A REVISION OF THE GENUS CALLIGONUM L. (POLYGONACEAE) IN IRAN

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Based on the herbarium studies and field observations, the genus *Calligonum* L. in Iran has been revised. In this paper, a brief revision of the genus in Iran is presented. Altogether, 23 species are known from Iran. A key to the species, a new species namely *C. alatosetosum* Maassoumi & Kazempour, short diagnose and or taxonomic discussions have been prepared. Among the cited species *C. molle* Litw. is a doubtful record to Iran. Former record of *C. tetrapterum* Jaub. & Spach from Iran is not improved.

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Key words. *Calligonum*, Flora, Iran, Taxonomy, new species, new record.

مروری بر جنس اسنکبیل (Calligonum) در ایران

علی اصغر معصومی، استاد پژوهش مؤسسه تحقیقات جنگلها و مراتع کشور.

بر پایه تجربیات بلند مدت شامل مطالعات هرباریومی و مشاهدات صحرایی, مروری بر جنس *Calligonum* در ایران صورت گرفته است. در این مقاله تعداد ۲۳ گونه از ایران شناسایی می‌شود، که گونه *C. molle* Litw. به طور مشکوک است و نیاز به مطالعه بیشتری دارد. کلید شناسایی گونه‌ها و شرح یک گونه جدید به نام *C. alatosetosum* Maassoumi & Kazempour نوشته می‌شود. گزارش قبلی گونه *C. tetrapterum* Jaub. & Spach از ایران تایید نمی‌گردد.

INTRODUCTION

Several years ago, preparation of *Polygonaceae* family in the form of Flora of Iran was the subject of my research. However investigation on the rich materials from different areas particularly with focusing on the genus *Calligonum* have been provided. Since long time ago from the appearance of Flora Iranica (Rechinger & Schiman-Czeika, 1968) and some other local Floras, not any taxonomic investigation have been considered on this genus. The major distribution pattern of the genus are concentrated in the Central and Middle Asia (Komarov, 1936; Grubov, 2005). In Iran according the last enumerating about 13 species are well known (Rechinger & Schiman-Czeika, 1968). Based on the new identifications the number of species increased to 19 species (Rechinger, 1977; Assadi, 1989; Mozaffarian, 2005). In this revision, a new species is described and the number of species is increased to 23, nine of which endemics to Iran. It seems that in desert and sand dune regions some more species may be found.

MATERIALS AND METHODS

Materials

The plant specimens of the herbarium of Research Institute of Forests and Rangelands (TARI) have been studied. Because of poor condition of herbarium specimens, materials from three different collections were also studied as follows:

1. *Living collection:* In Meibod (Yazd province) and Kashan (Esfahan province), living collections were previously established and several species from different areas of the provinces or the neighboring regions were planted at the same ecological condition in the experimental stations.
2. *New collection:* Some big areas such as Rig Boland, Rafsanjan, Zeh Kalut, several species have been previously forested with *Calligonum* species in sand dune fixation programs. However, unfortunately the origin of the species was unknown. In addition, in some protected areas of desert regions, particularly in Touran, Esfahan, Yazd, Kerman and Hormozgan provinces, the author collected rich materials of different species.

3. *Provincial herbaria:* In several provinces, local herbaria have been established by different taxonomists. These specimens also were available for study.

Used characters

The author concentrated to use only the reproductive characters such as fruit characters for the delimitation of the taxa. For this reason the author tried to study the fruit structure on the living plants, on the other hand it was tried to collect the fruits separately from herbarium specimens for better analyzing the ramification of the setae, final segments, direction of fruits and the type of the wings (Komarov, 1936). With careful analyzing of the fruits, finally the useful taxonomic characters came out to separate the related taxa. For separation of the taxa following characters were used.

1. *Fruit ornamentation:* Some species showing only the winged fruit (sect. *Ptereococcus*). But in *C. junceum* (sect. *Calliphysa*) the fruit surrounded by the membranaceous sac. There are very frequent cases that the fruits are setiferous, in which the setae are distributed on the wing margins, on the ribs or directly on the nuts. Several status of setae were seen on the fruits.

1.1. *Setae uniseriate:* In which the setae situated uniseriately on the wing margins or on the ribs.

1.2. *Setae biseriate:* in which the setae situated in double series on the wings margin. In some cases the ribs of fruit showing a tendency to divide into two rudimentary or abbreviated wings, such as *C. polygonoides* , the ribs becoming convex and the setae are found on the convex ribs.

1.3. *Setae polyseriate:* In which the setae situated in several series on the flattened ribs or on the rudimentary wings surfaces, e.g *C. molle*.

1.4. *Sparse setae:* In some cases such as *C. arborescens, C. griseum* and *C. crinitum*, the setae are directly on the short abbreviated ribs or directly on the nuts (not on the wing). In all these cases for separating the related taxa, length, ramification and direction of setae were carefully checked

2. *Wings and setae:* The nut in some species have the distinct wings, in which partly with simple and partly such as: *C. persicum, C. leucocladum* var. *serratum* have the double wings, which are very useful taxonomic characters. Some species in setiferous groups, usually showing two different types

2.1. The setiferous fruits with a short secondary or rudimentary wings, in which the setae situated on the margin of the rudimentary wings or on the ribs.

2.2. The setae situated directly on the nut (not on the rudimentary wings).

3. *Fruit coiling:* In few cases such as: *C. persicum, C bungei* the furrows of the fruits are straight, but in some cases such as *C. stenopterum* only the wings and furrows are twisted. In some other cases the fruit twisting depending the species and the direction of furrow in clockwise or anticlockwise.

4. *Setae ramification:* Except in few cases such as *C. alatosetosum* that some simple setae are found on the wing margin, in all other species, the setae are dichotomously branched along their length. In *C. densum, C. molle*, and C. *caput-medusae* the dichotomous branches are very dense. The density of setae is depended to the number of setae and the type of ramification, which are concealing totally the surfaces of the fruit and the nut not visible.

KEY TO THE SPECIES

1a. Fruits surrounded in membranaceous sac23.***C. junceum***
- Fruits winged or setose 2
2a. Fruit with developed winged, wings simple or double. 3
- Fruit setose 8
3a. fruit with 6-8 wings 4
- Fruit only with 3-4 simple wings. 5
4a. Secondary wings ca. 5-6 mm wide
1. C. ***leucocladum***
-Secondary wings ca. 3 mm wide 2. ***C. persicum***
5a.Wings of fruits narrow, shorter than the nut wide. Fruits twisted 90 degrees 6. ***C. stenopterum***
-Wings of fruits broad, wider than the nut. Fruit furrows straight 6
6a. Fruits usually 3 winged, rarely 4 winged; wings membranaceous, with transversal venation, margins entire or dentate *3*. ***C. bungei***
- Fruits always 4 winged; wings stiff, hard, with transversal venation up to margin; margin deeply dentate 7
7a.Transversal nerves are continued to the margin, on the margin arcuate, thick. *5*. ***C. denticulatum***
- Transversal nerves are continued to the margin, but on the margin not thick, thin, minutely dentate
4. ***C. schizopterum***
8a. Fruits quadrangular, with 4 furrows and 4 ribs; ribs convex or sometimes with rudimentary wings, broad or narrow. Setae situated on the ribs or on the margin of secondary wings. 9
- Fruit fusiform or elliptic to rounded, wingless; ribs absent or sometimes obscurely with convex ribs. Setae situated directly on the nut or on the ribs 19
9a. Fruits with straight furrow or shortly twisted 10
- Fruits twisted in 90-180 degrees. 15
10a. Fruits densely setose; setae concealing the nut 11
- Fruits sparsely setose; setae not concealing the nut 13

11a. Fruits including setae ca. 25-35 mm long. Setae ca. 12-20 mm 12
- Fruit including setae ca. 20 rarely 25 mm long; setae ca. 7-9 mm long 14. ***C. densum***
12a. Secondary wings 1.8-2 mm wide, on the margin with uniseriate setae. 15***. paletzkianum***
-Secondary wings very short or nearly with flattened ribs, with 4-5 seriate setae. 16. ***C. molle***
13a. wings short, ca. 1.2 mm wide. Setae densely on the wings margin, 3-times dichotomously branched. 13. ***C. laristanicum***
- Wings broad, ca. 5 mm wide. Setae or spine remotely on the margin of wings, simple or one time divided. 14
14a. Setae setiform, ca. 9-10 mm long. Fruits trigonous or tetragonous 8. ***C. alatosetosum***
-Setae spiniform, thick, ca. 2.5 mm long. Fruit tetragonous 7. ***C. spinosetosum***
15a. Fruits fusiform, twisted ca. 180 degree 17. ***C. microcarpum***
- Fruits oblong, twisted ca. 90 degree 16
16a. Fruits including setae ca. 25 mm long; setae densely concealing the nut 10. ***C. intertextum***
- Fruits including setae ca. 8-17 mm long; nut surface visible. 17
17a. Setae ca. 6-7 mm long, from the base 4-5 times dichotomously branched 9. ***C. polygonoides***
-Setae ca. 3-4 mm long, from lower middle part 4 times dichotomously branched 18
18a. Current year stems between articulation ca. 2.5-3 cm long. Fruits including setae 8-10 mm long. Secondary wings ca. 0.2 mm wide. 11. ***C. amoenum***
- Current year stems between articulation c. 1.5 mm long. Fruits including setae c. 15 mm long. Secondary wings ca. 0.8 mm wide 12. ***C. comosum***
19a. Setae sparse on the nut. Fruits without furrow and ribs. 20
- Setae dense on the nut. Fruits with obscure visible ribs 22
20a. Setae remote, ca. 10-15 mm long, with short branches 20. ***C. griseum***
- Setae very sparse, up to 22 mm long, with long branches 21
21a. Fruits twisted clockwise. Setae ca. 12-14 mm long, several times branched 21. ***C. arborescens***
-.Fruits twisted anticlockwise. Setae c. 22 mm long, many branched, rarely dichotomously divided or very rarely simple. 22. ***C. crinitum***
22a. Fruits including setae ca. 16-18 mm long. Setae 8-10 mm long, 4-5 times dichotomously branched, terminal segments about 20 19. ***C. turkestanicum***
- Fruits including setae ca. 30 mm long. Setae 10-12 mm long, 4-6 times dichotomously branched, terminal segments about 50 18***. C. caput-medusae***

1. ***C. leucocladum*** (Schrenk) Bunge var. s***erratum*** Litw. ex Pavl. Fl. URSS 5: 545 (1936). (Fig. 1 A)
Diagnose: Species by having the fruit with 4 straight furrows and 8 developed wings is distinguishable.
Gen. Dist.: Iran, Turkemenistan.
Dist. Iran: Semnan, Khorassan and Tehran.
Specimens seen. Semnan: Touran protected area, between Ahmadabad and Zamanabad, 900-1000 m, Wendelbo & Foroughi 18793. -Tehran: Kavir protected area, 7 km SE Karvansara Shahabbasi, 900 m, Foroughi 10906; SW Karaj, Shahdasht, 1200 m, Wendelbo & Foroughi 11266.

2***. C. persicum*** (Boiss. ex Buhse) Boiss., Fl. Or. 4: 999 (1879). (Fig. 1 B)
Diagnose: This species with double and narrower wings separable from its close species *C. leucocladum* var. *serratum.*
Gen. Dist.: Endemic
Dist. Iran: Yazd, Semnan, Khorassan and Ghazvin (Guilan).
Specimens seen. Guilan: Rudbar, between Rudbar and Rostamabad, 200 m, Assadi 86385; Beginning of Siahpush road, beside of the road, 24.01.1383, Charkhchian s.n. -Yazd: Meimand experimental station, 1140 m, Maassoumi, Kazempour & Nikchehreh 91606; 17 km to Chak Chak, 2700 m, Zarrei 92042. -Semnan: Touran proted area, 3 km on the road from Darbahang to Kalehdehgadeh, 940 m, Freitag & Jadidi 29010.

Notes: This species described from Guilan (Manjil, Rudbar area). In the original description the author not mentioned precisely about the wings structure, but distribution pattern extended to Semnan, Khorassan and Yazd areas. The author recently collected this species from Touran Protected Area, very mixed with *C. leucocladum* var. *serratum.* All collected materials from the type locality showing the 6-8 winged fruits like above mentioned species. From this point of view, this species strongly is close to *C. leucocladum* var. *serratum* in which, shows the same morphological features and widely distributed in same areas in Tehran and Semnan provinces. Therefore, more studies are needed to elucidate the reasonable results.

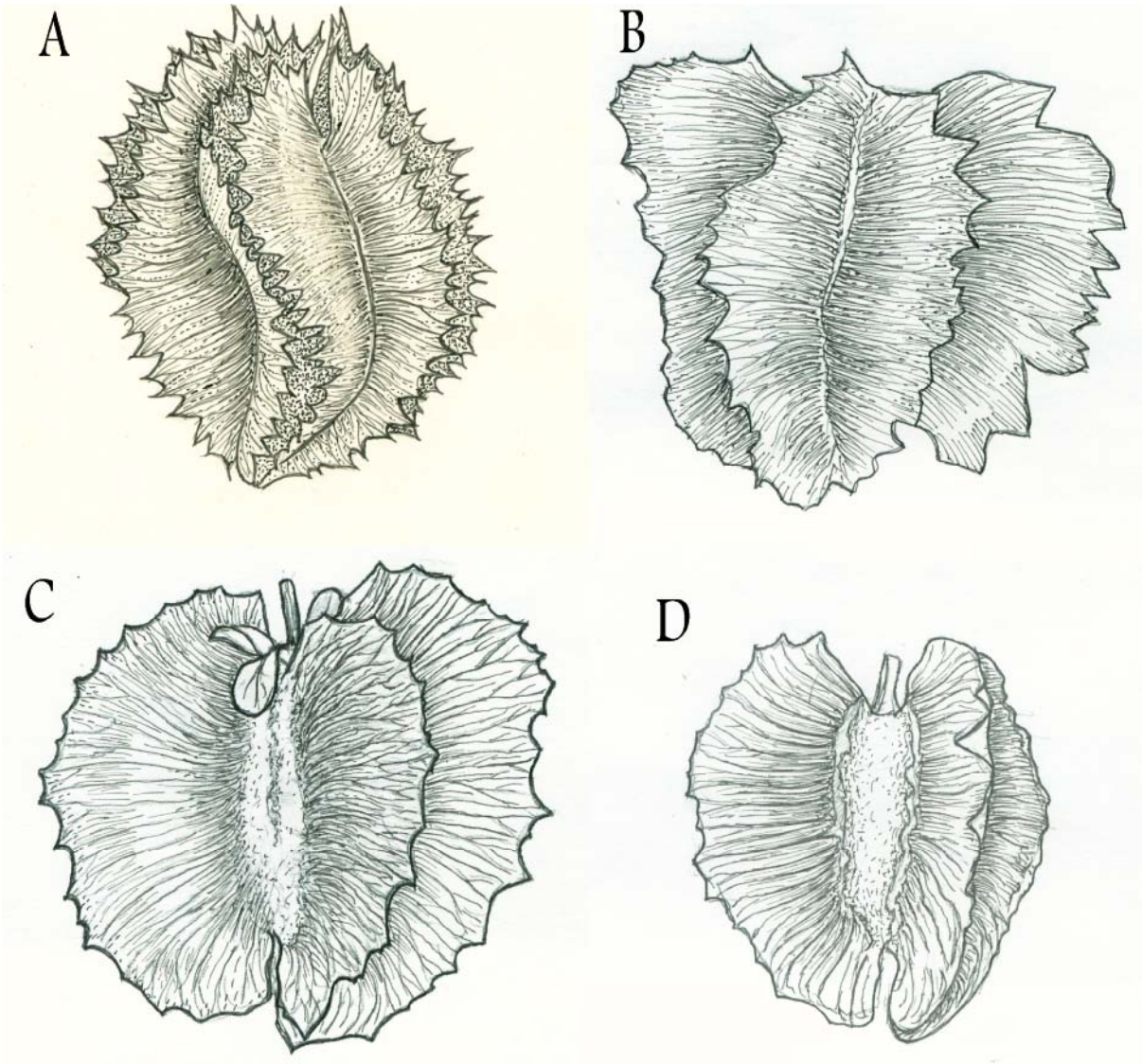

Fig. 1. *Calligonum* species, A) *C. leucocladum* var. *serratum* (×4), B) *C. persicum* (×6), C) *C. bungei* (×5), D) *C. denticulatum* (×5).

3. ***C. bungei*** Boiss., Fl. Or. 4: 999 (1879). (Fig. 1 C)
Diagnose: Species showing a wide range variation of the fruit ornamentation and wings margin. This species with 3 or 4 wings is distinguishable.
Gen. Dist.: Endemic.
Dist. Iran: Yazd, Kerman, Esfahan, Baluchestan, Khorassan and Tehran.
Specimens seen. Yazd: 78 km on the road from Anar to Yazd, 1600 m, Maassoumi Safavi 89574, 89577; Meimand experimental station, 1140 m, Maassoumi, Kazempour & Nikchehreh 91603, 91602, 89568, 89566, 89561, 89565. -Kerman: 25 km on the road from Baghein to Rafsanjan, 1160 m, Maassoumi, Kazempour & Nikchehreh 91588, 91589. -Esfahan: Kashan, Abouzeidabad, Rigboland, 1000 m, Maassoumi, Safavi & Batooli 89554. -Khorassan: SE. Tabas, Nayband, beginning of the road to Maadan Pravdeh, 1200 m, Zangooi 31185. -Baluchestan: 35 km on the road from Iranshar to Bazman, 570 m, Runemark, Assadi & Sardabi 22566, 22562. - Tehran: Kavir protected area, Ghaleh, 900-1000 m, Runemark , Foroughi & Assadi 19534.

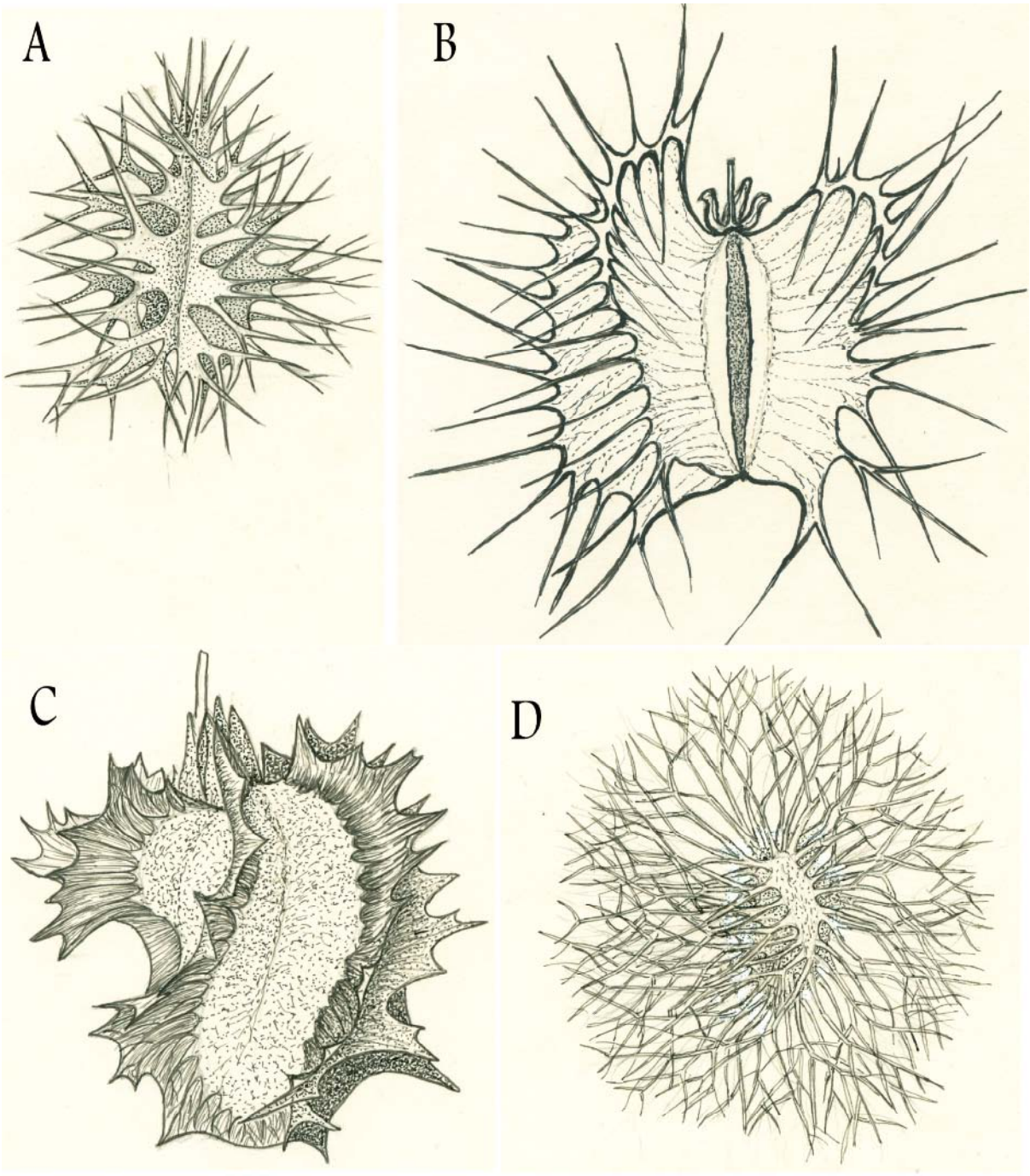

Fig. 2. *Calligonum* species, A) *C. polygonoides* (×4.5), B) *C. spinosetosum* (×9), C) *C. stenopterum* (×5), D) *C. intertextum* (×4).

4. ***C. schizopterum*** Rech. f. & Schiman-Czeika, Fl. Iranica 56: 41 (1968).

Diagnose: Close to *C. bungei* but differs from it in having the tetragonous fruits and narrower wings with elevated transversal nerves from the base to the margin, spiniform dentate at the margin. Pedicel articulation just at the middle half (not toward the base).

Gen. Dist.: Endemic.

Dist. Iran: Kerman, Esfahan, Baluchestan and Hormozgan.

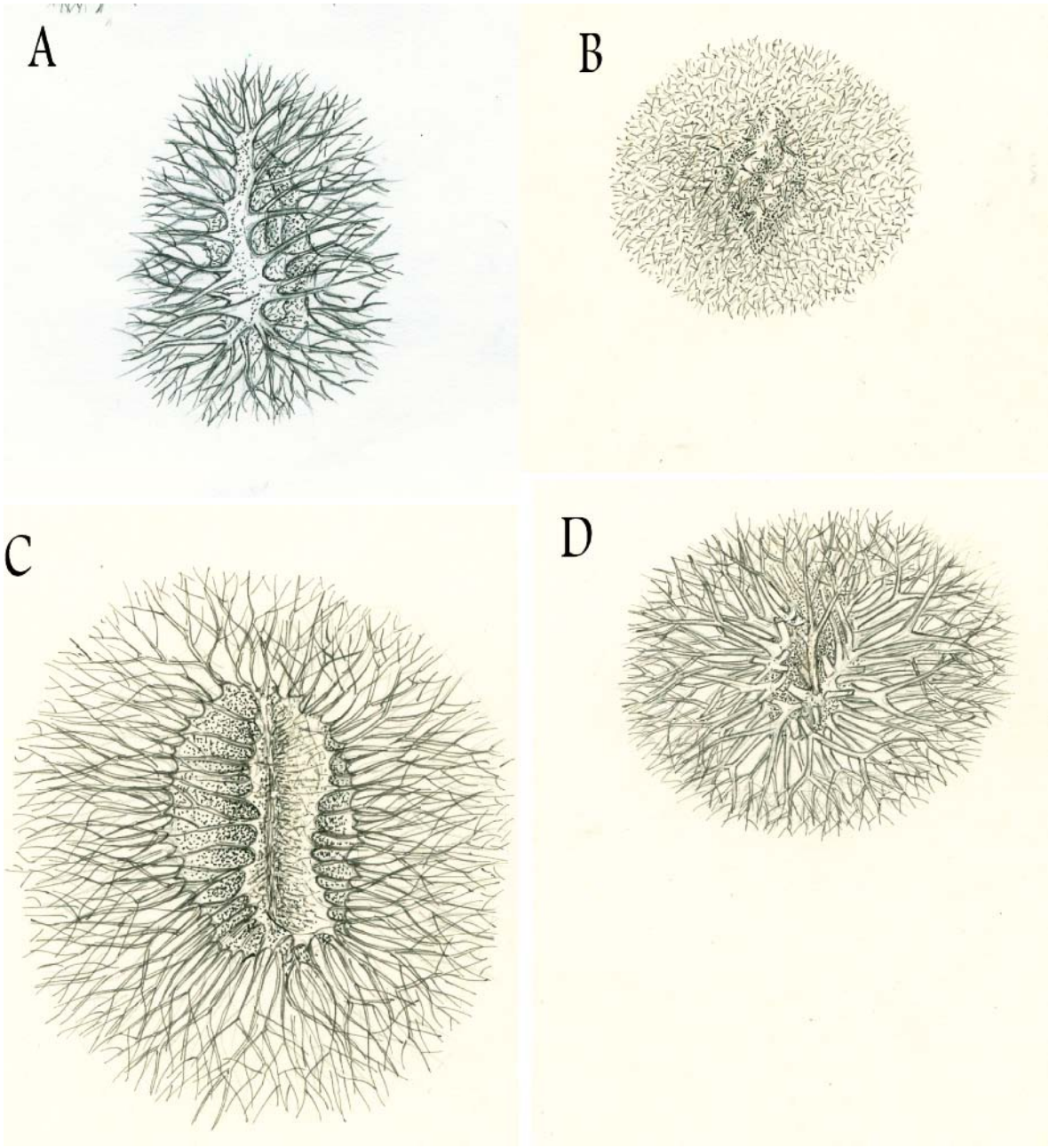

Fig. 3. *Calligonum* species, A) *C. amoenum* (×5.5), B) *C. comosum* (×4), C) *C. laristanicum* (×6), D) *C. densum* (×3.5).

Specimens seen. Esfahan: Kashan desert experimental station, Batooli s.n. - Hormozgan: c. 45 km from Rudan to Kahnuj, 420 m, Maassoumi, Kazempour & Nikchehreh 91579. -Kerman: Jiroft, 22 km to Kahnuj, 450 m, Babakhanlou 23015; 50 km on the road from Kahnuj to Bandar Abbas, 490 m, Maassoumi & Safavi 89616.

5. ***C. denticulatum*** Bunge ex Boiss., Fl. Or. 4: 999 (1879). (Fig. 1 D)

Diagnose: Related to *C. bungei* but it differs from it by the fruit with 4 furrows and wings in which the margins have the thick, pungent and acute teeth.

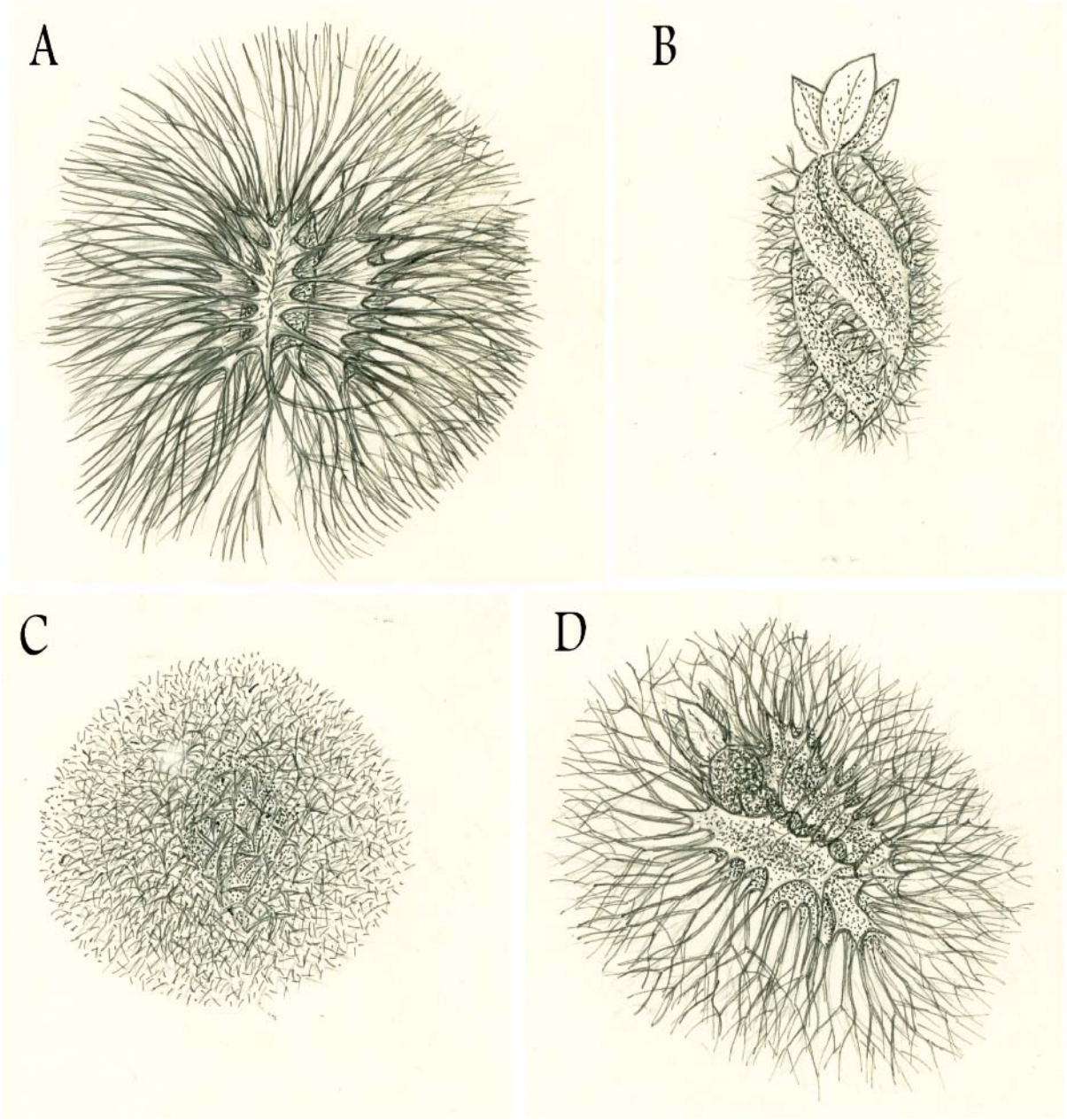

Fig. 4. *Calligonum* species, A) *C. paletzkianum* (×3), B) *C. microcarpum* (×6), C) *C. caput-medusae* (×2), D) *C. turkestanicum* (×7.5).

Gen. Dist.: Endemic.
Dist. Iran: Esfahan, Kerman, Baluchestan, Khorassan and Hormozgan.
Specimens seen. Esfahan: Kashan desert experimental station, Batooli s. n. -Hormozgan: c. 45 km on the road from Rudan to Kahnuj, 420 m, Maassoumi, Kazempour & Nikchehreh 92579. -Kerman: c. 27 km from Anar to Yazd, 1500 m Assadi & Bazgosha 56464. -Baluchestan: Zabol, Hirmand, 400 m, Zargari 5292. -Khorassan: SE. Tabas, Nayband, beginning of the road to Maadan Pravdeh, 1200 m, Rafiee & Zangooi 31187.

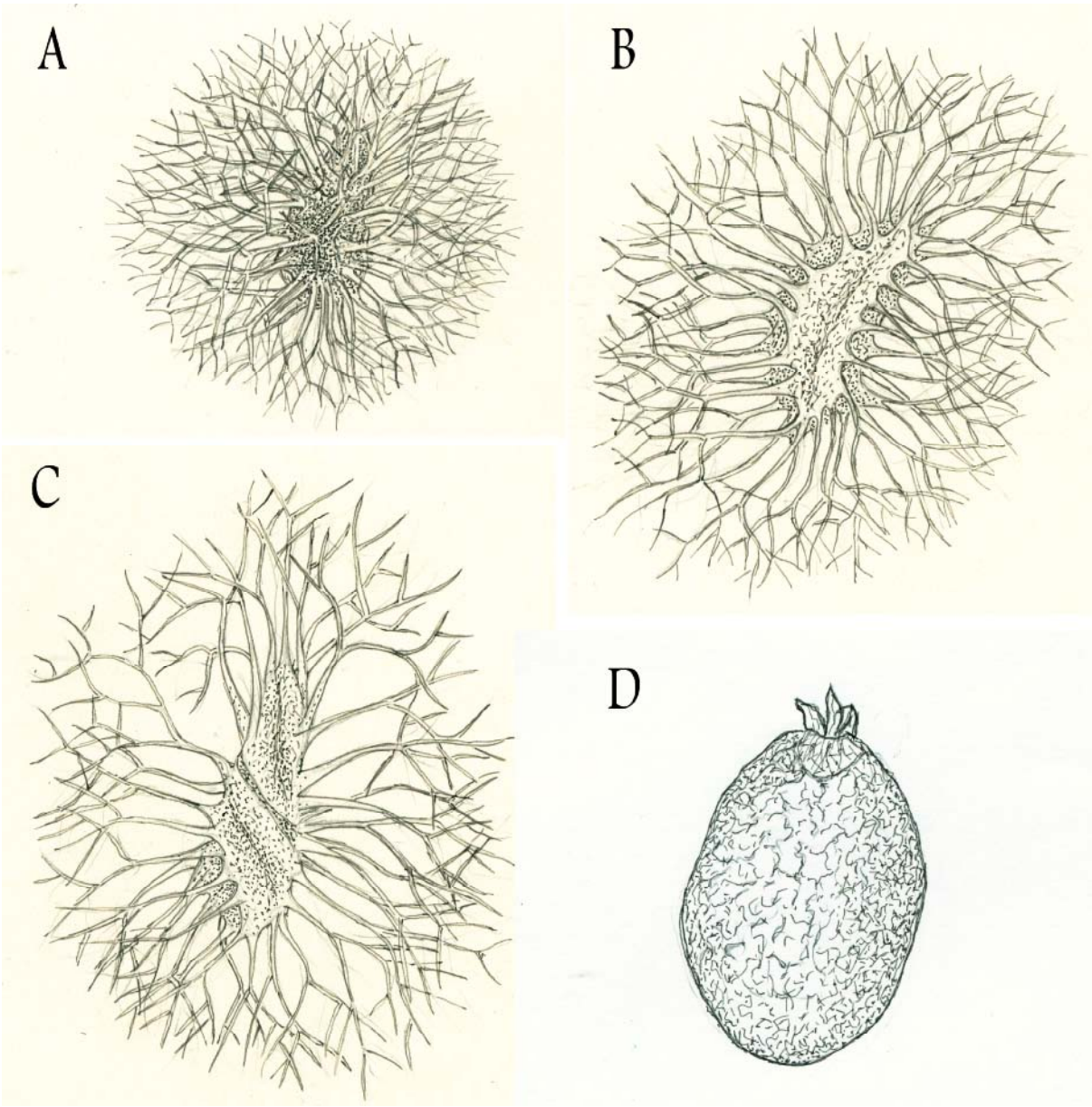

Fig. 5. *Calligonum* species, A) *C. griseum* (×3.5), B) *C. arborescense* (×5.5), C) *C. crinitum* (×4), D) *C. junceum* (×5).

6. ***C. stenopterum*** Bunge ex Boiss., Fl. Or. 4: 999 (1879). (Fig. 2 C).
Diagnose: Similar to *C. bungei* and *C. denticulatum*, but this species is separable from both of them by having clockwise twisted fruits and with narrow wings (not wide)
Gen. Dist.: Endemic.
Dist. Iran: Yazd and Khorassan.
Specimens seen. Yazd: Meibod experimental station, 1100 m, Maassoumi, Kazempour & Nikchehreh 91608. -Khorassan: c. 7 km on the road from Tabas to Yazd, 650 m, Faghinia 5293; SW. Tabas, Maadan-e Mazinow, 800 m, Rafiee, Zangooi 22082.

7. ***C. spinosetosum*** Maassoumi & Batooli, Iran. Journ. Bot. 15 (2): 153 (2010). (Fig. 2 B)
Diagnose: Unique species with having the wide wings ca. 4-5 mm wide and with spiny stiff and pungent setae in 1-2 series at the wing margin.
Gen. Dist.: Endemic.
Dist. Iran: Esfahan.

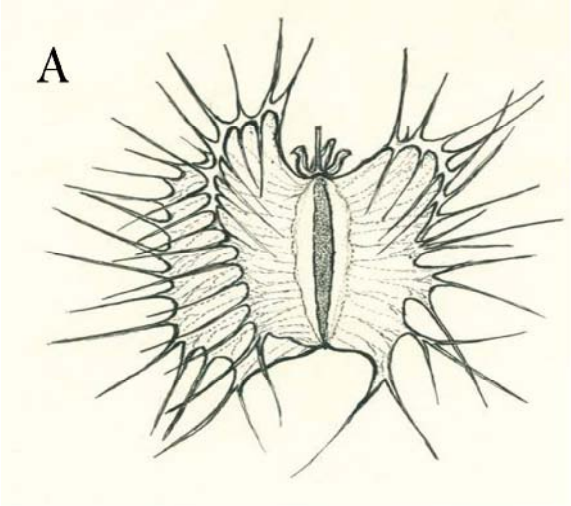

Fig. 6. *Calligonum alatosetosum* (×3.5).

Specimens seen. Esfahan: Kashan, Sefidab to Siah kuh, 1200 m, Batooli s. n.

8. ***C. alatosetosum*** Maassoumi & Kazempour, **sp. nov**. (Fig. 6 A)
Species ab fructu 3-4 late alato, setis longis, sparsis, simplicibus vel divaricate ramosis insignis. *C. setosum* simile sed setis longis (nec brevibus spinosis).
Typus. Hormozgan: ca. 45 km on the road from Rudan to Kahnuj, N:27,32; E: 27,34, 420 m, 2009.04.25, Maassoumi, Kazempour & Nikchehreh 91578 (holotypus TARI).

Shrubs with dense ramification, ca. 100 cm tall. Stems gray, ca. 5 cm in diameter; woody branches spreading, flexuous, grayish white or light yellowish-gray; herbaceous branchlets of current year green, articulated, ca. 1.5 cm. long. Leaves linear, readily deciduous, 2 mm long, adnate to the ochrea; ochrea vaginate, membranaceous. Pedicel 3 mm long, curved, slender, articulated below the middle. Flowers 3, pedicellate at leaf axil, white or light purple. Tepals deflexed in fruiting time, ovate, ca. 3 mm long. Fruit brown, winged and setose, ovate or ellipsoid, including the bristles ca. 23 mm long and 20 mm wide. Achenes narrowly to broadly ellipsoid, ca. 7 mm long and 4 mm wide, straight (not coiled), usually bearing 3 wings, rarely 4 wings; wings prominently transversally nerved, with setiferous margins; margins straight or sometimes irregularly flattened with one or two rows of filiform long and sharp bristles, ca. 9-10 mm long, wing surface glabrous. Bristles sparse, stiff, simple or dichotomous, sharply enlarged at the base, sometimes jointed at the base to each others, scarcely scabrous, very rarely with some few short delicate hairs.
Gen. Dist.: Endemic.
Dist. Iran: Hormozgan.

9. ***C. polygonoides*** L., Sp. Pl. 530 (1753). **(**Fig. 2 A)
Diagnose: Fruits including setae 15-17 mm long, twisted 90 degree; secondary wings ca. 0.8 mm wide; setae ca. 6-7 mm long, soft, stiff later, hard and pungent. Terminal segments 12-14, from the base 4-5 times dichotomously branched. Close to *C. laristanicum* but fruits twisted 90 degree and with more setae ramification.
Gen. Dist.: Turkey, Kurdestan, Iraq, Iran, Turkemenistan and Pakistan.
Dist. Iran: Azerbaijan, Kerman, Hormozgan and Baluchestan.
Specimens seen. Kerman: 5-10 km on the road from Anar to Rafsanjan, 1490 m, Maassoumi, Kazempour & Nikchehreh 91601. -Hormozgan: Hajiabad to Kahnuj, Dowlatabad, 1450 m, Mozaffarian 52570. -Baluchestan: Zahedan to Cheshmeh Ziarat and Hessaryouti to Rudmahi, 1530 m, Mozaffarian 72695; ca. 37 km on the road from Zahedan to Bam, 1200 m, Assadi 22705.

10. ***C. intertextum*** Rech. f. & Schiman-Czeika, Fl. Iranica 56: 43 (1968). (Fig. 2 D)
Diagnose: This species is easily distinguished by long setae and current year stem internodes that are ca. 3-4.5 cm long. It differs from *C. amoenum* and *C. comosum* by the secondary wings ca. 0.2 mm wide (not 0.8 mm) and ca. 8-11 mm long setae (not 6-7 mm). The species previously was reduced to a variety of *C. comosum* (Mobayen, 1979).
Gen. Dist.: Endemic.
Dist. Iran: Khuzestan (Karkheh).
Specimens seen. Khuzestan, Hamidieh, Karkhe Dam, Alvanieyeh village, 20 m, Mozaffarian 53443; NE. Bustan, around Mish-Dagh mnt. 50-200 m, Mozaffarian 53742; Ahvaz, Albaji, 30 m, Gheissari 1245, 1254.

11. ***C. amoenum*** Rech. f. & Schiman-Czeika, Fl. Iranica 56: 45 (1968). (Fig. 3 A)
Diagnose: difficult to recognize from its close relative *C. comosum*, which is widely distributed in the same area, but with the few small obscure taxonomic characters separable from it. *C. amoenum* has the current year stem with the distance between articulations ca. 2.5-3.5 cm long (not 1.5 cm), short rudimentary wings, setae ca. 3 mm long (not 4 mm), nut surface visible.
Gen. Dist.: Endemic.
Dist. Iran: Kerman, Hormozgan and Baluchestan.

Specimens seen. Kerman: ca. 30 km on the road from Jiroft to Kahnuj, 762 m, Maassoumi & Safavi 89612. -Hormozgan: Between Kahkom and Tarum, 800 m, Mozaffarian 52275; Hajiabad, Kahkom, 650 m, Mozaffarian 49582. -Baluchestan: Kahnuj, Bahadoran, ca. 11 km from Eslanabad to Zehkalout, 436 m, Maassoumi, Kazempour & Nikchehreh 91580, 91581.

12. ***C. comosum*** / ¶+HU 7UDQV / IQQ 6RF (1791). (Fig. 3 B)
Diagnose: Similar to *C. amoenum*, but in some characters these two species are separable. Setae dilated at the base, separated from each other or very rarely jointed to each other; fruits including setae c. 15 x 12 mm; ribs enlarged and creating a short rudimentary wings ca. 0.8 mm long (not 0.2 mm).
Gen. Dist.: Syria, Iran, Afghanistan, Pakistan and Africa.
Dist. Iran: Kerman, Yazd, Hormozgan and Baluchestan.
Specimens seen. Kerman: c. 5-10 km to Anar from Rafsanjan, 1490 m, Maassoumi, Kazempour & Nikchehreh 91600, 91598; Rafsanjan, Nasseriyeh, 1670 m, Maassoumi, Kazempour & Nikchehreh 91593, 91594. -Yazd: Meibod experimental station, 1000 m, Maassoumi & Safavi 89567, 89569. -Hormozgan: Rudan to Ziarat Ali, after Rahdar, 530 m, Mozaffarian 80535; ca. 35 km from Bandar Abbas to Jask, 40 m, Mozaffarian et al. 38014; ca. 100 km from Lar to Bandar Abbas, 300 m, Assadi & Sardabi 42047; Minab, ca. 4 km on the road from Jakdan to Jask, 260 m, Maassoumi, Kazempour & Nikchehreh 91583, 91584. -Baluchestan: Saravan, 4 km from Kuhak to Saravan, 926 m, Mozaffarian 72707.

13. ***C. laristanicum*** Rech. f. & Schiman-Czeika, Fl. Iranica 56: 42 (1968). (Fig. 3 C)
Diagnose: related to *C. comosum* and *C. amoenum*, but separable from those by having the rudimentary wings on the ribs ca. 1.2 mm long (not 0.2 or 0.8 mm), fruit with straight furrow or shortly turned (not twisted 90 degree); setae 3 times dichotomously branched (not 4 times).
Gen. Dist.: Endemic.
Dist. Iran: Hormozgan and Baluchestan.
Specimens seen. Hormozgan: ca.. 13 km on the road from Sarzeh to Ahmadi and Fareghan, S. of Rigzar area, 20 m, Mozaffarian et al. 38028; Near Hassan Langi to Rudan, 100 m, Wendelbo & Foroughi 15648; ca.. 34 km on the road from Bandar Abbas to Bandar Lengeh, Maassoumi, Kazempour & Nikchehreh 91571; Between Nastagh and Bandar-e Charak, 50-100 m, Maassoumi & Abouhamzeh 52025. -Baluchestan: 7 km from Rask to Chahbahar, 100 m, Runemark, Assadi & Sardabi 22450.

14. ***C. densum*** Borszcz., Mem. Acad. St. Petersb. 7 (3),1: 36 (1860). (Fig. 3 D)
Diagnose: Species with dense setae concealing the nut surface and with secondary short and visible wings ca. 2 mm wide separable from its related species such as *C. griseum* (setae lax); fruit twisted 180 degree (not shortly coiled).
Gen. Dist.: Iran and Turkemenistan.
Dist. Iran: Semnan.
Specimens seen. Semnan: Biarjomand area, between Chahjam and Toroud, Mozaffarian 93683; ca. 7 km from Eivankey diviation, Mozaffarian 93720.

15. ***C. paletzkianum*** Litw.,Trav. Mus. Bot. Acad. Sci. 11: 57 (1913). (Fig. 4 A)
Diagnose: A unique characteristic species with densely setiferous fruits which are covering and concealing the nut; setae up to 20 mm long and 3 times dichotomously branched. This species previously reported from Iran (Assadi 1989).
Gen. Dist.: Iran and Turkemenistan.
Dist. Iran: Khorassan (Ghaen, Gonabad).
Specimens seen. Khorassan: Torbat-e Heydariyeh, Gonabad, 1000-1500 m, Rajamand & Bazargan 31976; ca. 15 km E. Of Ghaen to Yazdan, east of Chahzard village, 700 m, Assadi & Amirabadi 66658; Road of Gonabad to Torbat-e Heydariyeh, Ghonabad, 920 m, Zargari 5289, 5290; 40 km N. Of Gonabad, Taghestan-e Omrani, 850 m, Joharchi & Zangooi 13122.

16. ***C. molle*** Litw., Trav. Mus. Bot. Acad. Sci. 11: 58 (1913).
Diagnose: This species has been doubtfully identified, more materials are needed. The specie with the following characters are distinguishable: fruits including the long setae are 25 mm in diameter, secondary wings ca. 2 mm wide and completely flattened on the ribs and 4-5 series of setae, setae 12-15 mm long.
Gen. Dist.: Iran, Turkemenistan.
Dist. Iran: Hormozgan.
Specimen seen. Hormozgan: Bandar Abbas, 08.12.1355, Javanshir no.1.

17. ***C. microcarpum*** Borszcz., Mem. Acad. Sci. St. Petersb. Ser. 7, 3: 41 (1860). (Fig. 4 B)
Diagnose: This species is distinguishable with fruits shortly fusiform, twisted 180 degree, dilated at the middle part, setae ca. 2-4 mm long and 2 times branched and with terminal segments 4-6.
Gen. Dist.: Iran, Kazaghistan and Turkemenistan.

Dist. Iran: Semnan.
Specimens seen. Semnan: Touran proted area, mountains in 50 km S. of Toroud, 800-850 m, Freitag & Mozaffarian 28662.

18. ***C. caput-medusae*** Schrenk, Enum. Pl. Nov. 9 (1841). (Fig. 4 C)
Diagnose: Species with setiferous fruit completely concealing the nut, biseriate setae and twisting fruit in 180 degree anticlockwise is distinguishable. Species previously reported from Iran (Mozaffarian 2005). This species recently placed to sect. *Caput-medusae* (Grubov 2005).
Gen. Dist.: Iran, Kazaghestan and Turkemenistan.
Dist. Iran: Esfahan and Baluchestan.
Specimens seen. Esfahan: Kashan, 1000 m, Mozaffarian, 78270. - Baluchestan: Saravan, ca. 40 km from Khash to Saravan, 926 m, Mozaffarian 72706.

19. ***C. turkestanicum*** (Korov.) Pavl., Feddes Repert. 33:156 (1933). (Fig. 4 D)
Diagnose: This species in vegetative parts is similar to *C. griseum* and *C. densum*, but in having the fusiform fruit, twisting fruit anticlockwise in 180 degree and with setae in 2-3 series is separable. The species doubtfully was reported from Touran protected area (Rechinger 1977).
Gen. Dist.: Iran and Turkemenistan.
Dist. Iran: Semnan and Khorassan.
Specimens seen. Khorassan: SW. Sabzevar, ca. 10 km from Parvand mountain, 800 m, Faghihnia & Zangooi 28103; S. of Sabzevar, Haresabad park, 800 m, Joharchi & Zangooi 16900, in the same place, Faghihnia & Zangooi 28102.

20. ***C. griseum*** Eug Kor. ex Pavl., Feddes Repert. Sp. Nov. 33: 156 (1933). (Fig. 5 A)
Diagnose: Close to *C. turkestanicum*, but differs by twisted fruit in clockwise (not anticlockwise), biseriate sparse setae which are separate at the base from each other (not jointed).
Gen. Dist.: Iran and Tajekistan.
Dist. Iran: Semnan.
Specimens seen. Semnan: Touran protected area, between Ahmadabad and Zamanabad, Mozaffarian 93706; Between Zamanabad and Talkhab, 1200 m, Freitag 13649, 13653; ca. 5 km WNW to Ahmadabad, 1170 m, Freitag 13869, 13874.

21. ***C. arborescens*** Litw., Fl. Ross. 2: 28 (1900). (Fig. 5 B)
Diagnose: Up to 3 meters high. Fruit twisted 90 degree in clockwise with sparse and long setae ca. 10-12 mm long. Species was reported from Iran (Mozaffarian, 2005) and widely planted for sand dune fixation.
Gen. Dist.: Iran and turkmenistan.
Dist. Iran: Semnan.
Specimen seen. Semnan: Semnan, 1050 m, Mozaffarian 72635, 75634.

22. ***C. crinitum*** Boiss., Diagn. Pl. Or. Nov. ser. 2, 4: 77 (1859). (Fig. 5 C)
Diagnose: Close to *C. arborescens*, but differs in having the twisted fruit anticlockwise (not clockwise) and long setae c. 22 mm long (not 12-14 mm). Species previously was reported from Iran (Mobayen, 1979, Parsa, 1950, Mozaffarian, 2005).
Gen. Dist.: Iran, Afghanistan and Pakistan.
Dist. Iran: Yazd, Khuzestan, Esfahan and Semnan.
Specimens seen. Yazd: Meibod experimental station, 1000, Maassoumi & Safavi 89572, 89563. -Khuzestan: Ahvaz, Karkheh, 1100 m, Jamzad, Naanai & Salehi 79226. -Esfahan: Kashan, Abouzeidabad, Rig Bolabd, 1000 m, Maassoumi, Safavi & Batooli 89551, 89557, 89553, 89556; Anarak, near Chupanan village 950 m, Assadi & bazgosha 56530. -Semnan: Semnan, 1120 m, Mozaffarian 58861(seeds origin from Kashan).

23. ***C. junceum*** (Fisch. & C. A. Mey.) Litw., Fl. Ross. 8:9 (1922). (Fig. 5 D)
Diagnose: Species with membranaceous sac surrounded the fruit separable from all Iranian taxa. It is also distinguishable by odorant vegetative parts growing on gypsum soil.
Gen. Dist.: Iran, Turkemenistan and Ghazaghestan.
Dist. Iran: Khorassan, Semnan and Tehran.
Specimens seen. Khorassan: 70 km from Neishabour to Kashmar, 1550-1950 m, Assadi & Mozaffarian 35460. -Semnan: Begining of the road from Aftar to Arvaneh, 1803 m, Mozaffarian 83955; Touran proted area between Toroud and Narkhar mountain, 900 m, Freitag & Jadidi 28969. -Tehran: Touran wildlife park, 3 km S. of flat area situated in N. of Narkhar mountain, 980 m, Freitag 13989.

DOUBTFUL RECORD

C. tetrapterum Jaub. & Spach
Rechinger and Schiman-Czeika (1968) in Fl. Iranica UHFRUGHG WKLV VSHFLHV IURP $QDWROLD 0 HVRSRWDPLD $UDEL± Caspian and Iran in general distribution, citing no herbarium specimen. The same mistake is in Fl. URRS (Komarov 1936). The species has a distribution in Aralo-Caspian area and not reported in Flora of Turkey (Davis 1967). Several local investigators such as Sabeti (1976); Mobayen (1979) and Parsa (1950) did not cite the presence of this species from Iran.

REFERENCES

Assadi, M. 1989: New species and new plant records IURP ,UDQ ±,UDQLDQ-RXUQDORI %RWDQ 204.

Boissier, E. 1879: Calligonum in Flora Orientalis vol. ±* HQHYDH %DVLOHDH

Cullen, J. 1967: Calligonum in P. H. Davis Fl. of 7XUNH YRO ±(GLQEXUJK 8QLYHUVLW Press.

Borodina, A. E., Grubov, V. I., Grudzinskaja, I. A. & Menitsky, J. L. 1989: Calligonum in V. I. Grubov Plants of Central Asia vol. 9: 168-178 (English translation published in 2005 by Science Publishers, Inc., USA).

3DUVD $ &DOOLJRQXP IQ)ORUH GH ¶,UDQ YRO ±7HKUDQ

Pavlov, N. V. 1936: Calligonum in V. L. Komarov,)ORUD RI WKH 8665 YRO ±0 RVNYD Leningrad.

Maassoumi & Batooli, 2010: A new species of the genus Calligonum (Polygonaceae) in Iran. -Iranian Journal of Botany 15 (2): 153.

Mobayen, S., 1979: Flora of Iran, Vascular Plants vol. 2: 161-169. (Persian language). -Tehran.

Mozaffarian, V. 2005: Trees and Shrubs of Iran 3HUVLDQ ODQJXDJH ±)DUKDQJ 0 RDVHU 3XEOLVKHU Tehran.

5HFKLQJHU . + 6FKP DQ±&]HLND + 3RO JRQDFHDH IQ)ORUD, UDQLFDQR ±* UD]

Rechinger, K. H. 1977: Plants of the Touran Protected Area, Iran. -Iranian Journal Bot. vol. 1 (2): 155-188.

6DEHWL +)RUHVW 7UHHV DQG 6KUXEV RI ,UDQ ± Tehran.