www.biodicon.com Biological Diversity and Conservation

ISSN 1308-8084 Online; ISSN 1308-5301 Print 7/3 (2014) 130-137

Research note/Araştırma notu

A note on *Salvia* sect. *Aethiopis* (Lamiaceae) of Iran

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Abstract

Salvia longipedicellata is reported as a new record of *Salvia* species for the first time from Iran. The morphological characters of this species have been described; in addition the lectotype for *S. hypoleuca* and *S. schimperi* designed and the morphological characters of the first species have been described here. Indumentum diversity of *S. longipedicellata* is provided in photographs. Finally, two keys to a part of *Salvia* sect. *Aethiopis* in Iran has been presented.

Key words: Anatomy, lectotype, morphology, *Salvia longipedicellata,* sect. *Aethiopis*

1. Introduction

The genus *Salvia* L. (Lamiaceae: tribe Mentheae) represents a cosmopolitan assemblage of nearly 1000 species displaying a remarkable diversity in growth forms, secondary compounds, floral morphology and pollination biology. *Salvia* has radiated extensively in three regions of the world: Central and South America (500 spp.), Western Asia (200 spp.) and Eastern Asia (100 spp.) (Walker and Sytsma, 2007). The genus is named "*Salvia*" derived from "Salveo" which means "to save, to recover" in Latin (Baran et al., 2010). *Salvia* is distinguished from the other 72 genera in the tribe Mentheae by having the two posterior stamens aborted, and the connective separating the thecae of the two expressed stamens significantly elongated (Walker and Sytsma, 2007).

Hedge (1982b), in his treatment of *Salvia* in the flora Iranica region, recognized 70 species. There, he grouped the species by stamen characters and other morphological similarities. Fifty six annual or perennial species of the genus are found in Iran of which 17 are endemic (Hedge, 1982b).

Salvia longipedicellata Hedge was first collected from B8 Erzurum between Ilica and Tercan, near the turning to Aşkale of Turkey in Eastern Anatolia by Davis and Hedge in 1957 (Hedge, 1982a) (Figure 1) and then described as a new species by Hedge (1959), but so far this species has not been reported in Iran. During floristic investigations in North West of Iran, collected some interesting *Salvia* specimens from around Khalkhal. Initial attempts to name them using the Flora Iranica (Hedge, 1982b) were not successful. Eventually, using the account in Flora of Turkey (Hedge, 1982a), the specimens were identified as *S. longipedicellata*. In this paper a new record, *S. longipedicellata* is reported and the habitat of this new record in Iran has been shown and its morphological characters and its indumentum diversity are exactly described. Moreover the lectotype for *S. hypoleuca* as an Iranian endemic species and *S. schimperi* disgined here. This article follows previous studies conducted on flora of Iran (Ranjbar and Negaresh, 2013; Ranjbar and Almasi, 2013; Ranjbar and Hajmoradi, 2014).

2. Materials and methods

2.1. *Plant material*

The morphological study was mainly based on herbarium material. Several sheets have been examined for each species from the following herbaria: BASU, BM, E, K, MPU, P and W.

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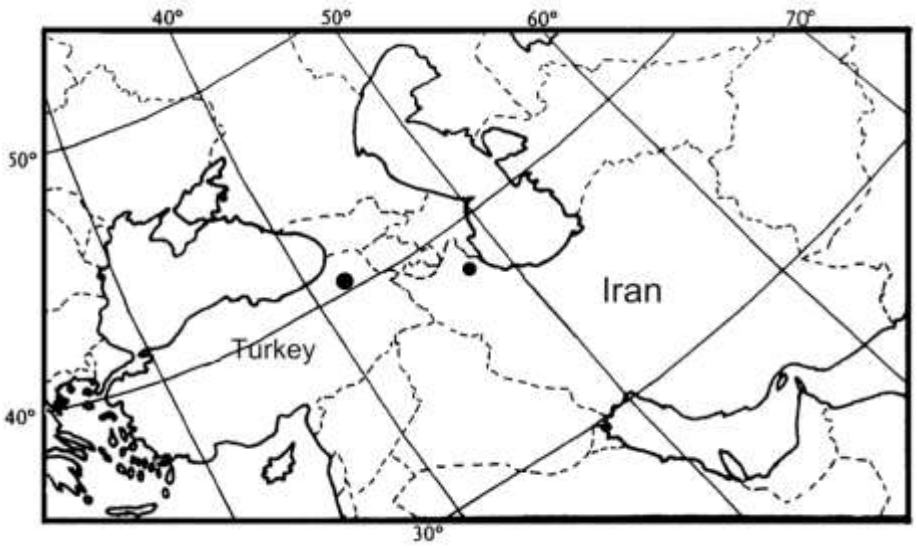

Figure 1. Distribution map of *Salvia longipedicellata* in Iran and Turkey

2.2. *Anatomical method*

The plant materials preserved in glycerine-alcohol (1 : 1) solution freshly and then washed with distilled water. Sections of stem and leaf were prepared by hand cutting, cleared with sodium hypochlorite and diluted acetic acid solutions and then were stained with methylene blue and carmine (Fahn, 1990). Micromorphology of hairs was studied and photographs were taken under an Olympus BX–51 photomicroscope. Voucher specimens are deposited in the herbarium of Bu-Ali Sina University (BASU), Hamedan, Iran.

3. Results and discussion

3.1. *Taxonomical notes on Salvia sect. Aethiopis*

Salvia sect. *Aethiopis* in Iran is represented by 34 species, 11 species, of which being endemic. Members of the section distributed phytogeographically in the mostly region of Iran (Boisser, 1875; Hedge, 1982b). This section is morphologically characterized by leaves simple, calyx thick-textured; upper lip not concave, upper lip of corolla more or less falcate; tube doesn't annulate, squamulate, stamen type B (staminal connectives clearly longer than filaments, lower theca reduced to a usually dolabriform plate and articulating stamens) (Martin et al., 2011). *S. longipedicellata* belonging to *S.* sect. *Aethiopis.*

3.2. *Key to the groups of species of Salvia sect. Aethiopis in Iran*

1. Stem 30 - 40 cm long, petiole up to 6 cm long, leaves ca. 11 cm long ……2
- Stem 70 - 90 cm long, petiole up to 11 cm long, leaves up to 17 - 22 cm long ……3
2. Indumentum of lower parts of stem glandular, leaves oblong-ovate or ovate, bracts 13 - 18 mm long ……*S. xanthocheila*
- Indumentum of lower parts of stem eglandular, leaves linear-oblong or oblong, bracts 7 - 12 mm long ……4
3. Margin of leaves crenate, bracts up to 7 mm long, corolla ca. 15 mm long……*S. frigid*
- Margin of leaves erose or lobate or more or less entire, bracts up to 12 mm long, corolla 18 - 22 mm long ……*S. grossheimii*
4. Inflorescence thinner or more or less panicule, pedicel up to 3 mm long ……*S. atropatana*
- Inflorescence paniculate, pedicel up to 10 mm long ……*S. longipedicellata*

3.3. *Description*

Salvia longipedicellata Hedge in Notes R.B.G. Edinb. 23:57 (1959).

Holotype: Turkey B8 Erzurum: between Ilica and Tercan, near the turning to Aşkale, 1850 m, 10 vii 1957, Davis and Hedge, D. 30875 (E!; isotype: BM!, K, photo BASU!) (Figure 2).

Perennial herbs, up to 85 cm tall. Stems solitary, unbranched, erect, greenish, quadrangular, densely eglandular lanate below, with capitate glandular pilose with some villous hairs above. Leaves mostly basal, simple, blades ± elliptic, 14 - 17 × 5 - 10 cm, attenuate at the base, ± acute at the apex, margin irregularly lobulate dentate or ± lobulate entire, greyish and densely lanate below, green with a thinner indumentum above.

Figure 2. Holotype of *Salvia longipedicellata* (up: sheet I, down: sheet II)

Petioles 1.5 - 10 cm long, with ± dense eglandular lanate, floral leaves sessile. Inflorescence paniculate, 50 - 55 cm long, nodes 3 - 3.5 cm apart toward the base, 7 - 9 verticillasters at each floral axis, verticillasters 6 flowered, clearly distant, floral axis densely capitate glandular pilose. Bracts broadly ovate, ca. 12 × 6 mm, greenish, aristate at the apex, truncate at the base, the margin entire, densely capitate glandular pilose, folios, persistent; bracteole not present. Pedicels ca. 10 mm long, ± erect, densely covered with capitate glandular and eglandular hairs. Calyces tubular to campanulate, greenish, ca. 9 mm long, up to 12 mm long in fruit, scarcely expanding in fruit, upper lip with three teeth, triangular to acuminate 2.5 - 3 mm long, median tooth much shorter, lower lip with two teeth, triangular to lanceolate 4 - 4.5 mm long, shortly spinulose, densely with capitate glandular pilose and sessile glands. Corolla white, 17 - 20 mm long, capitate glandular hairs on outside of upper lip, tube ca. 10 mm long, ventricose, squamulate, upper lip ca. 10 mm long, ± equaling lower lip, falcate, deeply retose at the apex; lateral lobes of lower lip ± broadly elliptic, middle lobe broad, subcordate. Stamens two, exerted, filaments ca. 2.5 mm long, staminal connective clearly longer than filaments ca. 15 mm long, upper theca 3 mm long, lower theca sterile and dolabriform. Style ca. 23.5 mm long, diffusely with short hairs, exerted from corolla lips and divided in two parts at apex, the upper one longer and arcuate. Nutlets ovate, ca. 2 × 1.5 mm, greenish to brown, surface smooth.

3.4. *Specimens seen*

IRAN, North-West Iran: Ardebil province, Khalkhal, 1940 m, 23.Mar.2012, *M. Ranjbar* 32527 BASU (Bu-Ali Sina University herbarium).

3.5. *Taxonomic and distribution remarks*

This species distributed in E. Anatolia and Iran (Ardebil province). *Salvia longipedicellata* is similar to *S. atropatana* Bunge in some morphological characters such as type of indumentum and many floral features, but differing by paniculate inflorescence and long pedicel.

3.6. *Lectotypification of Salvia hypoleuca*

The protologue of *Salvia hypoleuca* includes four syntypes from Iran:" prope Teheran et in Laridjan" Aucher-Eloy, 1560!, 3106, 5202! and Alborz mountain, Tehran, Darband, Kotschy, 409!. The collection Aucher-Eloy 1560 kept at herbarium of Paris, which has well-developed leaves and inflorescences, is selected as the lectotype.

3.7. *Description*

Salvia hypoleuca Benth. in DC., Prodr. 12: 279 (1848)

Lectotype (designed here): Iran: between Tehran and Larijan, 1850 m, 1837, Aucher-Eloy 1560 (P00714755!; isolectotypes P00714754!, K000929774!, K000929771!, photo BASU!) (Figure 3).

Perennial herbs; stems erect 60 - 150 cm tall, unbranched, stems essentially glabrous or with loosely short pilose or, sessile glandular hairs above. Leaves simple, orbicular to ± ovate, ca. 8 - 17 × 7 - 13(-15) mm, truncate to cordate at the base, rounded to obtuse at the apex, margin crenate to erose; green and glabrous above, greyish and densely tomentose below. Petioles ca. 3 - 65 mm long, floral leaves sessile. Inflorescence paniculate, 30 - 60 cm long, 5 - 8 verticillasters at each floral axis, verticillasters 2 - 6 flowered, clearly distant. Bracts narrowly ovate, ca. 5 × 25 mm, acuminate at the apex, membranous, persistent; bracteole not present. Pedicels 0 - 2 mm long, ± erect, covered with eglandular hairs. Calyces infundibular, membranous, 6 - 10 mm long, up to 12 mm long in fruit, clearly bilabiate and divergent, loosely eglandular pilose with sessile glands, lower lip with two teeth, ca. 4 mm long, upper lip with three teeth, triangular to acute, 1.1 - 2 mm long, median tooth much longer. Corolla white to pale yellow or with lilac hood, 15 - 24 mm long, eglandular hairs and sessile glands on outside of upper lip tube ca. 7 mm long, ventricose, squamulate, without an annulus in throat, upper lip clearly falcate. ca. 17 mm long, deeply retose at the apex; lateral lobes of lower lip ± broadly elliptic, middle lobe broad, subcordate. Stamens two, exerted, filaments ca. 3 mm long, staminal connective clearly longer than filaments ca. 15 mm long, upper theca 4.2 mm long, lower theca sterile and dolabriforme. Style ca. 32 mm long, diffusely with short hairs, exerted from corolla lips and divided in two parts at apex, the upper one longer and arcuate. Nutlets trigonus to ovoid, ca. 2.5 × 2 mm, brown with light venation, surface smooth.

3.8. *Specimens seen*

Mazandaran province: between Kamarband and Elika, 2800 m, Rechinger. 6392 (W!); Lar, 2400 m, Bornmoller 7994 (P!); Sanii and Assadi 14132 (TARI!); Kandavan, 2600 m, Rechinger 6746 (W!); Tehran and Larijan, Aucher-Eloy 1560 (P!, MPU!), 3106, 5202 (P!), Kotschy 409 (W!, P!); Tehran: 20 km E Tehran, 1550 m, Pabot 4049 (P!); 20 - 25 km from Ab Ali toward Tehran, Alava 10604 (W!); Between Tehran and Jaj Roud, Remaudiere 69, Aellen 760 (W!); Above Ab Ali, 1520 - 2300 m, Archibald 2564 (W!); Wendelbo. 1384 (W!); between Shemshakand Zaigan, 2040 m, Gheissari 2705 (IRAN!); Tehran toward Damavand, 1880 m, Bothmer and Buttler 1733 (W!); Damavand, 2650 - 3000 m, Bornmoller 7995 (W!); Kashkouli 6894 (E!); Between Eyn Varzan and Tar, 2400 m, Aellen 756 (W!); Sarak toward Shahrestanak, 1900 m, Terme 14567 (E!); Pas Qaleh, 2100 m, Alava 14074 (W!); Ask, Pichler (W!); Polur, 2500 m, Ress (W!); Between Simin Dashtand Kabutar Darreh, 1150 m, Manoucheri et al. 761, 762, 6310 (E!); Qara Agach toward Varamin, 1950 m, Brown 734 (E!). 22 km W Firuzkuh, Chehel Chashmeh, Renz and Iranshahr 16706 (IRAN!, W!); 25 km SE Tehran, Remaudiere 67 (W!); Tehran province: after Ghachsar, Chalous trifurcate toward Dizin, 2237 m, Rajabian 33077 (BASU!); Karaj Dam, 1835 m, Rajabian 33078 (BASU!); Lavasan to Fasham biforcate, 1743 m, Rajabian 33079 (BASU!); Damavand road, Saeed Abad, after Jajroud, 1570 m, Rajabian 33080 (BASU!); Semnan toward Firuzkuh, after Akhtar, 1793 m, Rajabian 32967 (BASU!); Taleghan - Jucetan, 1950 m, Ranjbar at al. 29351 (BASU!); Ziaran to Taleghan, 5 km after Ziaran, 2050 m, Ranjbar et al. 27235 (BASU!); Qazvin: Karaj, Koelz 33425 (W!); Schmid 6470 (W!); 15 km NE Karaj, Alava and Moussavi 20294 (IRAN!) 30 km N Karaj, 2000 m, Andersen and Petersen 148 (W!); Inter Karaj and Gach Sar, 1300 m, Davis 808 (E!); Kuh Dashteh, 1800 m, Rechinger 329 (W!); Darreh Wardi, 1600 m, Rechinger 752 (W!); Kandavan, 2850 m, Klein 2932; 7000, 7060 (W!); Archibald 2370 (W!); Sarv Dar, 1500 m, Foroughi et al. 12319 (TARI!); Nashtarud, Zarguani 6904 (E!); Semnan - Damghan: between Firuzkuh and Semnan, 2000 - 2200 m, Moussavi and Karavar 33713 (E!), Iranshahr and Zargani 15169 (E!).

Figure 3. Lectotype of *Salvia hypoleuca*

3.9. *Taxonomic remarks and distribution*

Salvia hypoleuca in the section *Aethiopis* is endemic of North and Central Iran which grows on clay stone at an altitude of 1150 - 3000 m in the north and central part of Iran. This species show morphologically close similarities to *S. chloroleuca* and *S. limbata*, two other species belonging to this section (Hedge, 1982b). In the references, *S. hypoleuca* Hochst. has been introduced as homonym of *S. hypoleuca* Benth. The former is invalid and is heterotypic synonym of *S. schimperi* Benth.

3.10. *Key to the groups of species of Salvia sect. Aethiopis in Iran*

1. Stems up to 180 cm long, petiole 6 - 18 cm long, pedicel up to 16 mm long, upper lip of corolla densely villose ……*S. limbata*
- Stems 30 - 150 cm long, petiole 0.3 - 9 cm long, pedicel 2 - 4 mm long, upper lip of corolla pilosus.....2
2. Stems 30 - 70 cm long, lower parts of stem hairy, leaves shape ovate to ovate–oblong, calyx 10 - 15 mm long in flowering state, bract size 7 - 12 mm long ….....*S. chloroleuca*
- Stems 60 - 150 cm long, lower parts of the stem glabrous, leaves shape ovate to orbicular, calyx 6 - 10 mm long in flowering state, bract size up to 5 mm long ……..…… *S. hypoleuca*

3.11. *Lectotypification of Salvia schimperi*

According to the protologue, *Salvia schimperi* was based on specimens of Shimper from the herbarium of Natural History Museum (BM). Since BM the original herbarium of Shimper, designation of a lectotype for this Schimperian *Salvia* name is necessary as BM sheet (BM000910211) containing potential type material for *S. schimperi* are present in BM herbarium, the collection Schimper 1916 from BM is suggested as lectotype (Figure 4).

S. schimperi Benth. in A.P.de Candolle, Prodr. 12: 282 (1848)

= *Salvia hypoleuca* Hochst. ex Benth. in A.P.de Candolle, Prodr. 12: 282 (1848), nom. inval.

Lectotype (selected here): Ethiopia: Axum ad pagum Hazabo, 2134 m, 1842, Schimper 1916 (BM000910211!, isolectotypes BR0000006250829!, BR0000006250492!, BR0000008364883!, GOET004477!, K000193314!, K000193315!, M0104769!, M0104770!, MPU017520!, P02988281!, P02988179! S08-10889!, TUB003868!, TUB003869!).

3.12. *Distribution*

Ethiopia, SW Arabian Penstock.

3.13. *Anatomy*

Figure 4. Lectotype of *Salvia schimperi*

In anatomical study two main types of trichomes were observed, eglandular and glandular hairs. In species studied, two different types of glandular trichomes were determined in detail, namely, capitate trichomes and peltate ones, which can be distinguished by head size and stalk length. Capitate glandular trichomes consist of a basal cell of epidermal origin, a unicellular or multicellular stalk, and a round to pear shaped, uni or multicellular secretory head. Peltate glandular trichomes consist of a basal cell embedded in the epidermis, a short stalk cell, and a wide head made of several secretory cells covered with a common cuticle, which can be arranged in one or two circles, and with varying morphology (Krstic et al., 2006).

According to the present observations, the capitate trichomes of *S. longipedicellata* displayed a variation in morphology:

Peltate trichomes: Peltate glandular trichomes had a base including epidermal cells and a very short stalk cell and a large secretory head forming the central and peripheral cells. They were present at the stem and pedicel (Figure 5 H and P).

Capitate trichomes: Capitate trichomes consisted of a base, a stalk 1 - 3 celled usually with a short neck cell and a uni-or bicellular head. They were present on the stem, leaf and pedicel (Figure 5 B–D, L and M).

Eglandular trichomes: Eglandular hairs were uni- or multicellular. These trichomes had a base and a hair with 1–8 cells. They were present on the stem, leaf and pedicel (Figure 5. A, E–G, I–K, N and O).

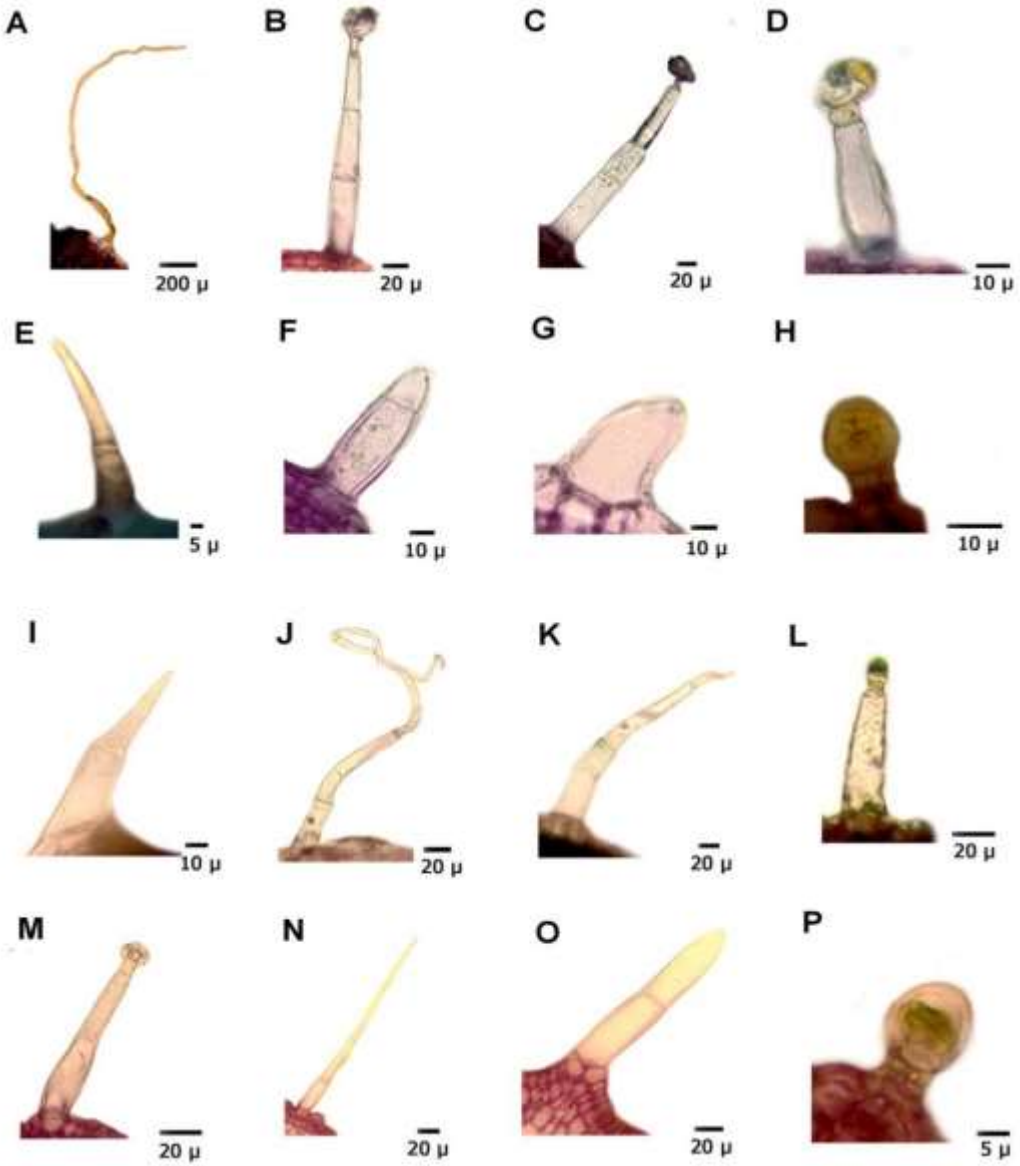

Figure 5. LM micrographs of trichomes in stem, leaf and pedicel in *Salvia longipedicellata*: A – H types of trichome in stem; Fig. A: eglandular hair on lower parts of stem Figs. B – D: stalked glandular hairs on upper parts of stem; Figs. E – G: eglandular hairs on upper part of stem; Fig. H: peltate glandular hair in upper parts of stem; Fig. I – L: types of trichome of leaf, Figs. I – K: eglandular hairs; Fig. L: stalked glandular hair; Figs. M – P: types of trichome of pedicel, Fig. M: stalked glandular hair, Figs. N and O: eglandular hairs, Fig. P: peltate glandular hair.

3.14. *Taxonomic conclusion*

Salvia has ca. 1000 species throughout the world (Walker and Sytsma, 2007), with 56 species in Iran (Hedge, 1982b). Later, 1 new species (Mozaffarian, 1991) and a new record (Kharazian et al., 2008) were reported; the total has now reached 59 with this record.

Acknowledgements

We thank Dr. Ihsan Al- Shehbaz for his comments on nomenclatural aspects of the manuscript. Also we are indebted to the curators of the following herbaria: B, BR, E, G, GOET, JE, LD, LE, MO, MPU, P, S, TUB, W and WU, for their contribution during the revision of materials. The field work in Iran was supported by grants from Bu-Ali Sina University.

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(Received for publication 15 July 2014; The date of publication 15 December 2014)