



A REVISION OF *CALENDULA* L. (ASTERACEAE), IN IRAN

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ABSTRACT

The genus *Calendula* belongs to tribe *Calenduleae*, (*Asteraceae* family). It morphologically studied for the ongoing project of the flora of Iran. Based on the herbarium studies and field observation, this genus has been revised. The study was based on fresh material from field as well as herbarium specimens. All specimens existed in the herbarium of Research Institute of Forests and Rangelands (TARI), herbarium of Iranian Research Institute of Plant Protection (IRAN), herbarium of Ferdowsi University of Mashhad (FUMH), Herbarium of Research center of Agricultural and Natural Resources of Fars, were revised. Description of genus and species with key of determination of species is designed. In this search the number of *Calendula* taxa increasing 9 and *Calendula karakalensis* Vass. Is presented as a new record for the flora of Iran also the checklist of accepted species have been prepared.

Keywords: Calendula, Iran, Revision, Species

INTRODUCTION

The genus *Calendula* includes about fifteen species in the Mediterranean, Irano-Turanian and Saharo-Arabian regions. According to flora the Iranica Rechinger, K. H (1989) there are six species of *Calendula* in different regions of Iran and among them *Calendula aurantiaca* is only endemic. Lt. Colonel Kirtikar and Major Basu, (1993), The term calends refers to the plant's tendency to bloom in accordance with the calendar every month in some regions, or during the new moon. It is one of the easiest plants to grow and one that provides great joy, bringing sunshine to the heart and mind. Khare, (2004), in Europe, the leaves are considered resolvent and diaphoretic while the flowers are used as a stimulant, antispasmodic and emmenagogue. In England, the decoction of the flowers was used as a posset drink for the treatment of measles and smallpox, and the fresh juice as a remedy for jaundice, costiveness (constipation) and suppression of menstrual flow. Khare, 2004, Lt. Colonel Kirtikar and Major Basu, (1993), in India, the florets are used in ointments for treating wounds, herpes, ulcers, frostbite, skin damage, scars and blood purification. The leaves, in infusion, are used for treating varicose veins externally. *Calendula* was used in German folk medicine as a remedy for wounds and glandular problems. Used historically as 'poor man's saffron,' calendula adds both color and flavor to

some foods, typically rice and chowders. It was prevalent in European marketplaces during the middle Ages and was a common soup-starter. (Bradley, 2006; Hoffmann, 2003), over thirty chemical components have been identified in *calendula*. These constituents include the flavonol glycosides isoquercitrin, narcissin, neohesperidoside, terpenoids, lupeol, longispinogenin, sterols, volatile oils, arvoside A, carotenoid pigments, calendulin, and polysaccharides. The plant contains a number of pentacyclic alcohols including faradol, brein, arnidiol, and caldenduladiol. Rutin, quercitin, and isorhamnetin are among the flavonoids in the plant. *Calendula* has been shown to be an effective bacteriostatic, anti-inflammatory, antipyretic, antifungal, and vulnerary herb. Clinical trials have shown that *calendula* increases cell proliferation and encourages the granulation process of wound healing. *Calendula* species generally grows in variety sites such as mountains, dry stony slopes in foothills, field edges, margin of garden, and road sides. The genus distributes in most part of Iran and also in Tunisia, Egypt, Algeria, Libya, Palestine, Pakistan, Iraq, Turkmenistan, Europe, Asia (south western part), northern Africa, Turkey, Morocco and Spain. The aim of this paper is to revise the taxonomy of the genus in Iran, to present an identification key to the known taxa to Iran, and to give the sequence of the species and to report a new record of *Calendula* (Jafar and Joharchi, 2009) for Iran.

MATERIALS AND METHODS

All specimens existed in different herbaria of Iran: TARI, IRAN, FUMH, Herbarium of Research center of Agricultural and Natural Resources of Fars, were revised. Stereomicroscopy was used for observation morphological and micromorphological characters in parts of capitula and achenes.

RESULTS

In this paper the number of *Calendula* taxa increasing to 9, and among them *Calendula aurantiaca* is only endemic to Iran.

Checklist of *Calendula* L. species

1. *C. officinalis* L., Sp. Pl. 921 (1753).

Type: Described from Europe

Typical characters: Annual plants, cultivated everywhere as one of the most popular ornamental plants,

2. *C. aurantiaca* Kotschy ex Boiss., Pl. Persiae austral. ed. Hohenacker no. 295 (11. 1845).

Syn: *C. sinuata* Boiss. & Gaill., Diagn. Pl. Or, Nov. Ser 2.6: 109 (1859); *C. sinuata* var. *aurantiaca* Boiss. F1. Or. 3: 416 (1875).

Type: Described from Iran (Shiraz)

Some studied specimens

Khorasan: 7 km from Mashhad to Neyshabure, Emamzadeh Hashem road, in river, Zokae 1089 (FUMH).

Typical characters: Perennial wetland plant

Distribution in Iran: C, NE.

3. *C. tripterocarpa* Rupr, Bull. Phys.-Math. Acad. St. Petersb. 14: 231 (1856).

Type: Described from Iraq.

Some studied specimens

Kohkiluyeh va Boirahmad: near Dehdasht, 500 m, Assadi & Aboohamzeh, 38674 (TARI).- Fars: Fasa, 55 km Jahrom road, 1100m, Foroughi, 1116TARI.- Busher: versus Borazjan, 43 km near Busher, Ab-e-Tavil, Termeh & Moussavi, 7690-IRAN; Ahram, chah-e- Talkh, Iranshahr & Terme 7710-IRAN.- Khorasan: NW Tabas, Pirhajat, 1045m, Ayatollahi & Joharchi 10721 (FUMH).

Typical characters

Annual plant, disk florets concolorous, (yellow-orange), beaked achenes absent, Fruiting head containing a few achenes nearly smooth at beak and broadly 3- winged.

Distribution in Iran: W, C, E, S.

4. *C. arvensis* L., Sp. Pl. ed. 2: 1303 (1762-63).

Type: Described from Europe

Some studied specimens

Golestan: Kalale towards Morave tappe, 35 km before Morave Tappe, 550m, Javadi & Ghanbari 31760-IRAN; Kalale towards Morave tappe, Gogjeh, 250m, Javadi& Ghanbari 31765-IRAN; Kalale towards Morave tappe, Ghareh- ghovakh, 400-600m, Mussavi& Tehrani 7707-IRAN.- Mazandaran: Kelard, Haraz road, 430m, Foroughi 4354 (TARI); Kelard, Haraz road, 460m, Foroughi 1382 (TARI).- Fars: 10 km to Firouzabad on the road from Shiraz, 1500 - 2100m, Assadi& Sardabi 41395 (TARI); 15 km from Firouzabad to Ghir, 1500-2100m, Assadi & Sardabi 41478 (TARI).- Khuzestan: NE of Dezful, Sardasht to Bolhasan, 600m, Jamzad & Morid 79200 (TARI).- Khorasan: NW of Bojnord, Emam darreh, 1000m, Joharchii & Zangooei 33 (FUMH).

Typical characters

Annual plant, fruiting head with or without beaked achenes, when present, it is small.

Distribution in Iran: N, W, C, NE.

5. *C. karakalensis* Vass., Fl .USSR. vol. 26: 895 (1961).

Type: Described from Kara-Kala.

Studied specimens

Khorasan: NW of Bojnord, 4 km Shishkhan to Khorramdeh, 548 m, Memariani and Zangooei 38827 (FUMH).

Typical characters

Florets yellow. External achenes sickle- shaped, 10-15 mm long, along dorsum with longitudinal groups of prickles- bristles, formed by two lateral bristly- toothed wings; on ventral side achenes winged and irregularly toothed; middle achenes boat- shaped (with membranous wings convoluted inside), with fine

teeth- prickles along dorsum, half as large as the external achenes; internal achenes ring- shaped, wingless, prickly- toothed along dorsum. (Figs. 1, 2)

Distribution in Iran: NE.

6. *C. persica* C.A. Mey., Verz. Pfl. Cauc. 72 (1831).

Type: Described from Baku.

Some studied specimens

Golestan: Moraveh Tappeh, 300m, Hewer 3625(TARI); 22 km to moraveh Tappeh, on the road from Inche Boroon (CG3), 180m, Assadi & Maasoumi 55433 (TARI); Gonbade- Kavus, Sharif 7700- IRAN.- Mazandaran: Rout Amol, Esfandiari 7706 – IRAN; Chalous towards Marzanabad, 17 km Chalous, 300-400 m, Termeh & Matine 7686- IRAN.- Gilan: Roud Lar, Barkhordari 7672-IRAN.- Azarbaygan: Arasbaran protected area, Ghaghalu, 660m, Assadi & Vosughi 24551 (TARI); Arasbaran protected area between Asheghlou and Kalaseh, 400m, Hamzeh'ee & Asri 81380 (TARI).- Lorestan: Khoranabad, Tange malavi, 1700m, Foroughi 3025 (TARI).- Kohkiluyeh: Tol cheghah towards Basht, 10km to Basht, 900-1000m, Moussavi, Delghandi & Fatehi 7688-Iran.- Fars: Shiraz, 1500m. Esfandiari 7705-IRAN; Shiraz toward Jahrom, 85 km Shiraz, 1300-1450m, Delghandi & Daneshpajooch 7696- Iran; Farashband, Mirzayan 7702- IRAN; Firozabad, Ahram, Kashkouli 7683-IRAN; Kazeron, Chenarshahijan, 920m, Foroughi 4229 (TARI); 34 km from Nurabad to Dogonbadan (WP1), 700m, Assadi & Aboohamzeh 38308 (TARI); Kazeron, Chenarshahijan, 920m, Foroughi 4229 (TARI); 34 km from Nurabad to Dogonbadan (WP1), 700m, Assadi & Aboohamzeh 38464 (TARI).- Hormozgan: 17 km from Kahgum to Darab, 750m, Mozaffarian 52236 (TARI); 40 km from Hajiabad to Sirjan, Tashkuyeh village, 550m, Mozaffarian 49516 (TARI).- Bushehr: Kharkau Island, Shirzadian & Karavar 31276-IRAN.- Khuzestan: Hendijan, 20m, Iranshahr & Terneh 7674-IRAN; Ahvaz towards Khoramshahr, 40 km Ahvaz, Iranshahr & Termeh 7676-IRAN; Ahvaz, Albaji, 40m, Mozaffarian, 62260 TARI, Shush, 120m Mozaffarian 58434 (TARI).- Baluchestan: Bazman, 7 km Dalkan road, 980m, Foroughi, 10635 (TARI).- Tehran: Qazvin- Rasht road, 13 km S of Loushan, 700m, Wendelbo & Maasoumi 19068 (TARI).

Typical characters: Annual plant, all achenes ring- shaped- curved.

Distribution in Iran: N, NW, W, C, NE, S, SE.

7. *C. sancta* L., Sp. Pl. ed. 2: 1304 (1762- 63).

Type: Described from Palestine.

Some studied specimens

Kermanshah: Mehran, Behbudi 7703-IRAN. - Fars: Firozabad, Ghir Karzin, 950 m, Hatami & Khalili 3786; Kazerun road towards Borazjan, 300m, Hatami & Abdollahipanah 11095.- Hormozgan: Bastak, Harang, 250m, Mozaffarian 49768 (TARI); 25 km from Minab to Senderk, 110m, Mozaffarian, Rastegar & Banihashemi 38103 (TARI).- Bushehr: 5 km S of Bandar –e Bushehr, 0-10 m, Runemark & Mozaffarian 26950-IRAN.- Khuzestan: Ramhormoz, 40 km Iseh road, 750m, Riazi 9443-IRAN, 10 km from Ahvaz to Susangerd, 20 m Mozaffarian 53435 (TARI); Shushtar, 37 km Masjed Solayman road, 290 m, Foroughi 3132 (TARI).

Typical characters

Annual plant, Plant branched from base, florets bicolor, disk florets (Yellow– maroon), beak smaller than 15 mm.

Distribution in Iran: NW, W, C, S,

8. *C. alata* Rech. f., Fl. Iranica. 164: 104 (1989).

Type: Described from Iraq.

Some studied specimens

Golestan: Center Gorgan to Pahlavi dej, Ghorban abad, Ridel & Ershad 7655-IRAN.-Kermanshah: Ghasre- shirin, Vakilian 7663-IRAN.- Lorestan Khorramabad, 1400m, Rayhani 25707-IRAN; Pol-e Dokhtar, 110km from Khorram abad on road to Andimeshk, 1000m, Wendelbo & Assadi 16606 (TARI).- Kohkiloyeh va Boirahmad: 5 km from Shamsabad to Basht (VP3), 700m, Assadi& Aboohamzeh 38619 (TARI).- Fars: Farashband, kuh-e Pir, near Konar malek, 800-1300m, Iranshahr & Termeh 7669- IRAN; Lar, Mojib 7661-IRAN; Shiraz, Bamu park, 1900m, Dehbozorgi 32730-IRAN; 6 km NW of Kazerun, 870m, Runemark & Mozaffarian 26730 (TARI).- Hormozgan: Center Bandar-e Khamir et Bandar-e Lengeh, near Dezhgan, Iranshahr & Termeh 7658-IRAN; Khuzestan, Sabzevari 7664-IRAN.- Bushehr: Center Kangan et Khormuj, 12 km N Abdan, Iranshahr & Termeh 7659-IRAN; 24 km E Khormuj Iranshahr & Termeh 7667-IRAN; Bandar-e Taheri to Gavbandi, Pag 7662- IRAN; Negin Island, Sangari, Ghayurfar & Mofidi 33466-IRAN; 30 km from Bandar-e Bushehr on road to Ameri, 20 m, Runemark & Mozaffarian 26990 (TARI).- Khuzestan: Haftgel to Masjed-Soleyman, 20-30 km Simeyli, 400 m, Iranshahr & Termeh 7656-IRAN.- Kerman: Bashagerd, Sinderk, 190- 260m, Iranshahr & Moussavi 7665-IRAN.- Baluchestan: Saravan, Zangian, Sakhohouri 7666-IRAN; Khash, Karevandar, Mirzayan 7668-IRAN.

Typical characters

Annual plant, Fruiting head containing outer achenes, 2- winged with laciniate margine.

Distribution in Iran: N, NW, W, C, NE, S, SE.

9. *C. palestina* Boiss, Diagn. Pl. Or. Nov. Ser. 1. 10:83 (1849).

Type: Described from Palestine.

Some studied specimens

Golestan: Kalale, Morave Tappe, 35 km before Morave Tappe, 550m, Javadi & Ghanbari 31759-IRAN.- Kermanshah: Mehran, Halat, 100m, Behbudii 7671-IRAN.- Kohkiloyeh va Boirahmad: Dogonbadan near Abrigoon (VP3), 800m, Assadi & Aboohamzeh 38558 (TARI).

Typical characters

Annual plant, Plant somewhat branched from base, florets yellow, very rarely disk florets maroon. Beak longer than 15-20 mm

Distribution in Iran: N, NW, W.



Fig1. *Calendula karakalensis*

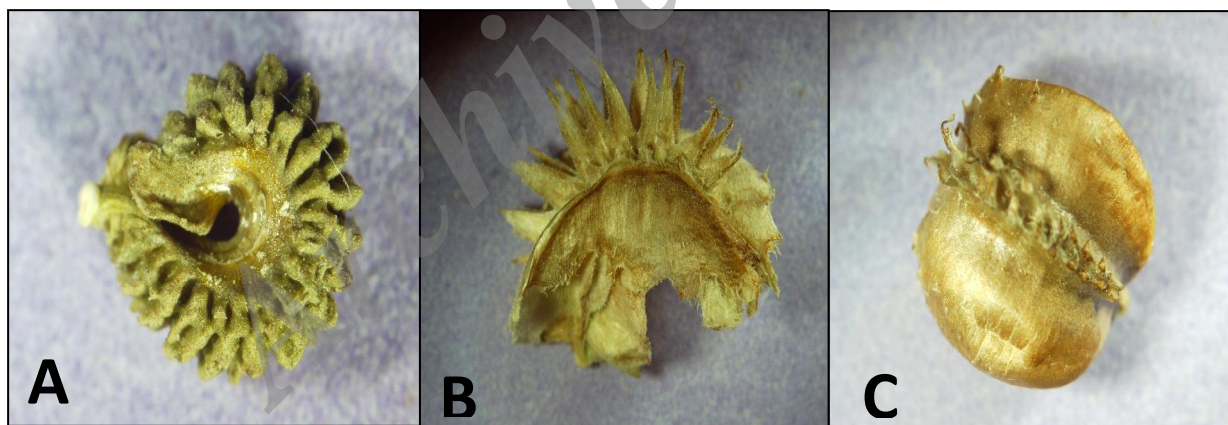


Fig 2. *Calendula karakalensis* A: external achene, B: middle achene, C: internal achene

Key to the accepted species of *Calendula*

- 1. Head large (up to 4-8 cm wide), cultivated plant.....1. *C. officinalis* L.
- Head smaller, plant uncultivated.....2
- 2. Perennial plant..... 2

C. aurantiaca Kotschy ex Boiss.

- Annual plant 3
- 3. Fruiting head without beaked achenes.....4
- Fruiting head with beaked achenes.....5
- 4. Achenes homomorphic.....6

C. persica C.A. Mey

- Achenes heteromorphic.....7
- 5. Some outer achenes have short incurved beak.....4

C. arvensis L.

- Some outer achenes have thick erect beak.....6
- 6- Plant somewhat branched from base, florets yellow, very rarely disk florets maroon. Beak longer than 15-20 mm9

C. palaestina Boiss.

- Plant branched from base, florets bicolor, disk florets (Yellow– maroon), beak smaller than 15 mm.....7 *C. sancta* L.
- 7. External achenes sickle shape, large, formed by 2 lateral bristly-toothed wings
- 5. *C. karakalensis* Vass.
- External achenes differ from above.....8
- 8. Fruiting head containing a few outer achenes, nearly smooth at back and broadly 3- winged, disk florets concolorous, Yellow.....3 *C. tripterocarpa* Rupr.
- Fruiting head containing outer achenes, 2- winged with laciniate margine.
- 8. *C. alata* Rech. F

DISCUSSION

Phytogeographically, the majority of the species of *Calendula* are found in Irano-Turanian region, a few species are found in Saharo- Sindian and Euro- Siberian regions. Some species of this genus have a limited distribution in Iran and grow individually or in the small isolated patches. These species are usually very rare or can be endangered, but some species, such as *C. persica* C.A Mey and *C. alata* Rech.f have widespread distribution in the country.

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