; 1994). After that new data on the Iranian leafhoppers were so scarce. Just Mirzayans (1995) has published a checklist of Auchenorrhyncha in the insect collection of Plant Pests and Diseases Research Institute. As Iranian researchers have been published their reports almost in local journals or presented them at national scientific congresses, it is really difficult for a foreign researcher to access these literatures. The present checklist is a survey to collect the results of all identified deltocephalinae in Iran and to indicate their taxonomic status and distribution. Also distribution in the world is added as much as possible. It can be a helpful reference for who are interested in Iranian Deltocephalinae.

MATERIAL AND METHODS
The first checklist of the Iranian Deltocephalinae was assembled using published records and original data. Species referred to in postgraduate theses and some scientific meetings are not formal publications not considered herein. For each species, the Iranian provinces are cited where the species has been collected (Fig. 1). The material examined were confirmed by Dr. Michael R. Wilson (National Museum of Wales, UK) and deposited in Jalal Afshar Zoological Museum at University of Tehran (JAZMUT).

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RESULTS
Subfamily Deltocephalinae Fieber, 1947
Genus *Acacimenus* Dlabola, 1979
*A. makranus* Dlabola, 1979
Records: Hormozgan, Mazandaran, Sistan & Balouchestan Provinces (Dlabola, 1984; Mirzayans, 1995).
Distribution: Iran, Saudi Arabia (Dlabola, 1979; Nast, 1982).

Genus *Aconura* Lethierry, 1876

*Aconura (Aconura) amitina* (Melichar, 1902)
Distribution: Afghanistan, Azerbaijan, European Russia, Georgia, Iran, Israel, Kazakhstan, Kyrgyzstan, Saudi Arabia, Tadzhikistan, Turkmenistan, Uzbekistan (Metcalf, 1967; Nast, 1972; Dlabola, 1979).
**A Checklist of Iranian Deltocephalinae**

*Aconura (Aconura) jakowlefi* Lethierry, 1876  
**Records:** Boushehr, Qom, Golestan, Khuzestan, Lorestan Provinces (Mirzayans, 1995).  
**Distribution:** European Russia, Iran (Metcalf, 1967).

*Aconura (Aconura) volgensis* Lethierry, 1876  
**Records:** Khuzestan, Sistan & Balouchestan Province (Dlabola, 1971).  
**Distribution:** European Russia, Iran, Kazakhstan, Kyrgyzstan, Tadzhikistan, Turkey, Turkmenistan, Uzbekistan (Metcalf, 1967; Nast, 1972).

**Genus Aconurella** Ribaut, 1948  
*Aconurella prolixa* (Lethierry, 1855)  
**Material examined:** Iran: Kerman Province: Bam, Baravat, 19.Sep.2010, 2 ♂ and 5 ♀, in palm trees by sweeping, leg.: F. Pakarpour (JAZMUT).  
**Records:** Alborz, Kerman, Kouzestan, Sistan & Balouchestan, Tehran, W. Azarbaijan Provinces (Dlabola, 1960; 1971; Mirzayans, 1995).  
**Distribution:** Oriental and Palearctic (Metcalf, 1967; Nast, 1972).

**Genus Aglena** Amyot & Serville, 1843  
*Aglena ornata* (Herrich–Schäffer, 1838)  
**Records:** Unknown locality.  
**Distribution:** Albania, European Russia, France, Germany, Greece, Iran, Italy, Morocco, Romania, Spain, Turkey, Ukraine (Metcalf, 1967; Nast, 1972).

**Genus Anaconura** Emeljanov, 1999  
*Anaconura instabilis* (Ribaut, 1948)  
**Records:** Hormozgan, Sistan & Balouchestan Provinces (Dlabola, 1994).  
**Distribution:** Cyprus, Greece, Iran, Saudi Arabia, Turkey (Metcalf, 1967; Dlabola, 1979; Kartal, 1982).

**Genus Anoplotettix** Ribaut, 1942  
*Anoplotettix golestanicus* Dlabola, 1984  
**Records:** Golestan Province (Dlabola, 1984).  
**Distribution:** Iran (Dlabola, 1984).  

*Anoplotettix guilanicus* Dlabola, 1981  
**Distribution:** Iran (Dlabola, 1981).

*Anoplotettix hyrcanus* Dlabola, 1981  
**Records:** Golestan, Guilan, Mazandaran Provinces (Dlabola, 1981; Mirzayans, 1995).  
**Distribution:** Iran (Dlabola, 1981).

**Genus Arocephalus** Ribaut, 1946  
*Arocephalus longiceps* (Kirschbaum, 1868)  
**Records:** Tehran Province (Mirzayans, 1995).  
**Distribution:** Iran, Mongolia, Western Palearctic (Dlabola, 1967a; Metcalf, 1967; Nast, 1972).

*Arocephalus remanei* Dlabola, 1971  
**Records:** Guilan, Tehran Provinces (Dlabola, 1972; Nast, 1982; Mirzayans, 1995).
Distribution: Iran (Nast, 1982).

Genus *Balclutha* Kirkaldy, 1900

*Balclutha flavella* Linnavuori, 1962

**Material examined:** Iran: Kerman Province: Jiroft, Dalfard, 13.Mar.2010, 3 ♂ and 2 ♀, with light trap, leg.: F. Pakarpour (JAZMUT).

**Records:** Kerman, Kordestan, Tehran Provinces (Mirzayans, 1995).

**Distribution:** European Russia, Iran, Israel (Linnavuori, 1962).

*Balclutha frontalis* (Ferrari, 1882)

**Records:** Khouzestan, Tehran Provinces (Dlabola, 1971; Mirzayans, 1995).

**Distribution:** This species has cosmopolitan distribution (Delong & Davidson, 1933; Metcalf, 1967; Cavichioli & Zanol, 1991).

*Balclutha punctata* (Fabricius, 1775)

**Records:** Guilan Province (Mirzayans, 1995).

**Distribution:** Nearctic, Oriental and Palearctic (Metcalf, 1967).

*Balclutha rosea* (Scott, 1876)

**Material examined:** Iran: Kerman Province: Khabr National Park, 5.Aug.2010, 2 ♂ and 5 ♀, swept on grassland, leg.: F. Pakarpour (JAZMUT).

**Records:** Kerman Province (Pakarpour & Nozari, 2011a).

**Distribution:** Eastern Palearctic, Western Palearctic (Metcalf, 1967).

*Balclutha rufofasciata* (Merino, 1936)

**Material examined:** Iran: Kerman Province: Shahdad, 10.Apr.2010, 14 ♂ and 23 ♀, in palm trees with light trap; Rahmat Abad Rigan, 23.Sep.2010, 12 ♂ and 7 ♀, in Citrus trees by sweeping, leg.: F. Pakarpour (JAZMUT).

**Records:** Hormozgan, Kerman Province (Dlabola, 1987; Mirzayans, 1995).

**Distribution:** Egypt, Iran, Palestine and Oriental regions (Metcalf, 1967).

Genus *Bampurius* Dlabola, 1977

*Bampurius bahunakalatus* Dlabola, 1977

**Material examined:** Iran: Kerman Province: Bam, Baravat, 19.Sep.2010, 2 ♂, swept on weeds, leg.: F. Pakarpour (JAZMUT).

**Records:** Kerman, Sistan & Balouchestan Provinces (Dlabola, 1977).

**Distribution:** Iran (Nast, 1982).

*Bampurius eberti* (Dlabola, 1964)

**Records:** Hormozgan, Sistan & Balouchestan Provinces (Dlabola, 1964; 1977; Mirzayans, 1995).

**Distribution:** Iran (Dlabola, 1964).

*Bampurius striatus* Dlabola, 1977

**Records:** Sistan & Balouchestan Province (Dlabola, 1977).

**Distribution:** Iran (Dlabola, 1977; Nast, 1982).

*Bampurius trilunulatus* Dlabola, 1984

**Records:** Hormozgan Province (Dlabola, 1984; Mirzayans, 1995).
Distribution: Iran (Dlabola, 1984).

Genus Brachylope Emeljanov, 1962

*Brachylope petrophila* (Dlabola, 1974)

**Records:** Alborz, Fars, Isfahan, Kordestan, Sistan & Balouchestan, Tehran Provinces (Dlabola, 1974; 1984; Mirzayans, 1995).

**Distribution:** Iran (Nast, 1982).

Genus Burakia Kocak, 1981

*Burakia eminens* (Dlabola, 1977)

**Records:** Fars, Hormozgan Provinces (Dlabola, 1977; Mirzayans, 1995).

**Distribution:** Iran (Nast, 1982).

*Burakia imitata* (Dlabola, 1977)

**Records:** Fars, Kohkilouyeh & Boirahmad Provinces (Dlabola, 1977; Mirzayans, 1995).

**Distribution:** Iran (Nast, 1982).

Genus Chiasmus Mulsant & Rey, 1855

*Chiasmus conspurcatus* (Perris, 1857)

**Records:** E. Azarbaijan, Golestan, Khorasan Razavi, Mazandaran, Tehran Provinces (Dlabola, 1961; 1971; Mirzayans, 1995).

**Distribution:** Austria, Bosnia and Herzegovina, Bulgaria, Canary Islands, Croatia, Egypt, France, Germany, Iraq, Iran, Italy, Portugal, Serbia, Spain, Yugoslavia (Metcalf, 1967; Nast, 1972).

Genus Cicadula Zetterstedt, 1840

*Cicadula* (Cicadula) *mesasiatica* Dubovsky, 1966

**Records:** Tehran Province (Mirzayans, 1995).

**Distribution:** Iran, Kyrgyzstan, Tajikistan, Uzbekistan (Dubovsky, 1966; Metcalf, 1967).

*Cicadula* (Cicadula) *placida* (Horváth, 1897)

**Records:** Tehran Province (Mirzayans, 1995).

**Distribution:** France, Hungary, Iran, Slovakia (Metcalf, 1967).

Genus Cicadulella China, 1928

*Cicadulella pallida* (Haupt, 1927)

**Records:** Boushehr, Hormozgan Provinces (Mirzayans, 1995).

**Distribution:** Iran, Israel, Saudi Arabia (Metcalf, 1967; Dlabola, 1979).

Genus Cicadulina China, 1926

*Cicadulina* (Cicadulina) *bipunctata* (Melichar, 1904)


**Records:** Hormozgan, Kerman, Khouzestan Provinces (Mirzayans, 1995).

**Distribution:** Australia, Canary Islands, Ethiopia, Guam, India, Indonesia, Iran, Japan, Kenya, Malaysia, Papua New Guinea, Philippines, Taiwan, Tanzania, Thailand, Yemen, Zambia, Zimbabwe (Metcalf, 1967; Webb, 1987).
Cicadulina (Cicadulina) mbila (Naudé, 1924)
**Material examined:** Iran: Kerman Province: Jiroft, 2.Dec.2009, 4 ♂ and 8 ♀, by light trap in corn field; Shahdad, 10.Apr.2010, 10 ♂ and 12 ♀, swept on Graminae, leg.: F. Pakarpour (JAZMUT).
**Records:** Kerman, Sistan & Balouchestan Provinces (Dlabola, 1960).
**Distribution:** Cape Verde, Ethiopia, India, Iran, Kazakhstan, South Africa, Sweden, Tajikistan, Tanzania, Yemen, Zambia, Zimbabwe (Metcalf, 1967; Webb, 1987).

Genus Concavifer Dlabola, 1960
**Concavifer marmoratus** Dlabola, 1960
**Records:** Hormozgan, Kerman, Khouzestan Provinces (Dlabola, 1960; 1961; 1984; Mirzayans (1995).
**Distribution:** Iran, Saudi Arabia (Dlabola, 1960; 1979; Nast, 1972).

Genus Diacra Emeljanov, 1961
**Diacra capraecornis** Dlabola, 1984
**Records:** Khorasan Razavi Province (Dlabola, 1984).
**Distribution:** Iran (Dlabola, 1984).

**Diacra gazellaecornis** Dlabola, 1984
**Records:** Khorasan Razavi Province (Dlabola, 1984); Mirzayans, 1995).
**Distribution:** Iran (Dlabola, 1984).

**Diacra vilbastei** Dlabola, 1984
**Records:** Khorasan Razavi Province (Dlabola, 1984).
**Distribution:** Iran (Dlabola, 1984).

Genus Diplocolenus Ribaut, 1946
**Diplocolenus (Diplocolenus) uniformis** Anufriev, 1970
**Material examined:** Iran: Kerman Province: Dalfard, 12.Sep.2012, 7 ♂ and 11 ♀, in citrus orchard, collected by sweeping.
**Records:** Kerman Province (Pakarpour & Nozari, 2014a).
**Distribution:** European Russia, Iran (Anufriev, 1970; Pakarpour & Nozari, 2014a).

Genus Dohukia Meyer–Arndt & Remane, 1992
**Dohukia dena** (Dlabola, 1977)
**Records:** Fars, Kohkilouyeh & Boirahmad Provinces (Dlabola, 1977; Nast, 1982).
**Distribution:** Iran (Dlabola, 1977; Nast, 1982).

Genus Doratura Sahlberg, 1871
**Doratura (Doratura) stylata** (Boheman, 1847)
**Records:** Ardebil Province (Abdollahi et al., 2014a).
**Distribution:** Nearctic, Palearctic, and Oriental (Metcalf, 1967; Hamilton, 1983; Duan & Zhang, 2012).

**Doratura (Doraturina) homophyla** (Flor, 1861)
**Records:** W. Azarbaijan Province (Mirzayans, 1995).
**Distribution:** China, Denmark, Estonia, European Russia, Finland, Germany, Iran, Latvia, Lithuania, Norway, Poland, Sweden (Metcalf, 1967; Duan & Zhang, 2012).
Doratura marandica Dlabola, 1981
Distribution: Iran (Dlabola, 1981).

Genus Doratulina Melichar, 1903
Doratulina pallida Dlabola, 1994
Records: Hormozgan, Sistan & Balouchestan Provinces (Dlabola, 1994).
Distribution: Iran (Dlabola, 1994).

Doratulina roseolutea Dlabola, 1994
Records: Hormozgan Province and other parts of Southern Iran (Dlabola, 1994).
Distribution: Iran (Dlabola, 1994).

Genus Doraturopsis Lindberg, 1935
Doraturopsis (Doraturopsis) heros (Melichar, 1902)
Records: Unknown locality.
Distribution: China, Georgia, Iran, Kazakhstan, Kyrgyzstan, Tadzhikistan, Turkmenistan, Uzbekistan (Metcalf, 1967; Nast, 1972).

Genus Dryadomorpha Kirkaldy, 1906
Dryadomorpha mangrovecola (Dlabola, 1979)
Records: Hormozgan Province (Dlabola, 1979).
Distribution: Iran (Dlabola, 1979; Nast, 1982).

Dryadomorpha pallida Kirkaldy, 1906
Records: Sistan & Balouchestan Province (Dlabola, 1960).
Distribution: Australia, Cape Verde, India, Iran, Israel, Japan, Seychelles, Sri Lanka (Lindberg, 1958; Dlabola, 1960; Metcalf, 1967).

Genus Elymana Delong, 1936
Elymana sulphurella (Z€terstedt, 1828)
Records: Tehran Province (Mirzayans, 1995).

Genus Eupelix Germar, 1821
Eupelix cuspidata (Fabricius, 1775)
Material examined: Iran: Kerman Province: Rafsanjan, 12.May.2010, 1 ♂ and 2 ♀, pistachio trees, collected by sweeping, leg.: F. Pakarpour (JAZMUT).
Records: Kerman, Lorestan Provinces (Dlabola, 1961; Mirzayans, 1995).

Genus Euscelidius Ribaut, 1942
Euscelidiusmundus (Haupt, 1927)


Genus *Euscelis* Brulle, 1832

*Euscelis alsius* Ribaut, 1952


Records: Fars, Kerman, Tehran Provinces (Dlabola, 1974; Kheiri, 1988; Mirzayans, 1995).

Distribution: Cyprus, France, Iran, Italy, Morocco, Tajikistan (Metcalf, 1967; Dlabola, 1974; Korolevskaya, 1979).

*Euscelis incisus* (Kirschbaum, 1858)

Material examined: Iran: Kerman Province: Jiroft, 2.Dec.2009, 2 ♂ and 2 ♀; with light trap in palm trees; leg.: F. Pakarpour (JAZMUT).


*Euscelis lineolatus* Brullé, 1832

Records: Isfahan Province (Dlabola, 1984).

Distribution: Eastern and Western Palearctic (Dlabola, 1965; Metcalf, 1967).

*Euscelis obsoletus* (Kirschbaum, 1858)


Records: Kerman Province (Pakarpour & Nozari, 2011a).

Distribution: Europe, Iran, Nearctic region and North of Africa (Metcalf, 1967).

Genus *Evinus* Dlabola, 1977

*Evinus graminicolus* Dlabola, 1977


Distribution: Iran (Dlabola, 1977).

Genus *Exitianus* Ball, 1929

*Exitianus capicola* (Stål, 1855)

Material examined: Iran; Iran; Kerman Province: Bam, 19.Sep.2010, 1 ♂ and 2 ♀, with light trap in palm orchards, leg.: F. Pakarpour (JAZMUT).

Records: Hormozgan, Kerman, Khouzestan, Sistan & Balouchestan Provinces (Dlabola, 1960; Mirzayans, 1995).

Exitianus coronatus (Distant, 1918)
Distribution: India, Iran (Ross, 1968; Pakarpour & Nozari, 2014b).

Exitianus indicus (Distant, 1908)
Material examined: Iran; Kerman Province: Shahdad, 10.Apr.2010, 2 ♂, swept on weeds, leg.: F. Pakarpour (JAZMUT).
Records: Kerman Province (Pakarpour & Nozari, 2014b).
Distribution: Australia, China, India, Iran, Nepal, Pakistan, Philippines, Taiwan (Metcalf, 1967; Ahmed et al. 1988).

Exitianus nanus (Distant, 1908)

Genus Fieberiella Signore, 1880
Fieberiella florii (Stål, 1864)
Records: Unknown locality.

Fieberiella hyrcana Dlabola, 1984
Records: Unknown locality.
Distribution: Iran (Dlabola, 1984).

Fiberiella macchiei Linnavauroi, 1962
Distribution: China, Czechoslovakia, Germany, Iran, Israel, Lebanon, Ukraine (Linnavaori, 1962; Wagner, 1963).

Genus Gonignathus Fieber, 1866
Goniagnathus bishapuricus Dlabola, 1994
Records: South and Southwest of Iran (Dlabola, 1994).
Distribution: Iran (Dlabola, 1994).

Goniagnathus (Goniozygotes) bolivari (Melichar, 1907)
Distribution: Iran, Israel, Portugal, Spain (Linnavauri, 1956; Dlabola, 1957; Metcalf, 1967).

Goniagnathus (Goniagnathus) brevis (Herrich–Schäffer, 1835)
Records: Kohkilouyeh & Boirahmad Province (Mirzayans, 1995).
Goniagnathus dursoicus Dlabola, 1994
Records: Kerman, Sistan & Balouchestan Provinces (Dlabola, 1994).
Distribution: Iran (Dlabola, 1994).

Goniagnathus (Epistagma) guttulinervis (Kirschbaum, 1868)
Material examined: Iran; Kerman Province: Rafsanjan, 12.May.2010, 1 ♂ and 3 ♀, swept on weeds, leg.: F. Pakarpour (JAZMUT).

Goniagnathus hanifanus Dlabola, 1979
Records: Hormozgan Province (Dlabola, 1994).
Distribution: Iran, Saudi Arabia (Dlabola, 1979; 1994).

Goniagnathus minor Kusnezov, 1928
Records: E. Azarbaijan Province (Dlabola, 1971).
Distribution: Iran, Ukraine (Metcalf, 1967; Dlabola, 1971).

Genus Grammacephalus Haupt, 1929
Grammacephalus genoiicus Dlabola, 1984
Records: Hormozgan Province (Dlabola, 1984; Mirzayans, 1995).
Distribution: Iran (Dlabola, 1984).

Grammacephalus minabicus Dlabola, 1984
Records: Hormozgan Province (Dlabola, 1984).
Distribution: Iran (Dlabola, 1984).

Grammacephalus pugio (Noualhier, 1895)
Records: Hormozgan, Kerman Provinces (Dlabola, 1960; Mirzayans, 1995).
Distribution: Iran, Israel, Jordan, Syria, Turkey (Dlabola, 1960; 1965; Metcalf, 1967; Nast, 1972).

Genus Graphocraerus Thomson, 1869
Graphocraerus montanus Dlabola, 1994
Records: Alborz, Mazandaran Provinces (Dlabola, 1994).
Distribution: Iran, Turkey (Dlabola, 1994).

Genus Handianus Ribaut, 1942
Handianus krameri Dlabola, 1971
Records: Hormozgan Province (Dlabola, 1971).
Distribution: Iran (Dlabola, 1971).

Handianus procerus (Herrich–Schäffer, 1835)
Handianus semiramidis Dlabola, 1981
Distribution: Iran (Dlabola, 1981).

Genus Hardya Edwards, 1922
Hardya (Hardya) iranicola Zachvatkin, 1946
Records: Guilan, Kordestan, Tehran, Qom Provinces (Mirzayans, 1995).
Distribution: Iran (Metcalf, 1967; Nast, 1972)

Hardya (Eohardy) fraudulent Horváth, 1903
Distribution: Cyprus, France, Hungary, Iran, Italy, Serbia, Spain.

Hardya (Eohardy) miyaneha Dlabola, 1971
Records: E. Azarbaijan Province (Dlabola, 1971).
Distribution: Iran (Dlabola, 1971).

Genus Hecalus Stål, 1864
Hecalus eximius (Kirschbaum, 1868)
Distribution: Iran, Israel, Italy, Saudi Arabia, Spain.

Hecalus glaucescens (Fieber, 1866)
Records: Alborz, Boushehr, Fars, Hormozgan, Kerman, Khouzestan, S. Khorasan, Sistan & Balouchestan Provinces (Mirzayans, 1995).
Distribution: Eastern & Western Palearctic (Dlabola, 1965; Metcalf, 1967).

Genus Henschia Lethierry, 1892
Henschia (Henschia) deminuta (Dlabola, 1981)
Distribution: Iran, Turkey (Dlabola, 1981).

Genus Limotettix Sahlberg, 1871
Limotettix (Limotettix) striolus (Fallén, 1806)

Genus Macrosteles Fieber, 1866
Macrosteles fieberi (Edwards, 1889)
Records: Unknown locality.
Distribution: Nearctic, Eastern and Western Palearctic (Dlabola, 1961; Metcalf, 1967).

Macrosteles laevis (Ribaut, 1927)
Distribution: Iran, Neartic regions, Turkey, Western Palearctic (Metcalf, 1967).

**Macrosteles oculatus** Dlabola, 1952
Records: Kerman, Khouzestan Provinces (Dlabola, 1960; 1984).

**Macrosteles ossiannilssoni** Lindberg, 1954
Records: Golestan, Khouzestan Provinces (Dlabola, 1971; Mirzayans, 1995).
Distribution: Canary Islands, Iran (Dlabola, 1971; Metcalf, 1967).

**Macrosteles pythicus** Dlabola, 1970
Records: South of Iran (Dlabola, 1970).
Distribution: Iran, Mongolia (Dlabola, 1970).

**Macrosteles quadripunctulatus** (Kirschbaum, 1868)
Distribution: Austria, Bulgaria, China, Czech Republic, Denmark, Finland, Germany, Greece, Iran, Iraq, Netherlands, Poland, Slovakia, Sweden, Turkey, United Kingdom (Dlabola, 1961; Metcalf, 1967; Zeybekoglu, 1993; Zhang et al., 2013).

**Macrosteles razvijakinae** Dubovsky, 1966
Records: Tehran Province (Mirzayans, 1995).
Distribution: Iran, Kyrgyzstan, Tajikistan, Uzbekistan (Dubovsky, 1966; Mirzayans, 1995).

**Macrosteles salsolae** (Puton, 1872)
Records: Mazandaran Province (Dlabola, 1984).
Distribution: Belgium, Cyprus, France, Iran, Italy, Romania (Metcalf, 1967; Dlabola, 1984).

**Macrosteles sexnotatus** (Fallén, 1806)
Material examined: Iran; Kerman Province: Dalfard, 30.Nov.2009, 4 ♂ and 6 ♀, with light trap in grasslands, leg.: F. Pakarpour (JAZMUT).
Records: Chaharmahal & Bakhtiari, Kerman Province (Mirzayans, 1995).
Distribution: Nearctic, Eastern and Western Palearctic (Dlabola, 1965; Metcalf, 1967).

**Genus Maiestas** Distant, 1917

**Maiestas horvathi** (Then, 1896)
Material examined: Iran; Kerman Province: Bam, 19 Sep. 2010, 1 ♂ and 2 ♀, with light trap in palm trees, leg.: F. Pakarpour (JAZMUT).
Records: Guilan, Hormozgan, Kerman, Khorasan Razavi, Khouzestan Provinces (Mirzayans, 1995).
Distribution: Austria, Bulgaria, European Russia, Germany, Hungary, Iran, Italy, Turkey, Ukraine, Yugoslavia (Metcalf, 1967; Nast, 1972).

**Maiestas schmidtgeni** (Wagner, 1939)
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**Genus Maiestas**

*Maiestas trifasciata* (Lindberg, 1954)
*Records*: Hormozgan, Sistan & Balouchestan Provinces (Dlabola, 1994).
*Distribution*: Canary Islands, Iran, Burkina Faso (Metcalf, 1967; Dlabola, 1994).

**Genus Megalopsius**

*Megalopsius oshanini* (Emeljanov, 1961)
*Records*: Hormozgan, Kerman, Sistan & Balouchestan Provinces (Dlabola, 1984; Mirzayans, 1995).
*Distribution*: Iran, Turkmenistan (Emeljanov, 1961; Dlabola, 1984).

**Genus Mirzayansus**

*Mirzayansus denaicus* Dlabola, 1979
*Records*: Fars Province (Dlabola, 1979; Nast, 1982).
*Distribution*: Iran (Dlabola, 1979; Nast, 1982).

**Genus Mocydiopsis**

*Mocydiopsis parvicauda* Ribaut, 1939
*Records*: Kerman Province (Dlabola, 1981).
*Distribution*: France, Germany, Great Britain, Iran, Italy, Sweden (Servadei, 1960; Metcalf, 1967).

**Genus Neoaliturus**

*Neoaliturus alboflavovittatus* (Lindberg, 1954)
*Records*: Kerman Province – (Pakarpour et al., 2014).
*Distribution*: Canary Islands, Iran (Lindberg, 1954; Pakarpour et al., 2014).

*Neoaliturus fenestratus* (Herrich–Schäffer, 1834)
*Records*: Kerman, Tehran Provinces (Kheiri, 1988; Mirzayans, 1995).
*Distribution*: Eastern Palearctic, Western Palearctic (Metcalf, 1967).

*Neoaliturus (Alituriscus) decemocellatus* Dlabola, 1987
*Records*: North of Iran (Dlabola, 1987).
*Distribution*: Iran (Dlabola, 1987).

*Neoaliturus (Circulifer) dubiosus* (Matsumura, 1908)
*Distribution*: European Russia, France, India, Iran, Israel, Italy, Morocco (Metcalf, 1967; Klein et al., 1982).

*Neoaliturus (Circulifer) haematoceps* (Mulsant & Rey, 1855)


**Neoaliturus (Circulifer) opacipennis** (Lethierry, 1876)


Distribution: Eastern Palearctic, Western Palearctic (Dlabola, 1960; Metcalf, 1967).

**Neoaliturus pulcher** (Haupt, 1927)

Records: Hormozgan, Kerman, Tehran, Sistan & Balouchestan Provinces (Dlabola, 1960; Mirzayans, 1995).

Distribution: European Russia, Iran, Israel, Saudi Arabia (Metcalf, 1967; Nast, 1972; Dlabola, 1979).

**Neoaliturus (Circulifer) tenellus** (Baker, 1896)


Genus *Neolimnus* Linnauvori, 1953

**Neolimnus (Neolimnus) egypiacus** (Matsumura, 1908)

Records: Hormozgan, Kerman, Sistan & Balouchestan Provinces (Dlabola, 1960; Mirzayans, 1995).


**Neolimnus (Sarbazius) superlaminatus** Dlabola, 1977

Material examined: Iran; Kerman Province: Rahmat Abad Rigan, 10.Apr.2010, 1 ♂ and 5 ♀, in palm trees, collected by sweeping, leg.: F. Pakarpour (JAZMUT).

Records: Kerman, Sistan & Balouchestan Province (Dlabola, 1977; Mirzayans, 1995).

Distribution: Iran, Saudi Arabia (Dlabola, 1979; Nast, 1982).

Genus *Opsius* Fieber, 1866

**Opsius cypriacus** Lindberg, 1958


Distribution: Cape Verde, Iran (Lindberg, 1958; Mirzayans, 1995).

**Opsius discessus** (Horváth, 1911)

Records: Kerman Province (Dlabola, 1960).

Distribution: Azerbaijan, European Russia, Georgia, Iran (Dlabola, 1960; Metcalf, 1967; Nast, 1972).
**Opsius jucundus** (Lethierry, 1871)
**Records:** Kerman, Khuzestan, Qom, Tehran, Sistan & Balouchestan Provinces – Dlabola (1960); Nast (1972); Dlabola (1981); Mirzayans (1995).
**Distribution:** Algeria, European Russia, Iran, Iraq, Kazakhstan, Kyrgyzstan, Tadzhikistan, Turkey, Turkmenistan, Uzbekistan.

**Opsius pallasi** (Lethierry, 1874)
**Records:** Fars, Hormozgan, Kerman, Sistan & Balouchestan Provinces (Mirzayans, 1995).
**Distribution:** Algeria, Armenia, Azerbaijan, European Russia, France, Georgia, Greece, Iran, Kazakhstan, Kyrgyzstan, Spain, Tadzhikistan, Tajikistan, Tunisia, Turkey, Turkmenistan, Uzbekistan (Dlabola, 1960; Metcalf, 1967).

**Opsius richteri** Dlabola, 1960
**Records:** Hormozgan, Kerman, Sistan & Balouchestan Provinces (Dlabola, 1960; Mirzayans, 1995).
**Distribution:** Iran (Dlabola, 1960; Nast, 1972).

**Opsius scutellaris** (Lethierry, 1874)
**Records:** Fars, Kerman Provinces (Kheiri, 1988; Abaei, 1998).
**Distribution:** Algeria, Canary Islands, China, Iran, Libya (Metcalf, 1967).

**Opsius tigripes** (Lethierry, 1876)
**Records:** Unknown locality.
**Distribution:** Afghanistan, European Russia, Iran, Saudi Arabia (Metcalf, 1967; Nast, 1972; Dlabola, 1979).

**Opsius versicolor** (Distant, 1908)
**Records:** Hormozgan, Kerman, Mazandaran, Sistan & Balouchestan Provinces (Dlabola, 1984).
**Distribution:** European Russia, India, Indonesia, Iran, Pakistan, Saudi Arabia (Dlabola, 1961; Nast, 1972; Ahmed & Sultana, 1994).

**Genus Orosius** Distant, 1918

**Orosius albicinctus** Distant, 1918
**Material examined:** Iran; Kerman Province: Manujan, 8.Dec.2009, 3 ♀, via light trap on citrus trees, leg.: F. Pakarpour (JAZMUT).
**Records:** Boushehr, Hormozgan, Kerman, Khuzestan Provinces (Mirzayans, 1995).
**Distribution:** Australia, India, Iran, Iraq, Israel (Metcalf, 1967; Mirzayans, 1995).

**Orosius minuicus** Dlabola, 1979
**Records:** Khuzestan Province (Dlabola, 1979).
**Distribution:** Iran, Saudi Arabia (Dlabola, 1979; Nast, 1982).

**Genus Osbornellus** Ball, 1932

**Osbornellus (Mavromoustacus) arboropictus** Dlabola, 1984
**Records:** Kerman Province (Dlabola, 1984).
**Distribution:** Iran (Dlabola, 1984).

**Osbornellus (Mavromoustacus) deviaticus** Dlabola, 1974
**Records:** Fars, Kerman Provinces (Dlabola, 1974).
**Distribution:** Iran (Dlabola, 1974; Nast, 1982).
Genus *Paradorydium* Kirkaldy, 1901
*Paradorydium breviceps* (Melichar, 1902)
Records: Sistan & Balouchestan Province (Dlabola, 1960).
Distribution: Iran (Dlabola, 1960; Nast, 1972; Metcalf, 1967).

*Paradorydium* (*Paradorydium*) *paradoxum* (Herrich–Schäffer, 1837)
Material examined: Iran; Kerman Province: Shahdad, 10 Apr. 2010, 1 ♂, swept on weeds, leg.: F. Pakarpour (JAZMUT).
Records: Kerman Province (Pakarpour & Nozari, 2011a).
Distribution: Iran, Italy (D'Urso, 1992; Pakarpour & Nozari, 2011a).

Genus *Parafieberiella* Dlabola, 1974
*Parafieberiella olivacea* Dlabola, 1974
Records: Fars Province (Dlabola, 1974; Mirzayans, 1995).
Distribution: Iran (Dlabola, 1974; Nast, 1982).

Genus *Paralimnus* Matsumura, 1902
*Paralimnus phragmitis* (Boheman, 1847)
Records: Khouzestan, Tehran Provinces (Dlabola, 1960; Mirzayans, 1995).

*Paralimnus straminostriatus* Dlabola, 1994
Records: Kerman, Sistan & Balouchestan Provinces (Dlabola, 1994).
Distribution: Iran (Dlabola, 1994).

Genus *Paralimnellus* Emeljanov, 1972
*Paralimnellus cingulatus* (Dlabola, 1960)
Material examined: Iran; Kerman Province: Shahdad, 10 Apr. 2010, 8 ♂ and 11 ♀, in citrus trees, collected with sweeping; leg.: F. Pakarpour (JAZMUT).
Records: Kerman province (Dlabola, 1960).
Distribution: Iran, Iraq, Tadjikistan (Dlabola, 1960).

Genus *Paramesanus* Dlabola, 1979
*Paramesanus wittmeri* Dlabola, 1979
Records: Sistan & Balouchestan Province (Dlabola, 1979; Mirzayans, 1995).
Distribution: Iran, Saudi Arabia (Dlabola, 1979; Nast, 1982).

Genus *Paramesodes* Ishihara, 1969
*Paramesodes lineaticollis* (Distant, 1908)
Records: Isfahan Province (Dlabola, 1984).
Distribution: Bangladesh, China, India, Indonesia, Iran, Pakistan, Philippines, Taiwan, Turkey (Metcalf, 1967; Mahmood & Meher, 1973; Dlabola, 1984).

Genus *Paramesus* Fieber, 1866
*Paramesus major* Haupt, 1927
Distribution: Iran, Israel, Turkey (Metcalf, 1967; Lodos & Kalkandelen, 1987).
Genus *Parapotes* Emeljanov, 1975  
*Parapotes reticulatus* (Horváth, 1897)  
**Records:** Mazandaran Province (Mirzayans, 1995).  
**Distribution:** Azerbaijan, European Russia, Georgia, Germany, Hungary, Iran, Netherlands, Romania, Turkey (Metcalf, 1967; Lodos & Kalkandelen, 1987).

Genus *Pedari*um Emeljanov, 1961  
*Pedari*um *ruderale* Emeljanov, 1961  
**Records:** Sistan & Balouchestan Province (Dlabola, 1984).  
**Distribution:** Iran, Kazakhstan (Emeljanov, 1961; Dlabola, 1984).

Genus *Penthimia* Germar, 1821  
*Penthimia scutellata* Melichar, 1902  
**Material examined:** Iran; Kerman Province: Kerman, 25.Apr.2011, 2 ♀, swept on weeds, leg.: F. Pakarpour (JAZMUT).  
**Records:** Kerman, Sistan & Balouchestan Province (Dlabola, 1960).  
**Distribution:** Iran, Yemen (Metcalf, 1967; Nast, 1972).

Genus *Phlepsi*us Fieber, 1866  
*Phlepsi*us *e*vinus Dlabola, 1974  
**Records:** Hormozgan, Tehran Provinces (Dlabola, 1974; 1984; Nast, 1982; Mirzayans, 1995).  
**Distribution:** Iran, Jordan, Saudi Arabia (Dlabola, 1974; 1980; 1984; Nast, 1982).

*Phlepsi*us *intricatus* (Herrich–Schäffer, 1838)  
**Records:** Fars, Isfahan, Kerman, Kermanshah, Kordestan, Qom, Tehran Provinces (Dlabola, 1974; Mirzayans, 1995).  
**Distribution:** Eastern and Western Palearctic (Metcalf, 1967; Nast, 1972).

*Phlepsi*us *isinus* Dlabola, 1979  
**Records:** Hormozgan Province (Dlabola, 1979; Mirzayans, 1995).  
**Distribution:** Iran (Dlabola, 1979).

*Phlepsi*us *kambysesi* Dlabola, 1984  
**Records:** Fars, Kohkilouyeh & Boirahmad Provinces (Dlabola, 1984).  
**Distribution:** Iran (Dlabola, 1984).

*Phlepsi*us *ornatus* (Perris, 1857)  
**Records:** Hormozgan, Kermanshah, Khorasan Razavi, Mazandaran, S. Khorasan, Tehran, W. Azarbaijan Provinces (Mirzayans, 1995).  
**Distribution:** Iran, Tajikistan (Korolevskaya.

Genus *Platymetopius* Burmeister, 1838  
*Platymetopius* *catenatus* Dlabola, 1981  
**Records:** Fars Province (Dlabola, 1981).
Distribution: Iran (Dlabola, 1981).

Platymetopius (Platymetopius) centralasii Dlabola, 1960
Records: Alborz, Isfahan, Khorasan Razavi, Markazi, Tehran Provinces (Dlabola, 1960); Mirzayans, 1995).
Distribution: Afghanistan, Iran, Uzbekistan (Dlabola, 1960; Nast, 1972).

Platymetopius (Platymetopius) chloroticus Puton, 1877
Distribution: Afghanistan, Azerbaijan, European Russia, Iran, Kazakhstan, Kyrgyzstan, Mongolia, Tadzhikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan (Metcalf, 1967; Lodos & Kalkandelen, 1986).

Platymetopius (Platymetopius) coronatus Dlabola, 1974
Records: North of Iran (Dlabola, 1974).
Distribution: Iran (Dlabola, 1974; Nast, 1982).

Platymetopius (Platymetopius) cruentatus Haupt, 1927
Records: Fars, Hormozgan, Kerman, Khouzestan, Sistan & Balouchestan Provinces (Dlabola, 1960; Mirzayans, 1995).
Distribution: Iran, Iraq, Israel, Jordan, Saudi Arabia, Turkey (Dlabola, 1960; 1965; 1979; Metcalf, 1967; Lodos & Kalkandelen, 1986).

Platymetopius (Platymetopius) distinctus Melichar, 1902

Platymetopius (Platymetopius) enatus Dlabola, 1974
Records: Fars, Kohkilouyeh & Boirahmad Provinces (Dlabola, 1974; Mirzayans, 1995).
Distribution: Iran (Dlabola, 1974; Nast, 1982).

Platymetopius (Platymetopius) exalbescens Dlabola, 1974
Records: Kohkilouyeh & Boirahmad Province (Dlabola, 1974; Mirzayans, 1995).
Distribution: Iran.

Platymetopius (Platymetopius) exhereditus Dlabola & Heller, 1962
Distribution: Iran (Dlabola, 1974; Nast, 1982).

Platymetopius (Platymetopius) guttatus Fieber, 1869
Distribution: Eastern Palearctic, Western Palearctic (Metcalf, 1967).

Platymetopius (Platymetopius) jasudicus Dlabola, 1981
Kohkilouyeh & Boirahmad, Tehran Provinces.
Distribution: Iran.

*Platymetopius (Platymetopius) major* (Kirschbaum, 1868)
**Records:** Golestan, Mazandaran Provinces (Mirzayans, 1995).
**Distribution:** Algeria, Armenia, Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Iran, Italy, Jordan, Ntherlands, Poland, Siberia, Slovakia, Sweden, Turkey (Dlabola, 1967b; Metcalf, 1967; Lodos & Kalkandelen, 1986).

*Platymetopius (Platymetopius) obsoletus* (Signoret, 1880)
**Records:** Fars Province (Dlabola, 1961; 1981).
**Distribution:** Armenia, Azerbaijan, Croatia, European Russia, Georgia, Iran, Israel, Italy, Turkey, Ukraine (Metcalf, 1967; Nast, 1972).

*Platymetopius (Platymetopius) rostratus* (Herrick–Schäffer, 1834)
**Material examined:** Iran; Kerman Province: Baft, 13.Jul.2010, 4 ♂ and 4 ♀, swept on Alfafa; Ravar, 1.Aug.2010, 2 ♂ and 5 ♀, swept on Alfa, leg.: F. Pakarpour (JAZMUT).
**Records:** Kerman, Tehran Province (Mirzayans, 1995).
**Distribution:** Eastern Palearctic, Western Palearctic (Metcalf, 1967).

*Platymetopius (Platymetopius) safavii* Dlabola, 1971
**Records:** Khouzestan, Kordestan, Sistan & Balouchestan, Tehran Provinces (Dlabola, 1971; Mirzayans, 1995).
**Distribution:** Iran, Turkey (Dlabola, 1971; Nast, 1982; Lodos & Kalkandelen, 1986).

*Platymetopius (Platymetopius) shirazicus* Dlabola, 1974
**Records:** Fars, Golestan, Guilan, Mazandaran, Tehran Provinces (Dlabola, 1974; Mirzayans, 1995).
**Distribution:** Iran, Turkey (Dlabola, 1974; Nast, 1982).

*Platymetopius (Platymetopius) trifasciatus* Dlabola, 1981
**Records:** Fars, Hormozgan, Kerman, Tehran Provinces (Dlabola, 1981; Mirzayans, 1995).
**Distribution:** Iran (Dlabola, 1981).

*Platymetopius (Platymetopius) undulatus* Dlabola, 1987
**Records:** Fars Province (Dlabola, 1987).
**Distribution:** Iran (Dlabola, 1987).

*Platymetopius (Quernus) complicatus* Nast, 1972
**Records:** Alborz, Fars, Hormozgan, Isfahan, Kohkilouyeh & Boirahmad, Sistan & Balouchestan, Tehran Provinces (Mirzayans, 1995).
**Distribution:** Austria, Croatia, Greece, Iran, Italy, Yugoslavia (Metcalf, 1967; Nast, 1972).

*Platymetopius (Quernus) quercinus* Dlabola, 1974
**Records:** Fars Province (Dlabola, 1974).
**Distribution:** Iran, Turkey (Dlabola, 1974; Nast, 1982; Lodos & Kalkandelen, 1986).

Genus *Proceps* Mulsant & Rey, 1855
*Proceps acicularis* Mulsant & Rey, 1855
**Records:** Hormozgan, Kerman Provinces (Dlabola, 1977; 1984; Mirzayans, 1995).
**Distribution:** Bosnia and Herzegovina, Croatia, Cyprus, France, Greece, Hungary, Iran, Italy, Jordan, Turkey, Yugoslavia (Dlabola, 1965; 1977; 1984; Metcalf, 1967; Lodos & Kalkandelen, 1986).
Genus *Psammotettix* Haupt, 1929

*Psammotettix alienus* (Dahlbom, 1851)

**Material examined:** Iran; Kerman Province: Jiroft, 2 Dec. 2009, 31 ♂ and 18 ♀, by light trap in potato field. leg.: F. Pakarpour (JAZMUT).


**Distribution:** Nearctic, Eastern Palearctic, Western Palearctic (Metcalf, 1967).

*Psammotettix pictipennis* (Kirschbaum, 1868)

**Records:** E. Azarbaijan, Zanjan Provinces (Dlabola, 1971).

**Distribution:** Austria, Belgium, European Russia, France, Germany, Great Britain, Hungary, Iran, Portugal, Romania, Slovakia, Spain, Ukraine (Metcalf, 1967; Dlabola, 1971).

*Psammotettix seriphidii* Emeljanov, 1962

**Records:** W. Azarbaijan (Abdollahi et al., 2014b)

**Distribution:** Iran, Kazakhstan (Emeljanov, 1962; Nast, 1972; Abdollahi et al., 2014b).

*Psammotettix striatus* (Linnaeus, 1758)

**Material examined:** Iran; Kerman Province: Dalfard, 30 Nov. 2009, 6 ♂ and 14 ♀, swept on grasslands, leg.: F. Pakarpour (JAZMUT).

**Records from Iran:** Alborz, Boushehr, Golestan, Kerman, Khorasan Razavi, Kohkilouyeh & Boirahmad, Khuzestan, Lorestan, Mazandaran, Sistan & Balouchestan, Tehran Provinces (Dlabola, 1960; 1961; Mirzayans, 1995).

**Distribution:** Afrotropical, Nearctic, Oriental, Palearctic (Metcalf, 1967; Nast, 1972).

*Psammotettix transcaucasicus* Dlabola, 1961

**Records:** South of Iran (Dlabola, 1994).

**Distribution:** Georgia, Iran, Kazakhstan, Turkey (Dlabola, 1961; 1994).

Genus *Pseudophlepsius* Zachvatkin, 1955

*Pseudophlepsius binotatus* (Signoret, 1880)

**Records:** E. Azarbajian, Kerman, Khorasan Razavi, Khuzestan, Kohkilouyeh & Boirahmad, Qom, Tehran Provinces (Dlabola, 1961; Mirzayans, 1995).

**Distribution:** Afghanistan, Armenia, Azerbaijan, European Russia, Georgia, Iran, Kazakhstan, Kyrgyzstan, Morocco, Tadzhikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan (Metcalf, 1967).

Genus *Pteropyx* Haupt, 1927

*Pteropyx hyalinus* Haupt, 1927

**Records:** Hormozgan, Sistan & Balouchestan Provinces (Dlabola, 1994).

**Distribution:** Afghanistan, Iran, Israel (Metcalf, 1967; Emeljanov, 1972; Dlabola, 1994).

Genus *Savanicus* Dlabola, 1977

*Savanicus sirik* Dlabola, 1977

**Records:** Hormozgan Province (Dlabola, 1977; Mirzayans, 1995).

**Distribution:** Iran, Saudi Arabia (Nast, 1982).
Savanicus ultimus Dlabola, 1977
Records: Hormozgan Province (Dlabola, 1977; Mirzayans, 1995).
Distribution: Iran, Saudi Arabia (Dlabola, 1977; 1980).

Genus Selenocephalus Germar, 1833
Selenocephalus dareicus Dlabola, 1981
Records: Fars Province (Dlabola, 1981; Mirzayans, 1995).
Distribution: Iran (Dlabola, 1981).

Selenocephalus hafezicus Dlabola, 1981
Records: Fars Province (Dlabola, 1981).
Distribution: Iran (Dlabola, 1981).

Selenocephalus kyrosicus Dlabola, 1981
Records: Fars Province (Dlabola, 1981; Mirzayans, 1995).
Distribution: Iran (Dlabola, 1981).

Selenocephalus nizamicus Dlabola, 1981
Records: Fars Province (Dlabola, 1981).
Distribution: Iran (Dlabola, 1981).

Selenocephalus pallidus Kirschbaum, 1868
Records: Chaharmahal & Bakhtiari, Fars Provinces (Mirzayans, 1995).
Distribution: Algeria, Austria, Cyprus, Egypt, European Russia, Greece, Hungary, Iran, Israel, Libya, Morocco, Sudan, Tunisia, Western Sahara (Metcalf, 1967).

Selenocephalus planus (Turton, 1802)
Records: Unknown locality.

Selenocephalus saadicus Dlabola, 1981
Records: Fars Province (Dlabola, 1981).
Distribution: Iran (Dlabola, 1981).

Selenocephalus zagrosicus Dlabola, 1974
Records: Lorestan Province (Dlabola, 1974).
Distribution: Iran (Dlabola, 1974; Nast, 1982).

Genus Stegelytra Mulsant & Rey, 1855
Stegelytra neveosparsa (Ghauri, 1972)
Distribution: Iran, Iraq (Ghauri, 1972; Dlabola, 1974).

Genus Stenometohardya Dlabola, 1981
Stenometohardya veriviva Dlabola, 1981
Records: South of Iran (Dlabola, 1981).
Distribution: Iran (Dlabola, 1981).
Genus *Stenometopiellus* Haupt, 1917

*Stenometopiellus iranicus* Zachvatkin, 1946

**Records:** Tehran Province (Mirzayans, 1995).

**Distribution:** Iran (Metcalf, 1967).

*Stenometopiellus sigillatus* Haupt, 1917

**Material examined:** Iran; Kerman Province: Bam, Baravat, 19.Sep.2010, 1 ♂ and 3 ♀, swept on weeds, leg.: F. Pakarpour (JAZMUT).

**Records:** Kerman Province (Pakarpour & Nozari, 2011a).

**Distribution:** Afghanistan, Iran, Kazakhstan, Kyrgyzstan, Tadzhikistan, Turkmenistan, Uzbekistan (Dlabola, 1957; Metcalf, 1967).

Genus *Stirellus* Osborn & Ball, 1902

*Stirellus lahorensis* (Distant, 1918)


**Records:** Sistan & Balouchestan Province (Pakarpour & Nozari, 2011b).

**Distribution:** India, Iran, Pakistan (Metcalf, 1967, Mahmood et al., 1972; Pakarpour & Nozari, 2011b).

Genus *Stymphalus* Stål, 1866

*Stymphalus rubrolineatus* (Stål, 1855)

**Records:** Khouzestan Province (Mirzayans, 1995).

**Distribution:** Ethiopia, Iran, South Africa, Tanzania, Zaire (Metcalf, 1967; Heller & Linnnuoru, 1968; Mirzayans, 1995).

Genus *Tamaricades* Emeljanov, 1962

*Tamaricades maculatus* (Emeljanov, 1962)

**Records:** Hormozgan, Kerman, Khouzestan, Qom, Sistan & Balouchestan Provinces (Dlabola, 1994; Mirzayans, 1995).

**Distribution:** Azerbaijan, Georgia, Iran (Nast, 1972; Dlabola, 1994).

*Tamaricades palliatus* (Lethierry, 1887)

**Records:** Hormozgan, Kerman, Khorasan Razavi, Sistan & Balouchestan Provinces (Dlabola, 1994; Mirzayans, 1995).

**Distribution:** Algeria, Azerbaijan, Egypt, European Russia, Georgia, Iran, Kazakhstan, Kyrgyzstan, Libya, Saudi Arabia, Tadzhikistan, Turkmenistan, Uzbekistan (Metcalf, 1967; Dlabola, 1979; 1994).

Genus *Tbilisica* Dlabola, 1958

*Tbilisica alata* Dlabola, 1984

**Records:** Mazandaran, Kerman Provinces (Dlabola, 1984).

**Distribution:** Iran (Dlabola, 1984).

*Tbilisica denticulata* Dlabola, 1958

**Records:** Fars, Guilan, Isfahan, Kohkilouyeh & Boirahmad, Mazandaran, Tehran (Dlabola, 1974; Mirzayans, 1995).

**Distribution:** Afghanistan, Georgia, Iran (Dlabola, 1974).
Tbilisica perseidis Dlabola, 1974
Records: Guilan, Golestan, Mazandaran Provinces (Dlabola, 1974).
Distribution: Iran (Dlabola, 1974; Nast, 1982).

Genus Thamnotettix Zetterstedt, 1840
Thamnotettix gazellus Emeljanov, 1962
Records: Golestan, Guilan, Mazandaran Provinces (Dlabola, 1972; Mirzayans, 1995).
Distribution: Iran (Nast, 1972).

Discussion
Although many reports for Iranian Deltocephalinae were disseminated from many years ago, but the leafhopper fauna in Iran still remains poorly known. The present checklist of Iranian Deltocephalinae totally demonstrated 184 species belonging to 74 genera. It seems that this number is far from trustworthy approximation of the number of deltocephalin leafhoppers species in Iran. Therefore this scarcity of data does not permit us making a proper geographical analysis of Iranian leafhopper fauna. However, in the future, when sufficient material will have been sampled, the Iranian leafhopper fauna will be comparable with adjacent regions in the Middle East e.g. Armenia, Azarbaijan, Turkey, Turkmenistan, Afghanistan & Arabian Peninsula. Likewise, the presence of material from oriental regions like Pakistan demonstrates a relation between Iranian fauna and this areas. Hence, further studies needed to improve our knowledge on Iranian leafhoppers and supplementary field work is really required for a suitable assessment of leafhopper biodiversity in Iran.

Acknowledgments
The authors wish to thank Dr. James N. Zahniser (Illinois Natural History Survey) for help during the course of compiling this list.

Literature Cited


A checklist of Iranian Deltocephalinae


Taxonomic status of sand boas of the genus *Eryx* (Daudin, 1803) (Serpentes: Boidae) in Bahr Al-Najaf depression, Al-Najaf Province, Iraq

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Five metric and 10 meristic characters were studied in 30 specimens of *Eryx* (Daudin, 1803) in Bahr Al-Najaf depression, Al-Najaf Province – Iraq. According to the results, and considering the principle of priority, we concluded that the populations of *E. jaculus* (Linnaeus, 1758) in the study area should be classified into *E. jaculus jaculus* (Linnaeus, 1758) and *E. jaculus familiaris* Eichwald, 1831. In addition, ten specimens belonging to a population of *Eryx* in the area were found to differ from all other *E. jaculus*. They have second upper labial scale being lower than the third one scale. These specimens, which are tentatively regarded as *Eryx cf. miliaris* (Pallas, 1773), need more comprehensive study to clarify their taxonomic status and phylogenetic relationship using more morphological traits, ecology, and molecular studies.

**Key words:** *Eryx*, morphological characters, Bahr Al-Najaf depression, Iraq

**INTRODUCTION**

The family Boidae comprises three subfamilies: Boinae, Ungaliophiinae and Erycinae (Wilcox et al., 2002), as currently defined comprises five subfamilies: Sanziniinae, Charininae, Erycinae, Candoiinae, and Boinae (Pyron et al., 2014). The genus *Eryx* (Daudin, 1803) belongs to the subfamily Erycinae and is distributed in southwestern Europe, North and East Africa, Middle East, southwestern Asia to India and Sri Lanka, northward to Caucasus and Afghanistan, and eastward from Turkestan to southern Mongolia and western China (Lanza and Nistri, 2005; Pyron et al., 2014). The Egyptian, Javelin Sand Boa or Spotted Sand Boa *Eryx jaculus* (Linnaeus, 1758) and *E. j. familiaris* Eichwald, 1831 is believed to be the only species and subspecies found in Iraq (Boulenger, 1920; Corkill, 1932; Khalaf, 1959). This subspecies having 9-12 supralabials, feebly keeled scales; brownish-green or grey, with darker blotches, belly white or yellowish, uniform or speckled darker (Khalaf, 1959). The distribution of this species is Algeria, Egypt, Greece, Turkey, Romania, Asia Minor, the Levant, Iraq and Persia. In Iraq specimens have been collected in Basra, Amara, Nasiriayah, Baghdad, Baquba, Mandali, and Sulaimainia (Terentyev and Chernov, 1965). In these regions this snake has been referred to as a local inhabitants as “batra” (Corkill, 1932). *Eryx jaculus* (Linnaeus, 1758) can be distinguished by its small eyes and indeterminate neck. The head is covered with small scales. The tail is short and has one row of subcaudal scales. Ventral scales are different from dorsal scales, and are narrower than the width of the body. They feed on lizards, small
mammals, and other snakes. According to Mohammad et al. (2013) *E. jaculus* is the only species reported from Bahr Al-Najaf depression, Al-Najaf Province, Iraq. The available compilations of snakes occurring in Iraq are that of Corkill (1932), Khalaf (1959), and Leviton et al. (1992). This note refers to specimens collected by the authors and stored in the collection of natural history Museum of the Baghdad University (NHMBU). There is no precise identification key for the species of *Eryx* in Iraq; this leads to misidentification of Iraqi species. As yet, no study has been done on the taxonomic status of *Eryx* in Iraq. The aim of this study is to determine some diagnostic characters for identification of the species of *Eryx* in southern Iraq.

![Figure 1](image-url)

**Figure 1.** Map showing the Known distribution of *Eryx* in Iraq. Indicated as red circle known locations (according to Boulenger, 1920; Corkill, 1932 and Mohammad et al., 2013). The current locality described in the paper is marked with Black Square. Bahr Al-Najaf-Al-Najaf Province-Iraq.

**Material and Methods**
Bahr Al-Najaf is a wetland depression area extends at northwest-southeast direction of Al-Najaf Province Iraq about 750 Km², of coordinates longitude 43° 40 - 44° 25 E and latitude 31° 40 - 32° 10 N and altitude elevation of about 47 - 11 m a. s. I. (Al-Atia, 2006; Benni and Al-Tawash, 2011). It is composed of a lake or marsh-like area with limited cultivated orchards beyond and surrounded by vast desert or semi desert areas. The area is classified as a part of the Arabian Desert and East Sahero - Arabian xeric shrub lands ecoregion (Bachmann et al., 2011). Thirty specimens including 12 males and 18 females were included in the study. The locality data and habitat features were recorded as well (Fig. 1, Table 1).

**Field identification in live:** A green brown, or grey snake dorsally with darker blotches, and with a spotted yellowish or white belly; no neck, a stumpy tail, small plates on the head, a vertical pupil, posterior dorsals slightly keeled, ventrals narrow (Corkill, 1932).

**Collection of specimens:** Samples were obtained either through direct collection by hand or through interviews with hunters and locals by visiting the area five times during the period from 19th
of September 2013 to 13th of May 2014. After collecting, the specimens were placed within a special sack, and transferred to the laboratory for identification and complementary studies.

**Fixation, preservation and identification of samples:** All the collected specimens were initially fixed with 96% ethanol and later preserved in 75% ethanol. Voucher specimens were stored in Razi University Zoological Museum (RUZM) at Razi University of Kermanshah-Iran, under museum number RUZM-BE 23.1-30. Specimens were identified according to Latifi (1991, 2000), Leviton et al. (1992), and Eskandarzadeh et al. (2013) using morphometric measurements, coloration, and pholidosis features (including the number, structure, and range of scales and plates). The metric and meristic characters used in this study are presented in Table 2.

**Sex determination:** The sex of snakes in this study determined using two methods for all specimens:

- **Cloacal probing:** Using a blunt probe of appropriate size (Schaefer, 1934). The probe is inserted caudally, at the lateral margins, into the cloacal opening of the animal. In a male snake, the hemipenial pockets will allow the probe to move caudally for some distance; in a female snake, the probe will not be able to move far. Great care must be taken when using this method as the tissues in this region are easily punctured. The hemipenial eversion is shown in Fig. 2 a-b.

- **Cloacal Popping:** By applying pressure to the base of the tail it is often possible to evert the hemipenes of male snakes. This method is preferred for sexing small snakes and neonates (Gregory, 1983) as large males are difficult to evert and excess pressure may cause injury (Fig. 2 c).

**Statistical analysis:** An independent samples t-test as well as the analysis of variance (ANOVA) was performed using SPSS 20.0 to survey differences among *Eryx* spp.

### TABLE 1. Details of the locality and habitat of *Eryx jaculus* and *Eryx* sp. included in study.

<table>
<thead>
<tr>
<th>Species</th>
<th>Locality</th>
<th>Mean of Elevation</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Eryx jaculus</em></td>
<td>Iraq - Bahr Al-Najaf it extends</td>
<td>N</td>
<td>Semi-arid area with bushes and usually at elevations of 19 m. It is composed of a lake or marsh-like area with limited cultivated orchards beyond and surrounded by vast desert or semi desert area.</td>
</tr>
<tr>
<td>(N=20)</td>
<td>at north west-south east direction of an area about 750 Km2</td>
<td>31˚52’ 28.5&quot;</td>
<td>19 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>31˚58’ 57.5&quot;</td>
<td></td>
</tr>
<tr>
<td><em>Eryx</em> sp.</td>
<td>E</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>(N=10)</td>
<td></td>
<td>44˚15’ 52.3&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>44˚18’ 29.4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 2. Description of the most informative metric and meristic characters in *Eryx*.

<table>
<thead>
<tr>
<th>No.</th>
<th>Definition</th>
<th>Character</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Distance between posterior edge of eye and corner of mouth</td>
<td>DEM</td>
</tr>
<tr>
<td>2</td>
<td>Width of interocular space</td>
<td>WI</td>
</tr>
<tr>
<td>3</td>
<td>Number of scales around right eye</td>
<td>RE</td>
</tr>
<tr>
<td>4</td>
<td>Number of scales around left eye</td>
<td>LE</td>
</tr>
<tr>
<td>5</td>
<td>Number of right supralabial scales</td>
<td>R\LAB</td>
</tr>
<tr>
<td>6</td>
<td>Number of left supralabial scales</td>
<td>L\LAB</td>
</tr>
<tr>
<td>7</td>
<td>Number of scales posterior to internasal</td>
<td>PIN</td>
</tr>
<tr>
<td>8</td>
<td>Number of scales between eyes</td>
<td>BE</td>
</tr>
<tr>
<td>9</td>
<td>Number of dorsal scales</td>
<td>DS</td>
</tr>
<tr>
<td>10</td>
<td>Number of ventral scales</td>
<td>VS</td>
</tr>
<tr>
<td>11</td>
<td>Number of subcaudal scales</td>
<td>ScdS</td>
</tr>
<tr>
<td>12</td>
<td>Body length</td>
<td>LB</td>
</tr>
<tr>
<td>13</td>
<td>Tail length</td>
<td>LT</td>
</tr>
<tr>
<td>14</td>
<td>Number of scales between eye and nasal</td>
<td>BEN</td>
</tr>
<tr>
<td>15</td>
<td>Second upper labial scale shorter or higher than third one</td>
<td>2nd\LAB</td>
</tr>
</tbody>
</table>
Figure 2. Cloacal probing technique to determine gender: (a) In most male snakes probe inserted a distance spanning 10 subcaudal scales, (b) female snakes have two out pockets that pass a short distance into the base of the tail; in most female snakes the inserted probe can be introduced into these pockets only a very short distance, usually only the distance of 2-3 subcaudal, (c) Cloacal popping technique: By applying pressure to the base of the tail it is often possible to evert the hemipenes of male snakes.

RESULTS
As shown in Table 3 *E. jaculus* (Linnaeus, 1758) and *Eryx* sp. show overlap in 13 morphometric and meristic characters. The only differing character between *E. jaculus* and *Eryx* sp. is the length of second upper labial (2nd LAB) in relation to the third one on the one side, and presence of three or two shields behind the internasals on the other side (Fig. 3 a-e).

The analysis of variance (ANOVA) was performed for meristic and metric characters to show significantly variable characters of *E. jaculus* (Linnaeus, 1758) and *Eryx* sp. The result of the ANOVA shows that the ratio of interocular space width to distance between the posterior edge of eye and corner of mouth (WI/DEM) was significantly different $P \leq 0.05$. Number of scales around right eye (RE), number of scales between eyes (BE), number of ventral scales (VS), number of subcaudal scales (ScdS), number of scales around left eye (LE), number of scales between eye and nasal (BEN), number of dorsal scales (DS), and the ratio of body length to tail length (LB/LT) with $P>0.05$ were not significantly different.

The results of the independent samples t-test showed that the number of dorsal scales (DS), the ratio of body length to tail length (LB/LT) and ratio of interocular space width to distance between the posterior edge of eye and corner of mouth (WI/DEM) were significantly different between males of *E. jaculus* and *Eryx* sp. $P \leq 0.05$. Ratio of interocular space width to distance between the posterior edge of eye and corner of mouth (WI/DEM) was significantly different between females of *E. jaculus* and *Eryx* sp. $P \leq 0.05$. The other studied morphometric and meristic characters with
**TABLE 3.** Descriptive table including minimum, maximum, mean and standard error in 13 morphometric and meristic characters and ANOVA of all morphometric and meristic characters in *Eryx jaculus* and *Eryx sp.* included in this study. Significant values (P < 0.05) are shown in bold.

<table>
<thead>
<tr>
<th>Characters</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eryx jaculus (N=9)</td>
<td>Eryx sp (N=3)</td>
</tr>
<tr>
<td>Range</td>
<td>Mean</td>
<td>St. Error</td>
</tr>
<tr>
<td>R/E</td>
<td>8-11</td>
<td>9.4</td>
</tr>
<tr>
<td>L/E</td>
<td>9-11</td>
<td>9.6</td>
</tr>
<tr>
<td>R/LAB</td>
<td>10-11</td>
<td>10.7</td>
</tr>
<tr>
<td>L/LAB</td>
<td>10-11</td>
<td>10.7</td>
</tr>
<tr>
<td>BE</td>
<td>5-8</td>
<td>6.2</td>
</tr>
<tr>
<td>PIN</td>
<td>2-2</td>
<td>2</td>
</tr>
<tr>
<td>BEN</td>
<td>3-3</td>
<td>3</td>
</tr>
<tr>
<td>DS</td>
<td>47-53</td>
<td>48.8</td>
</tr>
<tr>
<td>VS</td>
<td>187-204</td>
<td>191.7</td>
</tr>
<tr>
<td>ScdS</td>
<td>25-35</td>
<td>31.3</td>
</tr>
<tr>
<td>LB/LT</td>
<td>6.7-11.4</td>
<td>9</td>
</tr>
<tr>
<td>W/DE M</td>
<td>1-1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>SVL</td>
<td>42.2-65.5</td>
<td>52.1</td>
</tr>
<tr>
<td>2nd LAB</td>
<td>Higher than third one</td>
<td>-</td>
</tr>
</tbody>
</table>

P> 0.05 were not significantly different. Descriptive characters and descriptive statistics of the studied species are shown in Tables 3.

**DISCUSSION**

In their treatment Corkill (1932) and Khalaf (1959) considered *E. j. familiaris* as to be the only subspecies found in Iraq. Leviton et al. (1992) mentioned *E. j. jaculus* (Linnaeus, 1758) and *E. j. familiaris* Eichwald, 1831 from Iraq. According to the results, and considering the principle of priority, the populations of *E. jaculus* included in this study (20 specimens) are regarded as *E. j. jaculus*
Figure 3. The topography of the head in *Eryx*. (a) the second upper labial higher than the third one in *E. jaculus*. (b) the second upper labial lower than the third one in *Eryx* sp. (c) three scales behind internasals in *Eryx* sp. (d) three scales behind internasals, the middle shield inserted between the other two and in contact with internasals in *E. j. jaculus*. (e) two large shields behind internasals, a third large median shield may insert itself between the other two but does not contact internasals in *E. j. familiaris*.

(one specimen) and *E. j. familiaris* (19 specimens). The characters of *E. j. jaculus* based on the studied specimens are as follows: the second supralabial is higher than the third; width of interocular space is more than 1.2 times than distance between posterior edge of eye and corner of mouth; eyes directed sideways; three scales between eye and nasal area; the ventral surface is cream-colored with black spots more or less interconnected; in some cases they are seen as linear lines; the undersurface of the head has scattered spots, some spots are seen on the lateral surfaces; dorsal surface olive-brown, with scattered black or brown spots meeting as transverse and diagonal lines in most samples. 187-201 ventrals; three large shields behind internasals, the middle shield inserted between the other two and in contact with internasals; this character is the most diagnostic character for *E. j. jaculus*, since *E. j. familiaris* has only two large shields behind internasals, a third large median shield may insert itself between the other two but does not contact internasals; dorsal scales, vary from 40 to 55 rows at midbody; the ventral scales number from 180 to 205 and the subcaudals range from 20 – 30. The scale count for the specimens in Iraq having a higher average than those from Europe and Africa (Corkill, 1932; Khalaf, 1959).

In addition, in ten specimens of *Eryx* sp. the second supralabial is lower than the third one. Two or three scales located posterior to the internasal. Width of interocular space is equal or smaller than...
distance between posterior edge of eye and corner of mouth, and eye directed sideways. Three scales are present between eyes and nasal. The lower surface of head has a few black spots in comparison with *E. jaculus*, the morphological features generally agree with published data (Latifi, 1991, 2000; Eskandarzadeh et al., 2013), being very close to *Eryx miliaris* (Pallas, 1773). So, we tentatively regard this snake as *Eryx cf. miliaris*. This snake has not already been reported from Iraq. It is found in north coast of the Caspian Sea, east through Kazakhstan to western Inner Mongolia, Iran, south to Turkmenia, Afghanistan, and China (Kluge, 1993; Latifi, 2000).

The characters of this new population in Iraq are generally similar to *E. miliaris*, a more comprehensive study is needed using morphology, ecology and molecular data to clarify the real taxonomic status of this taxon. In this study we determined some diagnostic characters for identification of the species of *Eryx* in southern Iraq and our findings show that taxonomy and distribution of snakes in Iraq need more attention and deserve further studies.

**Key to the species of *Eryx* in the study area**

1a. Second supralabial longer than third .................................................................2

1b. Second supralabial shorter than third .................................................................3

2a. Two large shields behind internasals, a third median shield may insert itself between the other two but does not contact internasalsventrals ....................................................*Eryx jaculus familiaris*

2b. Three large shield behind internasals, the third median shield inserted between the other two and in contact with internasals ....................................................*Eryx jaculus jaculus*

3a. Two or three scales posterior internasals .............................................................*Eryx cf. miliaris*

3b. Four scales posterior internasals .............................................................................*Eryx miliaris*

**Acknowledgments**

We are grateful to the Iraqi Ministry of Higher Education and Scientific Research for their kind collaboration. Also, we thank the authorities of Razi University (Kermanshah-Iran) for their support during field work. We also thank the Department of the Environment in Al-Najaf Province, Iraq for providing facilities and for their efforts in collecting specimens.

**LITERATURE CITED**


Sequence variation in the mtDNA, ND4-tRNA<sub>LEU</sub>, segments of *Laudakia nupta* (De Filippi, 1843) in Iran

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*Laudakia nupta*, with numerous local populations through Iran, is one of the most widely distributed species of the Genus *Laudakia* in Iran. Eight hundred and fifty nine bp of mitochondrial ND4-tRNA<sub>LEU</sub> were sequenced and analyzed for 47 specimens of *L. nupta* and three specimens of *Laudakia melanura*, as an out-group taxon. All specimens were collected during field work in Iran. Based on branch pattern of the phylogenetic trees and the amounts of genetic distances within and between major clades recovered in the phylogenetic trees, *L. nupta*, as a species complex in Iran, should be fundamentally revised taxonomically. Based on our results, two clear geographically isolated clades could be distinguished; one nominate species (*L. nupta*) distributed through southwest to eastern Iran, and the other consisting of the populations of western foothills of the Zagros Mountains. The morphological analysis would enable us to describe the latter populations as a new species.

**Key words:** Agamidae, new entity, phylogeny, species complex, taxonomy.

**INTRODUCTION**

The genus *Laudakia* Gray, 1845, comprises about 20 species, mainly occurring in upland and mountainous regions of the central and southern Asia. Of these, at least five species occur in Iran (Šmíd et al., 2014). Based on a non-phylogenetic morphological analysis, *Laudakia* has recently been divided into three genera *Stellagama, Paralaudakia* and *Laudakia* (Baig et al., 2012). But, shortly after that, a robust molecular phylogenetic analysis, strongly supported monophyly of the genus *Laudakia* Gray, 1845 suggesting that the taxonomic revision of the genus is not necessitated (Pyron et al., 2013).

*Laudakia nupta*, with numerous local populations through Iran, is one of the most widely distributed species of the Genus *Laudakia* in Iran (Anderson, 1999). In 1843, DeFilippi described *L. nupta*, based on material collected from Persepolis, about 45 km NE of Shiraz, Fars Province in Iran. Ever since its description, taxonomic status of *L. nupta* has been the subject of controversial interpretations. Latter, two subspecies of this taxon were introduced: *L. nupta nupta* and *L. n. fusca* (Blanford, 1876). Subsequently, Bouleneger (1885) supported this grouping furthermore, separated *fusca* from the nominate form by having more developed spinose scales on the sides of head and...
FIGURE 1. Sampling locations along the distribution range of *Laundakia nupta*, in Iran (see Table 1 for individual sampling sites).

neck. Smith (1935), however, did not find any significant difference between *L. n. nupta*, *L. n. fusca*, and *L. carinatus*, and placed all three under the nominate form *nupta*. For many years, some authors (e.g. Anderson, 1999) have considered the Eastern populations in SE Iran and Pakistan as a subspecies, *L. n. fusca*. Despite that, other authors have considered this taxon as a full species (Cheatsazan et al., 2008; Khan, 2006; Rastegar-Pouyani et al., 2008). The latest taxonomic revision by Baig et al. (2012), however, resurrects subspecies status for *L. n. fusca*.

Considering the confusion surrounding the status of *L. nupta*, the main goal of this study is to elucidate the taxonomical position of the Iranian populations of *L. nupta* using mitochondrial ND4-tRNA sequences.

MATERIAL AND METHODS

Specimens used in the present study were collected during expeditions to different parts of Iran since 2010 to 2013. Description on localities, geographic coordinates, voucher numbers and NCBI accretion numbers are presented in Table 1 and localities on the Iranian map are shown in Figure 1. The specimens and DNA materials are vouchered in the department of Biology, Hakim Sabzevari University, Iran. Specimens were identified according to the morphological keys as presented in Anderson (1999).

DNA was extracted using non-organic DNA Extraction Procedure (Proteinase K and Salting out Rastegar-Pouyani et al., 2014). After washing the pellet in ice-cold 70% EtOH once, the air-dried DNA was dissolved in 100µl of ultrapure, sterile H2O, and finally DNA concentration was determined using spectrophotometer, that ranged from 50-900 ng/ml. Mitochondrial gene encoding
the fourth subunit of NADH dehydrogenase (plus downstream Serine, Histidine, and Leucine tRNAs; hereafter collectively referred to as ND4 was amplified using standard PCR procedures with the following primers: ND4F, 5'-CACCTATGACTACAAAAAGCTCATGTAGAAC-3' (Thuang et al., 2009) and Leu R, 5'- CATTACTTTTTACTGGATTGGACACCA-3' (Arevalo et al., 1994). PCR reactions performed in 20µl with the following conditions: Initial denaturation stage of 95°C (05:00) followed by the 36 cycles with denaturation at 95°C (00:40), annealing at 50°C (00:40) and extension at 72°C (01:40) then single extension cycle at 72°C (05:00).

### Table 1 - List of the specimens and their localities (see Fig. 1).

<table>
<thead>
<tr>
<th>Species</th>
<th>Field Number</th>
<th>Accession Number</th>
<th>Location Number</th>
<th>Geographic Coordinates</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. nupta</td>
<td>ZUTCREP.1857</td>
<td>KX130988</td>
<td>1</td>
<td>27.50N 60.12E</td>
<td>Sistan and Baluchistan Province, Bazman</td>
</tr>
<tr>
<td>L. nupta</td>
<td>ER437</td>
<td>KX130981</td>
<td>9</td>
<td>27.12N 54.14E</td>
<td>Hormozgan province, Bastak</td>
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<tr>
<td>L. nupta</td>
<td>ZUTCREP.1845</td>
<td>KX130982</td>
<td>13</td>
<td>28.53 N 51.39 E</td>
<td>Fars Province, Kerman</td>
</tr>
<tr>
<td>L. nupta</td>
<td>ZUTCREP.1848</td>
<td>KX130983</td>
<td>25</td>
<td>24.30 N 50.56 E</td>
<td>Qom Province, around the city of Qom</td>
</tr>
<tr>
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<td>ZUTCREP.1849</td>
<td>KX130984</td>
<td>24</td>
<td>27.56 N 54.26 E</td>
<td>Bushehr Province, Asalouy-Nayband region</td>
</tr>
<tr>
<td>L. nupta</td>
<td>ZUTCREP.1850</td>
<td>KX130985</td>
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<td>28.80 N 51.39 E</td>
<td>Bushehr Province, Around Abaran</td>
</tr>
<tr>
<td>L. nupta</td>
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<td>KX130986</td>
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<td>Bushehr Province, Around Abaran</td>
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<td>28.80 N 51.39 E</td>
<td>Bushehr Province, Around Abaran</td>
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<td>Bushehr Province, Around Abaran</td>
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<td>Bushehr Province, Around Abaran</td>
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<tr>
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<td>24</td>
<td>28.80 N 51.39 E</td>
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</tr>
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<td>ZUTCREP.1858</td>
<td>KX130993</td>
<td>24</td>
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<td>Bushehr Province, Around Abaran</td>
</tr>
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<td>ZUTCREP.1859</td>
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<tr>
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<tr>
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<td>KX130997</td>
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<td>KX130998</td>
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<td>Bushehr Province, Around Abaran</td>
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<td>KX131003</td>
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<td>Bushehr Province, Around Abaran</td>
</tr>
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<td>Bushehr Province, Around Abaran</td>
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<td>Bushehr Province, Around Abaran</td>
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<td>Bushehr Province, Around Abaran</td>
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<td>KX131009</td>
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<td>Bushehr Province, Around Abaran</td>
</tr>
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<td>L. nupta</td>
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<td>KX131010</td>
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<td>28.80 N 51.39 E</td>
<td>Bushehr Province, Around Abaran</td>
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<td>L. nupta</td>
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<td>KX131011</td>
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<td>Bushehr Province, Around Abaran</td>
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<td>Bushehr Province, Around Abaran</td>
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<td>KX131015</td>
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<td>28.80 N 51.39 E</td>
<td>Bushehr Province, Around Abaran</td>
</tr>
</tbody>
</table>

Field Number: P.1858

Accession Number: KX130988

Location Number: 1

Geographic Coordinates: 31.52 N 49.85 E

Locality: Khuzestan Province, 40 km east of Hafteh
ALIGNMENT AND PHYLOGENETIC ANALYSIS

Following Baig et al., (2012), *Laudakia melanura* was designated as the out-group taxon. Sequences were aligned using Clustal W, as implemented in Bioedit version 7.0.5.3 (Hall, 1999). Prior to analysis, sequences of the ND4 gene were translated into amino acids using vertebrate mitochondrial translation code implemented in the program Mega 6 (Tamura et al., 2013) to check if there were any inspected stop codons and to ensure that all the sequences were protein coding and functional instead of pseudo genes. Genetic distances among the major clades were also calculated by Mega 6 (Tamura et al., 2013).

Three methods of phylogenetic analysis were used: The software PAUP* 4.0b10 (Swofford, 2001) for maximum parsimony, MrBayes v3.2.0 (Huelsenbeck & Ronquist, 2001) for Bayesian inference, and RaxML GUI v. 0.95 (Silvestro & Michalak, 2012) for Maximum likelihood. Because of the negligible effects of saturation in our data set, the MP analysis was performed with all sites weighted equally. For ML and BI analyses J Modeltest 2.1.4 (Darriba et al., 2012) was used, to select the most appropriate model of sequence evolution. Nonparametric bootstrapping (Felsenstein, 1985) performed with 1000 replicates to estimate stoutness of the branches of the shortest MP and ML trees.

RESULTS

A total of 859 characters of mtDNA ND4 were clearly aligned and analyzed in 50 specimens (including three out-group and 47 in-group taxa). No premature stop codons were observed in ND4, indicating that the obtained sequences were mitochondrial in origin and not nuclear pseudo copies. Of these characters, 603 characters were invariable and 238 sites (27.7%) were variable; just 224 sites (26.0%) were parsimony informative. A+T proportion (58.1%) was much higher than the C+G (41.9%) proportion. Uncorrected genetic divergence and Kimura-2-parameter genetic distance (Table 2) among the major groups of the tree indicated a considerable distance among the major clades. The selected models under Akaike information criterion, was TrN+I with the following parameter settings: -lnL = 2467.895; base frequencies: A = 0.3729, C = 0.2866, G = 0.1249, T = 0.2157; six substitution types: A–C = 1.0000, A–G = 18.7567, A–T = 4.0405, C–G = 1.0000, C–T = 11.7774, G–T = 1.0000; Pinvar = 0.6110. The trees generated using different methods of phylogenetic reconstruction resulted in same general topology, insofar only the Bayesian tree is shown in figure 2. Two major clades were revealed in the phylogenetic tree (Fig. 2) with clade one.

### Table 2. Uncorrected genetic divergence (p-distance) for major clades and sub-clades recovered in this study and the outgroup taxon.

<table>
<thead>
<tr>
<th>Outgroup</th>
<th>Sub-clade 1A</th>
<th>Sub-clade 1B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outgroup</td>
<td>0.223</td>
<td></td>
</tr>
<tr>
<td>Sub-clade 1A</td>
<td></td>
<td>0.013</td>
</tr>
<tr>
<td>Sub-clade 1B</td>
<td>0.226</td>
<td></td>
</tr>
<tr>
<td>Clade 2</td>
<td>0.220</td>
<td>0.097</td>
</tr>
</tbody>
</table>

### Table 3. Kimura-2-parameter genetic distance for major clades and sub-clades recovered in this study and the outgroup taxon.

<table>
<thead>
<tr>
<th>Outgroup</th>
<th>Sub-clade 1A</th>
<th>Sub-clade 1B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outgroup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-clade 1A</td>
<td>0.270</td>
<td></td>
</tr>
<tr>
<td>Sub-clade 1B</td>
<td>0.273</td>
<td>0.013</td>
</tr>
<tr>
<td>Clade 2</td>
<td>0.264</td>
<td>0.107</td>
</tr>
</tbody>
</table>
**Figure 2.** Phylogenetic relationships between different populations of *Laudakia nupta* (Bayesian inference) based on the 859 bp of ND4 (tRNAsHis+Ser+Leu). *L. melanura* was designated as outgroup taxon. Numbers next to the nodes indicate clade credibility (Posterior probability) followed by bootstrap values obtained under ML Tree with 1000 replicates.
being subdivided into two distinct sub-clades. Clade one consists of specimens distributed in SW and Central Iran, through eastern Iran, and also along the coastal regions of the Persian Gulf (localities 1-15, 24, and 25; Fig. 1), whilst clade 2 consists of specimens restricted to western foothills of the Zagros Mountains (localities 16-23; Fig. 1). Although the sub-clade1B is geographically distributed in eastern part of Iran, but due to the low genetic distance between the sub-clades 1A and 1B (Table 2 and 3), we consider them both as members of the same major clade.

**DISCUSSION**

We have produced the first detailed and well-supported molecular phylogeny pattern for the Iranian populations of *L. nupta*. The results clearly showed that the Iranian populations of *L. nupta* are composed of two major monophyletic clades. These clades are correlated well with the geographic distribution of the species. Despite various debates about species tree and gene tree (Goodman et al., 1979), one mitochondrial genetic distance reflects taxonomic status of reptiles (Johns & Avise, 1998). Based on the results presented here, we propose that two major clades of *L. nupta* in Iran could be signed as distinct taxa at species level. Based on our proposal, the clade 1 that contains specimens from Perspolis (the type locality) should be named as traditional *L. nupta* and Clade 2, containing populations from western Iran (Fig. 1 and 2), should be described as a new species. Considering topology of the tree and the amounts of genetic distances between the sub-clades 1A and 1B, they together constitute the same major clade (Table 2, Fig. 2). Samples from type locality of *L. n. fusca* were not available for our study (mostly because of security considerations), therefore we are not able to make decision about taxonomic status of *L. n. fusca* in our phylogenetic analysis. However, specimens of sub-clade 1B are morphologically close to description of this subspecies (unpublished data), in addition these are geographically close to the terra typical for *L. n. fusca* and It has been found only at its type localities, near (Kalagan area Jalq (34°02’N, 64°42’E) in Baluchistan, close to the Iran-Pakistan border line) (Rastegar-Pouyani & Nilson, 2002). According to Anderson (1999) and Mahjoorazad et al. (2005) the range of *L. n. fusca* extends westwards along the coast of the Persian Gulf in Southwestern Iran. However, our tree does not support the occurrence of *L. nupta fusca* along coastal regions of the Persian Gulf, because populations of this area are all grouped within the sub-clade 1A (*L. n. nupta*). Based on the results and distribution pattern of *L. nupta* in Iran, it could be concluded that possibly the Zagros Mountains uplifting has played an important role in genetic divergence among clade 1 and 2. With this hypothesis, divergent time of two major clades probably goes back to the Late Miocene, around 10–12.4 MYA (Mouthereau, 2011; Sborshchikov et al., 1981). Influence of the geological event of the uplifting of Zagros Mountains on the Iranian herpetofauna has been proposed in a couple of studies (Macey et al., 1998, 2000; Rastegar-Pouyani et al., 2009).

In conclusion, it sounds that more field samplings as well as supplementary ecological and morphological studies, and further molecular data are necessary to shed light on the taxonomic status and historical biogeography of *L. nupta* in Iran. However, this preliminary study suggests that the taxonomic status of populations traditionally attributed to *L. nupta* in Iran should be fundamentally revised.

**LITERATURE CITED**

MTDNA SEQUENCE VARIATION OF LAUDAKIA NUPTA IN IRAN


Studying morphological and environmental characteristics of the Plateau Snake Skink *Ophiomorus nuchalis* Nilson and Andrén, 1978 (Sauria: Scincidae) in Central Plateau of Iran

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(Received: 27 November 2014; Accepted: 30 May 2015)

The nocturnal burrowing skinks of genus *Ophiomorus* is composed of 11 species (Anderson & Leviton, 1966; Nilson & Andrén, 1978; Anderson, 1999; Kazemi et al., 2011) and are distributed from southern Balkans to Sindbian deserts in India (Anderson & Leviton, 1966; Sindaco & Jeremčenko, 2008). Seven species of *Ophiomorus* have been recorded from Iran including *O. blanfordi* (Boulenger, 1887); *O. brevipes* (Blanford, 1874); *O. nuchalis* (Nilson & Andrén, 1978); *O. persicus* (Steindachner, 1867); *O. streiti* (Anderson and Leviton, 1966); *O. tridactylus* (Blyth, 1853); *O. maranjabensis* (Kazemi et al., 2011)(Anderson, 1999; Rastegar-Pouryan et al., 2008; Kazemi et al., 2011; Safaei-Mahroo et al., 2015). According to Greer and Wilson (2001), the scincid lizard is more attractive case to study because of having ancestral characters and limb reduction. In the case, *O. nuchalis* is one of the shink species with having the most primitive limb morphology which has four digits on the manus and three on the pes (Greer & Wilson, 2001; Fig. 4). A comprehensive phylogenetic cladistic analysis on the genus *Ophiomorus* was done by Greer and Wilson (2001). Their analysis confirmed *Ophiomorus* as a monophyletic genus and the eastern species clade as monophyletic. The western group of species was expressed as polyphyletic in origin. The *O. nuchalis* is located is the western group. Another study has been mentioned molecular phylogenetic relationships of *O. punctatissimus* in Aegean trench but phylogenetic relationship among all Iranian *Ophiomorus* still remain unclear (Poulakakis et al., 2008).

The type locality of *O. nuchalis* is the northern slope of “Siah Kooh” in the center of the Kavir Protected Region, Iran (52°11' E, 34°44' N) (Nilson & Andrén, 1978). So far, distribution range of *O. nuchalis* extended to Qom and Yazd provinces in west and east, respectively (Nilson & Andrén, 1978, Mozaffari et al., 2011, Farhadi Qomi et al., 2011 Hosseinzadeh et al.,Inpress).
**Figure 1.** Distribution map of *Ophiomorus nuchalis*. 1: Type locality in Cheshmeh Shah, Kavir Protected Region, Tehran (52°11' E, 34°44' N) (Nilson & Andrén, 1978). 2: 5 Km north of Kavir Protected Region entrance (51°46'14'' E, 35°6'42'' N) (Mozaffari et al., 2011). 3: Arisman village (52°0'11'' E, 33°39'27'' N). 4: Abouzeid Abad (51°45'30''E, 33°54'52'' N), Isfahan Province (Farhadi Qomi et al., 2011).

**Figure 2.** Habitat of *O. nuchalis*. A: Abouzeid abad, B: Arisman.
### TABLE 1. Locality and the voucher numbers of studied specimens of *O. nuchalis*.

<table>
<thead>
<tr>
<th>Voucher Number</th>
<th>Locality</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Collector</th>
<th>Date</th>
<th>Type of Habitat</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Arisman village</td>
<td>52° 0'</td>
<td>33° 39'</td>
<td>Kazemi</td>
<td>6 June, 2010</td>
<td>cucumber farm</td>
</tr>
<tr>
<td>ZMGU.2580</td>
<td>Abouzeid Abad village</td>
<td>51°45'</td>
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<td>Farhadi Qomi</td>
<td>9 June, 2011</td>
<td>plowed farm near a peach garden</td>
</tr>
<tr>
<td>ZMGU.2589</td>
<td>Abouzeid Abad village</td>
<td>51°45'</td>
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<tr>
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<td>51°45'</td>
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<td>30 April, 2012</td>
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<td>33°55'</td>
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<td>13 May, 2012</td>
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### TABLE 2. Available vegetation in the study areas.

<table>
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<tr>
<th>Regions</th>
<th>Kavir protected regions (Nilson &amp; Andrén, 1978)</th>
<th>Mobarakkie (Mozaffari et al., 2011; Farhadi Qomi, 2011)</th>
<th>Abouzde Abad (Farhadi Qomi et al., 2011)</th>
<th>Arisman (Farhadi Qomi et al., 2011)</th>
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<td>vegetation</td>
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<td>Haloxylon</td>
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<td>*</td>
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</tr>
<tr>
<td>Alhagi</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
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<td>Peganum</td>
<td>*</td>
<td>*</td>
<td>*</td>
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</tr>
<tr>
<td>Prosopis</td>
<td>*</td>
<td></td>
<td></td>
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</tr>
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<td></td>
<td></td>
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<tr>
<td>Stipa</td>
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<td></td>
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<tr>
<td>Artemisia</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td></td>
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<tr>
<td>Pannus pertica</td>
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<tr>
<td>Tamarix</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>berba-alba</td>
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<td></td>
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<tr>
<td>Astragalus</td>
<td></td>
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<td></td>
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<tr>
<td>Shrubs cucumber</td>
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</table>

* : Containing specimens  
** : Dominant specimens

### TABLE 3. Results of measurement nine metric and eight meristic characters for six specimens of *O. nuchalis*.

<table>
<thead>
<tr>
<th>Characters</th>
<th>GNM4418</th>
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<th>ZMGU.2589</th>
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<tr>
<td>HH</td>
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<td>FLL</td>
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* The Arisman specimen has been hurted and we do not have the back of the body.
**Figure 3.** Graphs of measurement values and comparisons of 8 metric characters for six specimens of *O. nuchalis*. a) length of snout to vent and tail length, b) head length and snout length, c) head width and head height and d) forelimb length and hindlimb length.

**Figure 4.** A) Dorsal view of *O. nuchalis* (ZHIM 23), B) Ventral view of head *O. nuchalis* (ZMGU.2580).

**Figure 5.** View of tongue *O. nuchalis*, and small scale between eye and preocular (ZMGU.2580).
We attempted to investigate morphology variation and environmental condition, to give more information of biological aspects of *O. nuchalis* in Iran. The six studied specimens were deposited in Göteborg Natural History Museum (GNM), Zoological Museum Gorgan University (ZMGU) and Zagros Herpetological Institute Museum (ZHIM). In addition, Data were taken from literature (Nilson & Andrén, 1978; Mozaffari et al., 2011). A list of studied specimens and their localities with voucher numbers are given in Table 1, Figure 1. The morphology of used materials was examined using 9 metric and 8 meristic characters as follow: SVL= including Length of snout to vent (from tip of snout to anterior edge of cloaca), TL= Tail Length (from posterior edge of cloaca to tip of tail), HL= Head Length (from end of snout to angle of jaw), SL= Snout Length (from tip of snout to anterior corner of eye), HW= Head Width (widest point of head), HH= Head Height, FLL= Forelimb Length, HLL= Hindlimb Length, DHF= Distance between hindlimbs and forelimbs, PTO= Postocular, PO=Preocular, LO= Loreal, SQ= Scales round the middle of the body, IP-V= Scales between interparietal at the level of vent, SPL= Supralabials, IFL= Infralabials, SPO= Supraoculars.

**ENVIRONMENTAL DATA**

The average annual precipitation of Kavir Protected Region is 100 mm at the nearest meteorological station in Varamin city, about 30 km to the northwest. During the hot summer months the temperature may reach 50 °C and the minimum temperature reaches -15 °C in winter. In the case, the maximum and minimum temperatures of Abouzeid abad, Arisman regions reach to 46.2 °C and -12.5 °C, respectively (Fig. 2). The average rainfall is 170 mm. The species found in low hills with stony or rocky ground, near dry river with clay topsoil, agricultural farms and sand dunes (Nilson & Andrén, 1978; Mozaffari et al., 2011; Farhadi Qomi , 2011; Hosseinzadeh et al., Inpress). Type of vegetation has been examined in four area of catching the species (Table 2). According to Mozaffari et al. (2011), dominant habitat vegetation contained *Tamarix, Prosopis*, *Alhagi* and *Artemisia* (Table 2). *Artemisia herba-alba* constitutes the dominating species in the plant community on the low hills (Nilson and Andrén, 1978). In total, *Artemisia* and *Tamarix* are dominant in habitat of the species. With regard to environmental findings and previous researches, it seems the species is adapted to live in arid climatic condition and widely distributed in the central Iranian plateau including Semnan, Tehran, Qom, Isfahan, Yazd provinces (Nilson & Andrén, 1978; Mozaffari et al., 2011; Farhadi Qomi et al., 2011; Hosseinzadeh et al., Inpress).

**MORPHOLOGICAL DATA**

Results of comparison morphology of six specimens of *O. nuchalis* showed some variation as follow. The tip of the tongue of *O. nuchalis* from Abouzeid abad, Kashan (ZMGU.2580) has dichotomy style (Fig. 5). The style of tongue has not been mentioned in the species by comparing with other specimens from Abouzeid abad, Arisman, Kavir protected area (holotype). According to Nilson and Andrén (1978), the holotype has two postmentals, which the first in contact with first and second pairs of sublabials but our data showed a specimen has one postmental which is in contact with the first scale of sublabials (ZMGU.2580; Fig. 5; Fig. 4B). In the holotype, there is a single preocular; but we have found a small scale before preocular, between eye and preocular (Fig. 5). The holotype has four supraocular that second and third scales are divided longitudinally and the lower part is one third of the top part but in the specimen of Abouzeid abad (ZMGU.2580), the situation is just right for left eye. The study mentions that the length of the hindlimb is slightly larger than one fourth distance of axilla to groin in the holotype but the measurement value in our adat is 15.1 mm which is smaller than one fourth of the distance of axilla to groin (ZMGU.2580, Fig. 3). In holotype specimen, the hand length is about two third of length of leg but in our specimen the forelimb
lenght is less than two third of the length of hindlimb (ZMGU.2580, Fig. 3). Therefore, further sampling is needed to shed more light of morphological variation and habitat insights of O. nuchalis.

ACKNOWLEDGEMENTS

We are very grateful to Professor Steven Clement Anderson for his assistance and helpful comments on a draft of the manuscript. We also thank Professor Göran Nilson and Dr. Haji Gholi Kami for their cooperation.

LITERATURE CITED


Additional records for *Ophiomorus brevipes* (Blanford, 1874) and *O. tridactylus* (Blyth, 1853) (Sauria: Scincidae) from Sistan and Baluchestan Province, Southeastern Iran

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(Received: 16 December 2014; Accepted: 2 May 2015)

The burrowing skinks of the genus *Ophiomorus* Duméril and Bibron, 1839 with eleven described species distributed from Greece through southwest Asia to northwestern India (Anderson and Leviton, 1966; Nilson and Andrén, 1978; Anderson, 1999; Kazemi et al., 2011). The main diagnostic exo-morphological characteristics of these lovely lizards are described as follows: body elongate; limbs greatly reduced or absent; eye small, lower eyelid with an undivided, transparent disc; ear opening absent or hidden; “nostril between an upper and lower nasal scale, both of uncertain homology; prefrontal scales separated; frontal scale hour-glass shaped due to constriction of frontal by first supraocular (except in *O. latasti*); frontoparietal and parietal distinct; postmentals two; dorsal and lateral body scales with one or sometimes two (in tandem) minute pits in central posterior part of scale” (Boulenger, 1887; Anderson and Leviton, 1966; Anderson, 1999; Greer and Wilson, 2001). Iran hosts seven species of the genus including the Iranian endemic species namely *Ophiomorus maranjabensis* Kazemi, Farhadi Qomi, Kami and Anderson, 2011; *O. nuchalis* Nilson and Andrén, 1978; *O. persicus* (Steindachner, 1867); *O. streeti* Anderson and Leviton, 1966; and native species including *O. blanfordii* (Boulenger, 1887) from Pakistan and Iran; *O. brevipes* (Blanford, 1874) from Iran, Afghanistan and Pakistan; and *O. tridactylus* (Blyth, 1853) from Iran, Pakistan and Afghanistan (Leviton, 1959; Anderson and Leviton, 1966; Anderson, 1999; Khan, 2004; Gholamifard, 2011; Kazemi et al., 2011).

Šmíd et al. (2014) recorded eight species of *Ophiomorus* for Iran, but listed seven species of the genus (the above mentioned species). Based on Ananjeva et al. (2006) perhaps the eighth member of the genus *Ophiomorus* for the herpetofauna of Iran is *O. chernovi* Anderson and Leviton, 1966, as they included it for northeast of Iran (“on the left bank of Tejen River” of Iran), whereas the holotype of this rare species is from “Pul-i-Khatun, at confluence of Geshef-Rud and Hari-Rud” in Turkmen, near the Iranian and Afghan borders (Anderson and Leviton, 1966). However *O. chernovi* not listed among the Iranian lizards by Anderson (1999), Rastegar-Pouyani et al. (2008), Kamali (2013), and Šmíd et al. (2014).

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Because of the fossorial habits of *Ophiomorus*, its species have been collected and investigated less often than most other lizards in Iran. In spite of the relatively high species diversity of *Ophiomorus* (with emphasis on the endemic species), there are relatively limited published data about these scincids.

Here we record two new populations of the sand skinks from southeastern Iran. During fieldwork on the herpetofauna of Sistan and Baluchestan Province three specimens of *Ophiomorus* were collected by the first author and his field assistants from two habitats in eastern and southeastern regions of Sistan and Baluchestan Province (Fig. 1). One adult specimen of *O. brevipes* (RUZM-SO14.01) (Fig. 2a) was collected on 3rd November 2013 at about 9:00 a.m. from under a mass of dried palm leaves on the ground in a palm grove (Fig. 3a) in Sarjou (approximately 27°21’N, 62°19’E), Saravan County, east of Sistan and Baluchestan Province (Fig. 1). Further, two adult and subadult specimens of *O. tridactylus* (RUZM-SO13.01, RUZM-SO13.02) (Fig. 2b) were collected on 9th July 2014 at about 6:00 p.m. from a sandy habitat with semi-dense cover of halophilic bushes in Beris-e Kohneh region (approximately 25°09’N, 61°11’E) (Fig. 3b), Chabahar County, south east of Sistan and Baluchestan Province (Fig. 1).

For preparation of the distribution map of the present specimens in Iran, approximate coordinate of each locality was inserted in the Google earth map (www.earth.google.com) via installed Google earth software and labeled, and then the prepared map was edited (Fig. 1). The collected specimens of *Ophiomorus* are now deposited at the Razi University Zoological Museum (RUZM), Kermanshah, Iran. Counts and measurements for these specimens are given in the Table 1.

The short-legged snake skink, *O. brevipes* originally described as *Zygnopsis brevipes* Blanford 1874 based on a single specimen (ZSI 3464; Zoological Survey of India, Kolkata, India) from “haud procul a Karman in Persia meridionali” [= near Kerman in southern Persia]. Das et al. (1998) specified the type locality to “Saadatabad, southwest of Karman, Persia”. In Iran most records are from Khorasan Razavi, South Khorasan, Sistan and Baluchestan Provinces along the Afghan and Pakistani border, and other records are from Semnan, Kerman, and Hormozgan Provinces (Anderson, 1999; Rastegar-Pouyani et al., 2006; Šmíd et al., 2014).
Morphology and habitat characteristics *Ophiomorus nuchalis*

**Figure 2.** (a) Dorsolateral view of an adult specimen of *Ophiomorus brevipes* (RUZM-SO14.01) with broken tail from Sarjou, Saravan County, and (b) dorsal view of an adult specimen of *O. tridactylus* (RUZM-SO13.01) from Beris-e Kohneh, Chabahar County, both in Sistan and Baluchestan Province, southeastern Iran. Scale bar = 1 cm. (Photo by Ali Gholamifard).

Morphologically, *O. brevipes* is distinguished from its closely related congener, *O. nuchalis* by having the nuchal scales equal to or about 1½ times size of the dorsals (Fig. 4a), while the nuchals in *O. nuchalis* are distinctly enlarged (about 2½ times larger than the dorsals) (Nilson and Andrén, 1978; Anderson, 1999). It is also recognized from the other Iranian congeners (*O. persicus* with 3 fingers and 2 toes, *O. maranjabensis*, *O. streeti* and *O. tridactylus* all with 3 fingers and 3 toes) by having 4 fingers and 3 toes; 22 scales around middle of body (*O. blanfordii* and *O. streeti* both with 20 scales around middle of body), and the interparietal shield that is broader than long (Fig. 4a) (Anderson and Leviton, 1966; Nilson and Andrén, 1978; Anderson, 1999; Kazemi et al., 2011).

*Sphenocephalus tridactylus* Blyth, 1853 is the original name for *O. tridactylus* and was described from Afghanistan (exact locality not given). The Iranian populations of this species known from the Zabol area in Sistan and Baluchestan Province (northeast of province) and from isolated localities in South Khorasan and Hormozgan Provinces (Anderson and Leviton, 1966; Anderson, 1999; Šmíd et al., 2014).

Morphologically, the three-toed sand skink, *O. tridactylus* is distinguished from its congeners by having three fingers, three toes, 22 scales around middle of body, and the parietal and prefrontals shields that are in contact with the anterior temporal and upper labials, respectively (Figs. 4b, f) (Anderson and Leviton, 1966; Anderson, 1999).

According to Anderson and Leviton (1966) and based on the current pattern of diversity and distribution of *Ophiomorus* species in Iran and adjacent areas, the Iranian Plateau can rightly be called a world hot-spot for *Ophiomorus*. 
**TABLE 1.** The main measurements (in mm) and counts for examined specimens of *Ophiomorus brevipes* (RUZM-SO14.01) and *O. tridactylus* (RUZM-SO13.01, RUZM-SO13.02) from Sistan and Baluchestan Province. (R/L): Right/Left.

<table>
<thead>
<tr>
<th>Museum number</th>
<th>Snout-vent length</th>
<th>Tail length</th>
<th>Head width</th>
<th>Head height</th>
<th>Upper labials (R/L)</th>
<th>Lower labials (R/L)</th>
<th>Scales around the middle of body</th>
<th>Scales from the postmental to level of vent</th>
<th>Fingers/Toes</th>
</tr>
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<tbody>
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<td>22</td>
<td>127</td>
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<td><em>O. tridactylus</em> (RUZM-SO13.02)</td>
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<td>-</td>
<td>4.40</td>
<td>3.54</td>
<td>6/6</td>
<td>6/6</td>
<td>22</td>
<td>128</td>
<td>3/3</td>
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</tbody>
</table>

Based on Anderson (1999), local residents of Sistan refer to *O. tridactylus* as “mar-rig,” literally “sand-snake.” The most common name of these snake-like lizards among the local people in Sistan and Baluchestan Province is “roghan lis” literally “oil licking”, probably due to their shiny and greasy like skin. Other local name for *O. brevipes* in Sistan region is “mar-ke rigi” just “small snake of sand.” Although there are a number of more or less detailed publications providing distributional and taxonomic data on the Iranian sand skinks (see above), there are still questions concerning the distribution and taxonomy of *Ophiomorus* in Iran that need to be resolved. Finally we recommend molecular studies to understand the taxonomy and phylogeny of these lovely scincids in Iran.
Morphology and habitat characteristics *Ophiomorus nuchalis*

**Figure 4.** Dorsal (a, b), ventral (c, d), and lateral (e, f) views of head in *Ophiomorus brevipes* (RUZM-SO14.01) and *O. tridactylus* (RUZM-SO13.01) from Sistan and Baluchestan Province. ip: interparietal, n: nuchal, p: parietal, pf: prefrontal, sl: supralabial, t: temporal. Scale bar = 1 mm. (Photo by Ali Gholamifard).

**Acknowledgements**
The authors wish to thank local residents of Saravan and Chabahar Townships for their valuable assistance in collecting the specimens.

**Literature Cited**


Range extension of Misonne’s swollen-nose gecko, *Rhinogecko misonnei* de Witte, 1973 (Sauria: Geckonidae) in Iran

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*Rhinogecko misonnei* (de Witte, 1973) is a species of geckonid lizard distributed in Iran and Pakistan. This species was called *Agamura misonnei* by Szczerbak and Golubev in 1993. Witte (1973) was the first to introduce this species from Dasht-e-Lut in eastern Iran (30°13' N, 58°47' E). The last report of this species that of Moradi et al. (2009) in the western Dasht-e-Lut in eastern Iran (30°29' N, 57°44' E). Here, we report a new record that shows a wider distribution of *Rhinogecko misonnei* in southeastern Iran. An adult specimen of this species (ZMSBUK703) was collected during field work from Rigan county, southeastern Kerman Province.

During field work on the herpetofauna of desert areas in Rigan county (28°33'59" N, 58°47'48" E), Kerman province, southeastern Iranian plateau in May 2015, an adult female specimen of *Rhinogecko misonnei* de Witte, 1973 was collected by hand with the aid of an electric torch at night (12 AM). This specimen was preserved in 70% ethanol at the Shahid Bahonar University laboratory. The specimen was identified according to Anderson (1999). This specimen is compared with specimens from the Dasht-e-Lut using six morphometric and eight meristic characters.

Morphometric characters: SVL: snout to vent length (from tip of snout to anterior edge of cloaca); TL: tail length (from posterior edge of cloaca to tip of tail); HW: head width; HH: head height; ED: eye diameter; Eal: ear length (at widest point of the ear opening)

Meristic characters: SL: number of supra labials scales; IL: number of infralabial scales; TVe: number of transverse ventral scales (across midbody); LVe: number of longitudinal ventral scales (between mental and cloaca); LsT: number of enlarged scales on lower surface of thigh; SaH: number of scales across the head (interorbital, the scales on the ridge above the eye were not counted); SdT: number of scales around dorsal tubercles. Morphometric measurements were taken by mechanical Vernier Calipers to the nearest 0.01 mm.

Comparison of our specimen of *Rhinogecko misonnei* from the desert of Rigan County with specimens from the Dasht-e-Lut shows that specimens of both areas have the same range of metric and meristic characters. It has 25 shields across (TVe) and 89 longitudinal abdominal shields (LVe), the three nasal scales are strongly bulbous and extended into tubes; a row of 10 enlarged scales on lower surface of thigh (LsT). Tail longer than the body (TL>SVL). All measurements and ranges are shown in Table 1. Distance of the new locality for *Rhinogecko misonnei* to type locality is 186 km and...
to last locality in the west of Dasht-e-Lut is 238 km. the new distribution of *Rhinogecko misonnei* are presented in Fig. 1.

**Color pattern and habitat:** Dorsal surface of the head and body are gray with white tubercles between small scales and five wide transverse dark bars on body and nine on tail, the limbs have small dark bands that are lighter than the others (Fig. 2). The habitat is a gravel desert with low vegetation (Fig. 3).

De Witte (1973) described *Rhinogecko misonnei* from the eastern Dasht-e-Lut. This species is known from Iran and Pakistan (Anderson 1999). The last report of *Rhinogecko misonnei* was 100 km west of the type locality (Moradi et al. 2009). This record from the Rigan County shows a new locality for this species. This locality is situated 186 km south of the type locality and 238 km from the last report in the western Dasht-e-Lut. It indicates a somewhat more extensive distribution of *R. misonnei* in southeastern Iran. The collected specimen from Rigan County agrees with the descriptions of *R. misonnei* given by Anderson (1974, 1999), Szczerbak and Golubev (1993), Rastegar-Pouyani et al. (2006) and Moradi et al. (2009) except for number of longitudinal ventral scales (135 instead of 125) that show wider range of LVe.

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**Figure 1.** Distribution of *Rhinogecko misonnei* in Iran. Yellow circle: type locality (Witte, 1973). Black circle: previous record. Red circle: record from present study.
FIGURE 2. *Rhinogecko misonnei*: (a) complete view; (b) Dorsal view of head; (c) Lateral view of head; (d) Enlarged scales on lower surface of thigh; (e) ventral view of head; (f) ventral scales; (g) dorsal scales; (h) dorsal view of tail scales; (i) ventral view of tail scales.
FIGURE 3. The habitat of *Rhinogecko misonnei*.

LITERATURE CITED


First report of the brine shrimp *Artemia* (Branchiopoda: Anostraca) from Bazangan Lake, Iran

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*Artemia* has been recorded in thalassohaline and athalassohaline saline habitats from all over the world (Persoone & Sorgeloos, 1980) and is widely used in aquaculture as a food source for crustaceans and fish (Leger et al., 1986). The occurrence of wild *Artemia* populations from 17 hypersaline environments such as saline lakes, lagoons and salty rivers, distributed over 12 provinces in Iran were previously reported (Abatzopoulos et al., 2006) We added parthenogenetic *Artemia* from Bazangan lake as 18th natural habitat in the country (Fig. 1). All Iranian *Artemia* populations are parthenogenetic except one bisexual population namely *Artemia urmiana* from Urmia Lake (Agh, 2006). The historical record of existence of *Artemia* dates back to 982, more than one thousand years ago, from Urmia Lake, by an unknown Iranian geographer (Asem, 2008). The parthenogenesis populations have been reported from Lagoons around Urmia Lake, Urmia and Fesendooz, West Azerbaijan province; Lagoons around Urmia Lake Dasht-E-Tabriz, East Azerbaijan province; Maharlu Lake Shiraz, Bakhtegan Lake Shiraz and Tashk Lake Shiraz, Fars province; Incheh Lake Gonbad and Shor Lake Gonbad, Golestan province; Varmal catchment Zabol, Sistan and Baluchestan province; Mizan Lake Arak, Central province; Qom Salt Lake Qom and Houze Sultan Lake Qom, Qom province; Gaav Khooni Lake Hasan Abad, Isfahan province; Kale Shoor Gonbad, Razavi Khorasan province; Kale Shoor Khorram Abad, Lorestan province; Nough Kerman, Kerman province; Shurabil Lake (extinct) Ardabil, Ardabil province; Kale Shoor Hashtgerd Karaj, Alborz province (Agh, 2006; Abatzopoulos et al., 2006). Several studies have been done about the geology, biology and ecology of Bazangan Lake (Adabi & Mohammadzadeh, 1998; Khoshbakht, 1998 & Gholami et al., 2007). Bazangan Lake is located at N 36°18.48’, E 060°28.53’ between Mashhad and Sarakhs in north east of Iran (Fig. 1). Its surface area is 690,000 m\textsuperscript{2}(69 hectare), altitude 860 m and maximum depth 12 m in high water years (Gholami et al., 2007; Behroozi Rad, 2007). Bazangan wetland is an important habitat for birds, especially as a nesting site for some native and migrating species (Behroozi Rad, 2007). *Artemia* is the major food source for these species. During a regularly annual sampling, the brine shrimp *Artemia* was observed for the first time in Bazangan Lake and some water characteristics were also recorded for environmental monitoring. Plankton net (100 µm mesh size) was towed through the water for sampling cyst and adult *Artemia* in November 2015. The presence or absences of males were carefully recorded with visual inspection in *Artemia* population. Physical and chemical water characteristics like temperature, TDS, pH and electrical conductivity were determined with HANNA HI 98129 Pocket multimeter-combo
and total salinity with ATAGO salinometer. Adult animals were preserved in 96% Ethanol and harvested cysts were frozen in -20°C for future studies. In this annual monitoring on Bazangan wetland the following physico-chemical factors were recorded: total area: 300,000 m² (30 hectare), pH: 7.6, EC to >20 mS/cm, salinity 210 ppt, temperature 15°C.


**Figure 2.** A. Current status of Bazangan Lake. B. Female *Artemia* of Bazangan Lake.
A parthenogenetic population of *Artemia* is reported in this study for the first time from the habitat. The density of *Artemia* population in the lake was high but male individuals were rarely observed. Parthenogenesis is common in Old World populations of *Artemia*, whereas in the New World, only sexual reproduction has been reported (Persoone & Sorgeloos, 1980). Since the ecological condition of Bazangan lake has been monitored by Ecology Research Laboratory annually since 1973 (unpublished data), we hypothesize that this parthenogenetic *Artemia* population was established in the lake in the recent years; because of its tolerance to high salinity. As shown in Figure 3, the salinity of Bazangan Lake has been increasing exponentially since the early 2000’s. During the recent year’s climate has changed and severe drought has caused salinity increase in the aquatic ecosystems, which could affect a dramatic reduction of population sizes and species replacement in most of the natural habitats of the country. Wetland systems are vulnerable to changes in quantity and quality of their water supply. Therefore, successful long term restoration and management of these systems will depend on how we choose to respond to the effects of climate change and choose priorities for restoration and research (Erwin, 2009). Bazangan Lake was a hyposaline water catchment that currently has changed to a hypersaline type. *Artemia* populations are good indicators for these severe change in the inland water. Mean depth of Bazangan Lake is less than one meter, causing huge changes in salinity and temperature across a year. Currently, this ecological and environmentally important lake is facing the danger of drying like many other hypersaline lakes in the country and all over the world; hence, an important mission for scientists, local and national officials to save it.

**LITERATURE CITED**


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