

A SYNOPSIS OF THE GENUS *COLUTEA* (FABACEAE) IN IRAN

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The genus *Colutea* (Fabaceae) has been revised in preparation for the *Flora of Iran* treatment and a synopsis is presented here. In Iran the genus includes four sections, three subsections and nine species. An identification key, notes and distributions are given for the taxa. Two new subsections are described: *Colutea* sect. *Rostrata* subsect. *Gifana* and *Colutea* sect. *Rostrata* subsect. *Uniflora*.

Keywords. Endemism, identification key, new subsections, *Oreophysa*, Papilionoideae.

INTRODUCTION

The genus *Colutea* L. (Fabaceae), commonly known as bladder senna, is composed of about 28 deciduous species (Mabberley, 2008) found in southern Europe, northeastern and eastern Africa, and western and Central Asia (Browicz, 1963a, 1968; Krüssmann, 1984; Mabberley, 2008). The species are currently classified into five sections: *Colutea* (consisting of four subsections), *Multiflora* Browicz, *Rostrata* Browicz (consisting of two subsections), *Armata* Browicz and *Oreophysa* Bunge ex Boiss. (Boissier, 1872; Browicz, 1963a). The infrageneric groups found in Iran are *Colutea* sect. *Colutea* subsect. *Colutea* and subsect. *Graciles* Browicz, *Colutea* sect. *Rostrata* subsect. *Centralasiaticae* Browicz, *Colutea* sect. *Armata*, and *Colutea* sect. *Oreophysa* (Boissier, 1872; Browicz, 1963a, 1984; Kazempour Osaloo *et al.*, 2006). The genus includes nine species in Iran, five of which are endemic to the country (Boissier, 1872; Browicz, 1984; Kazempour Osaloo *et al.*, 2006; Ghahremaninejad & Ghahremani, 2008).

The identification, classification and subdivision of *Colutea* species has always been challenging and difficult as the species tend to be very similar, especially those with the same flower colour. The delimitation of sections, subsections and species in *Colutea* has largely been based on the following characters: spinescence of shoots; the shape of the top of the keel; pubescence of ovary; shape and length of wings; colour and length of flowers; number of flowers in inflorescence; length of calyx teeth and kind of incisions between them; number of leaflet pairs; size and shape of leaflets; pubescence of leaflets; arrangement of leaves; pattern of bark peeling; termination of fruit apex; length of fruit stipe; and colour of calyx hairs (Browicz, 1963a; Krüssmann, 1984).

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Browicz (1984), in the last comprehensive study on the genus in Iran, recorded 13 species of *Colutea* from the Iranian plateau, of which seven are known from the country of Iran. From the surrounding countries, 13 *Colutea* species were recorded by Shaparenko (1946) in the *Flora of the USSR*, four of which are known from Iran, and four species were recorded by Davis (1970) in the *Flora of Turkey*, one of which is also in Iran. The latter, *Colutea cilicica*, is also recorded from Greece (Browicz, 1968). Since the account in *Flora Iranica* (Browicz, 1984) a molecular taxonomic study has shown that *Oreophysa microphylla* (Jaub. & Spach) Browicz should be included in *Colutea* as *C. triphylla* (Kazempour Osaloo *et al.*, 2006). In addition, Ghahremaninejad & Ghahremani (2008) have recorded *Colutea komarovii* from the Arasbaran protected region in western Iran.

The study of *Colutea* in Iran has necessitated the description of two new subsections within the existing infrageneric framework of the genus. Hence a key is presented to the sections, subsections and species, and additional notes are given for the species. The distribution of each species in the country has also been indicated (Fig. 1). The order for the species follows that of Browicz (1963a, 1984).

MATERIALS AND METHODS

This study is based on a combination of field studies and the investigation of 305 herbarium specimens from the following herbaria (Thiers, continuously updated): FAR, FUMH, IRAN, KAR, P, T, TARI, TUH, W and Shahid Bahonar University of Kerman herbarium (abbreviated UKH, but this is not in Thiers (continuously updated)). Fresh specimens were collected in the field allowing us to examine morphological variation of species in both living and herbarium material.

Identification key to the sections, subsections and species of Colutea in Iran

- 1a. Shrub; leaves multifoliolate _____ 2
 1b. Suffrutescent herb; leaves trifoliolate; (sect. *Oreophysa*) _____ **4(i). *C. triphylla***
- 2a. Shrubs unarmed; inflorescences with one or numerous flowers; flowers large, around or more than 15 mm long _____ 3
 2b. Shrubs with thorns; inflorescences with 1–2 flowers; flowers small, up to 15 mm long; (sect. *Armata*) _____ 8
- 3a. Keel rounded at the apex; (sect. *Colutea*) _____ 4
 3b. Keel with small beak at the apex; (sect. *Rostrata*) _____ 6
- 4a. Shoots after peeling grey-brown; leaflets large, 15–30 × 9–15 mm, mostly broad-elliptic; ovary glabrous; (subsection. *Colutea*) _____ **1a(i). *C. cilicica***
 4b. Shoots after peeling brown-violet, lustrous; leaflets shorter, 5–13 × 3–10 mm, mostly obovate; ovary glabrous-tomentose; (subsection. *Graciles*) _____ 5
- 5a. Leaflets glabrous above; inflorescence shorter than supporting leaves; flowers up to 16 mm long; ovary tomentose _____ **1b(i). *C. gracilis***



FIG. 1. Distribution map of the genus *Colutea* L. in Iran. Filled shapes indicate species endemic to the country. \diamond *C. komarovii*, \blacklozenge *C. uniflora*, \triangle *C. cilicica*, \blacktriangle *C. gifana*, \circ *C. buhsei*, \bullet *C. persica*, \blacksquare *C. triphylla*, \star *C. porphyrogramma*, \square *C. gracilis*.

- 5b. Leaflets more or less pubescent above; inflorescence longer than or equal to supporting leaves; flowers 16–23 mm long; ovary glabrous or with a few hairs on ventral suture _____ **1b(ii). *C. persica***
- 6a. Flowers generally 15 mm long; wings falcate; (subsect. *Uniflora*) _____ **2c(i). *C. uniflora***
- 6b. Flowers over 18 mm long; wings linear geniculate _____ 7
- 7a. Shoots after peeling red-brown, lustrous; leaves with 2–5(–6) pairs of leaflets; leaflets pubescent below; inflorescence more or less equal to supporting leaves; calyx teeth 4–5 times shorter than tube; (subsect. *Centralasiaticae*) _____ **2a(i). *C. buhsei***
- 7b. Shoots after peeling grey; leaves with 1–2 pairs of leaflets; leaflets glabrous on both sides; inflorescence more than 1.5 times longer than supporting leaves; calyx teeth equal to tube; (subsect. *Gifana*) _____ **2b(i). *C. gifana***

- 8a. Leaflets 2–7.5 × 2–6 mm; pedicels 0.3–1 mm long; wings with spur; fruits papery-leathery _____ **3(i). *C. komarovii***
 8b. Leaflets 3–4.5 × 1.5–3 mm; pedicels 2–8 mm; wings without spur; fruits thin, papery _____ **3(ii). *C. porphyrogramma***

NOTES ON THE SECTIONS, SUBSECTIONS AND SPECIES
OF *COLUTEA* IN IRAN

- 1. *Colutea* sect. *Colutea*.** – *Colutea* sect. *Eucolutea* Boiss., Fl. Orient. 2: 194 (1872), p.p. – Type species: *Colutea arborescens* L.

Unarmed shrubs. Leaves with 2–6(–7) pairs of leaflets. Inflorescence with 1–6 flowers. Flowers over 15 mm long; wings linear; keel rounded at the apex.

- 1a. *Colutea* sect. *Colutea* subsect. *Colutea*.** – *Colutea* sect. *Colutea* subsect. *Arborescentes* Browicz, Monogr. Bot. 14: 22, 24 (1963). – Type species: *Colutea arborescens* L.

Leaflets large, mostly broad-elliptic. Flowers yellow; wings geniculate. One species in Iran.

- 1a(i). *Colutea cilicica*** Boiss. & Bal. in Boiss., Diagn. Pl. Orient. nov. ser. 2, 5: 83 (1856). – Type: Turkey, Cilicia, Mersina, *Balansa* s.n. (G n.v.). **Figs 1, 2.**

Distribution. Turkey, Iran, Caucasus, N Iraq, N Syria, N Palestine and Greece.

Specimens studied. **East Azarbaijan:** Qaradagh Mountains, Arasbaran protected region, Kaleibar, before Babak Fort, 13 viii 2009, *Pooyan* 12013 & 12014 (FAR!); After Babak Fort, 27 v 2010, *Pooyan* 12015 & 12016 (FAR!); Arasbaran protected region, Hejrاندust to Makidi, 1400–1750 m, 7 vi 1976, *Assadi & Maassoumi* 20185 (TRAI!); Makidi to Veinagh, 1000–1700 m, 14 v 1975, *Wendelbo & Assadi* 17041 (TARI!, W!); Veinagh, 4 vii 1978, *Termeh, Moussavi & Habibi* 38971 (W!); Between Veinagh and Tou-Ali, 20 vi 2005, *Ghahreman & Attar* 35481 (TUH!); Between Kalaleh Olya and Vaighan three-way, 1200 m, 19 vi 2004, *Ghahreman, Attar & Hamzeh'ee* 35532 (TUH!); Kaleibar to Hasan Beiglou, vi 1941, *Sabeti* 3725 (KAR!); Hasan Beiglou, iv 1958, *Mirdamadi* 6156 (W!); *ibid.*, iv 1950, *Unknown* 3726 (KAR!). **Zanjan:** Tarom, Abhar, 900 m, 19 vi 1973, *Makouii* 9917 (TARI!).

- 1b. *Colutea* sect. *Colutea* subsect. *Graciles*** Browicz, Monogr. Bot. 14: 22, 69 (1963). – Type species: *Colutea gracilis* Freyn & Sint.

Leaflets medium, mostly obovate. Flowers yellow or orange yellow; wings geniculate. Two species in Iran.

- 1b(i). *Colutea gracilis*** Freyn & Sint. ex Freyn, Bull. Herb. Boiss. sér. 2, 4: 46 (1904). – Type: Turkmenistan, Kasil-Arwat, Karakala, Sundsodagh Mountain, *Sintenis* 1705 (P!).



FIG. 2. *Colutea* sect. *Colutea*. A. *Colutea cilicica*, Arasbaran protected region, East Azarbaijan; B. *Colutea persica*, Shiraz to Dasht-e-Arjan, Fars.

Colutea gracilis Freyn & Sint. is reported here from Iran for the fourth time. The previous specimens were collected from Chartut, in Golestan province (Gorgan), and Kuh-i-Nasr, in Kerman province (Browicz, 1963a, 1984).

Note. Parsa (1948) listed the taxon '*Colutea persica* Boiss. var. *gracilis* Freyn' but there is no evidence that Freyn ever published this name as a variety. In *Flora Iranica* Browicz (1984) included the name '*Colutea persica* Boiss. var. *gracilis* (Freyn) Parsa' in synonymy of *C. gracilis* Freyn & Sint. ex Freyn, presumably in the belief that Parsa had made a new combination from *Colutea gracilis*. This may be because Parsa listed the variety as occurring in Kuh-i-Nasr at 2800–3000 m, a known locality for *Colutea gracilis*, and that it had small leaves (in comparison to *C. persica*). Parsa (1948), however, gave no evidence he was making a new combination, listed no specimens, there is no illustration, and the description is too short to have any confidence in the identity of this plant. This variety must, therefore, remain an unknown entity.

Distribution. Turkmenistan and Iran.

Specimens studied. **Kerman:** Kuh-i-Nasr, 2800–3000 m, 23 v 1892, *Bornmüller* 3688 (P!); Rayen, 2400 m, 24 v 1981, *Manuchehri, Heravi & Jafari* 277 (TARI!).

1b(ii). *Colutea persica* Boiss., *Diagn. Pl. Orient. nov. ser. 1, 6: 33 (1845).* – Type: Iran, Fars, Kuh-e Delu, *Kotschy* 4348 (holo W!; iso P!, W!). **Figs 1, 2.**

Colutea persica is a problematic, challenging species which occurs over a large part of southern Iran. There is a wide range of variation in features such as hairs on the ovary and leaf and flower size. *Colutea persica* is intermediate in leaf and flower size between *C. buhsei* and *C. gracilis* (*C. buhsei* > *C. persica* > *C. gracilis*) although there is an overlap with both species. Even though, on first appearance, it is hard to distinguish this species from each of the other two they can be readily distinguished on closer examination (see key above). In particular *Colutea persica* does not have the tomentose ovary of the other two species.

Distribution. Endemic to Iran.

Specimens studied. **Kohgiluyeh and Boyer-Ahmad:** Yasuj, Kakan, Margoan waterfall, 1960 m, 23 v 2005, *Noroozi & Shams* 14850 (TARI!); *ibid.*, 2100 m, 27 v 1995, *Ghahreman & Attar* 19062 (TUH!). **Fars:** 100 km N Shiraz, Sad-e-Doroudzan, 1000 m, 30 iv 1973, *Babakhanlou* 9097 (TARI!); Shiraz to Dasht-e-Arjan, 10 km before Dasht-e-Arjan, 1997–2016 m, 5 v 2010, *Pooyan* 12017, 12018, 12019 & 12023 (FAR!); Dasht-e-Arjan to Kazerun, 40 km before Kazerun, 2048 m, 5 v 2010, *Pooyan* 12020, 12021 & 12022 (FAR!); 42 km E Kazeroun, 2100 m, 10 v 1959, *Pabot* 986 (TARI!); Kuh-e Delu, 13 vi 1842, *Kotschy* 511 (P!, W!); 27 km from Nurabad to Korekan, Doshman-Ziary region, 2000 m, 31 v 1983, *Mozaffarian* 45755 (TARI!); 20 km from Estahbanat to Neiriz, S Daryach-e Bakhtegan, 1750 m, 8 vi 1983, *Mozaffarian* 47100 (TARI!); 26 km NW Ardekan, 2500 m, 13 vii 1959, *Pabot* 2394 (TARI!). **Hormozgan:** c.100 km NE Bandar Abbas, Bagh-e Hana, 2000–2500 m, 26 vi 1995, *Assadi* 73692 (TARI!). **Kerman:** SE Kerman, Sekonj, 9 vi 2000, *Mirtajeddini* 1326 (UKH!); Mahan to Joopar, Ghanat-e-Ghastan, 20 v 2010, *Pooyan* 12025 & 12026 (FAR!); Jebal Barez mountains, after Deh-e Bakri, after Esfand tunnel, 2405 m, 20 v 2010, *Pooyan* 12024 (FAR!); 40 km from Jiroft on the road to Kerman, Kuh-e Sarzeh, 3000–3300 m, 13 vi 1997, *Assadi & Miller* 25367 (TARI!); Kerman to Jiroft (Rayen road), 35 km to Jiroft, 20 v 2010, *Pooyan* 12030 (FAR!); Rayen to Jiroft, before Dalfard, 20 v 2010, *Pooyan* 12027 & 12028 (FAR!); Dalfard, 1900 m, *Unknown* 21 (TARI!); Rayen, Kuh-e Hazar, Hazargol valley, 2800–3200 m, 16 vi 1975, *Foroughi & Assadi* 16256 (TARI!); Kuh-e Hazar, Zahroud, 2700 m, *Edmondson & Miller* 1644 (TARI!); 54 km Jiroft to Baft, 20 v 2010, *Pooyan* 12029 (FAR!); 40 km to Baft, road of Gughar, after Godal village, 2864 m, 27 v 2002, *Ghahreman, Attar, Mehdigholi & Mirtajeddini* 28582 (TUH!); Bardsir, Bid Khun, 23 v 2011, *Mirtajeddini* s.n. (UKH!); Baft, 18 v 2011, *Hofreh Nejadi* s.n. (UKH!); Baft, Goghar, 27 v 2011, *Majdzadeh* s.n. (UKH!); Baft to Khabr, Kuh-e Khabr, 3500–3800 m, 8 vi 1977, *Assadi, Edmondson & Miller* 1779 (W!); *ibid.*, 2300–2500 m, 28 v 1975, *Mousavii & Tehrani* 33567-E (W!); Khabr National Park, 2400 m, 9 vi 77, *Assadi, Edmondson & Miller* 1728 (W!); Rafsanjan, Sarcheshmeh, 28 viii 1998, *Sarcheshmehpour* 1327 (UKH!).

2. *Colutea* sect. *Rostrata* Browicz, *Monogr. Bot. 14: 22, 83 (1963).* – *Colutea* sect. *Eucolutea* Boiss., *Fl. Orient.*, 2: 194 (1872), p.p. (not including the type). – Type species: *Colutea orientalis* Mill.

Unarmed shrubs. Leaves with 1–5 pairs of leaflets. Inflorescence with 1–5 flowers. Flowers 14–25 mm long; wings linear or falcate; keel ending with a beak at the apex; beak often elongated and bent.

2a. *Colutea* sect. *Rostrata* subsect. *Centralasiaticae* Browicz, Monogr. Bot. 14: 22, 93 (1963). – Type species: *Colutea buhsei* (Boiss.) Shap.

Shoots after peeling red or red-brown, lustrous. Leaflets pubescent below. Inflorescence more or less equal in length to subtending leaves, with 1–5 flowers. Flowers large, over 18 mm long; wings longer than keel or, exceptionally, equal to it, geniculate. Calyx teeth at least 2 times shorter than tube. Fruit large.

2a(i). *Colutea buhsei* (Boiss.) Shap., Fl. URSS 11: 320 (1941). – Type: Iran, Mazandaran, Elburz Mountain, *Boissier* s.n. (G n.v.). **Figs 1, 3.**

Although Browicz (1963a, 1967) mentioned two *Colutea buhsei* specimens from southern Iran, and included these in a distribution map, we have not seen any



FIG. 3. *Colutea* sect. *Rostrata*. A. *Colutea buhsei*, Salook National Park, North Khorassan, provided courtesy of Atefeh Ezazi; B. *Colutea gifana*, near Ghezalghan, North Khorassan; C. *Colutea uniflora*, near Lowshan, Gilan.

specimens from this area, either in the herbarium or in the field. This species, found in northern Iran, is the most widespread of the *Colutea* species in the country.

Distribution. Iran and Central Asia.

Specimens studied. **Golestan:** Gorgan, Naharkhoran Forest, *Bani Agheli* 12050 (T!); Gorgan to Shahrud, Chaharbagh, Chelcheli Protected Region, 31 vii 2009, *Pooyan* 12007, 12008 & 12009 (FAR!); Shahkuh, 17 vii 1940, *Koelz* 16327 (W!); 15 km N Aliabad, Zarrin-Gol valley, 470 m, 19 v 2005, *Assadi & Hemmati* 88858 (TARI!); Aliabad, *Gauba & Mirdamadi* 597 (KAR!); 12 km SE Azadshahr, 320 m, 10 v 1960, *Pabot* 75339 (TARI!); 28853 (W!); Azadshahr to Shahrud, 1400 m, 22 v 1977, *Rechinger* 55485 (W!); *ibid.*, 300 m, 23 viii 1996, *Assadi & Azadi* 76114 (TARI!); *ibid.*, 300 m, 3 v 1974, *Wendelbo, Foroughi, Sanii & Shirdelpur* 11102 (TARI!); *ibid.*, 320 m, *Pabot* 7539 (TARI!); Now Deh, 7 v 1955, *Money* 6534 (W!); 84 km E Gonbad-e Kavus, 740 m, 3 ix 1960, *Pabot* 5029 (TARI!); 85 km NE Gonbad, 750 m, 14 v 1966, *Pabot* 7762 (TARI!); Minudasht, 11 v 1968, *Unknown* 118 (W!); Golestan National Park, 600 m, 1 v 1974, *Wendelbo, Foroughi, Sanii & Shirdelpur* 11022 (TARI!); *ibid.*, 30 vii 2009, *Pooyan* 12004 & 12005 (FAR!); *ibid.*, 7 vii 2000, *Mirtajeddini* 1325 (UKH!); *ibid.*, 1640 m, 9 v 1972, *Sabeti* 6017 (TARI!); *ibid.*, *Rezaian* 23861 (TARI!); *ibid.*, 1350–1700 m, 5 vi 1987, *Mozaffarian & Abouhamzeh* 59043 (TARI!); *ibid.*, 26 vii 1972, *Iranshahr & Zargani* 41198-E (W!); *ibid.*, 1700 m, 26 vii 1972, *Rowshan* 7533 (TARI!); *ibid.*, 27 viii 2009, *Pooyan* 12012 (FAR!); *ibid.*, 30 vii 2009, *Pooyan* 12006 (FAR!); *ibid.*, 400–600 m, 3 vi 1975, *Rechinger* 52601 (W!); *ibid.*, 600 m, 21 xi 1996, *Akhani* 12376 (W!); *ibid.*, 1800 m, *Hewer* 3871 (TARI!). **Mazandaran:** Kiasar forest, 2068 m, *without collector* 3449 (T!); *ibid.*, 1593 m, *without collector* 3257 (T!); Kiasar to Damghan, 1850 m, 29 vii 1975, *Moussavi & Karavar* 33593-E (W!); *ibid.*, 29 vii 2009, *Pooyan* 12001 & 12002 (FAR!); *ibid.*, 450 m, 17 v 1978, *Wendelbo & Assadi* 29578 (TARI!); Pol-Sefid to Sangedeheh, 4500 m, 14 x 1977, *Assadi* 25535 (TARI!); *ibid.*, 1200 m, 18 vi 1995, *Assadi* 73388 (TARI!); *ibid.*, 1400 m, 25 ii 1972, *Domanchik* 31375 (TARI!); Pol-Sefid to Firuzkuh, 1400 m, 20 vi 1948, *Rechinger & Rechinger* 5563 (W!); *ibid.*, 29 vii 2009, *Pooyan* 12003 (FAR!); *ibid.*, 1710 m, 12 v 1971, *Gheissari* 1313 (TARI!); *ibid.*, 2500 m, 30 iii 1973, *Babakhanlou & Amin* 16171 (TARI!); *ibid.*, 17 v 1989, *Haghighian* 12047 & 12048 (T!); *ibid.*, 27 v 1986, *Daneshpajuh & Zangani* 41197-E (W!); Amol to Polur, 10 v 1990, *Bafendeh* 12045 & 12046 (FAR!); *ibid.*, 3 v 1965, *Tregubov* 115 (TARI!); *ibid.*, 2350 m, 5 x 1982, *Mozaffarian & Aboohamzeh* 42611 (TARI!); *ibid.*, 2260 m, 10 vii 1960, *Pabot* 4095 (TARI!); 28852 (W!); *ibid.*, 16 viii 1981, *Zargani* 41196-E (W!); *ibid.*, 1930 m, 10 vii 1971, *Athari* 2553 (TARI!); Chalus to Kandavan, 1000 m, 27 v 1965, *Mobayan* 7227 (TUH!); *ibid.*, 500 m, 9 v 1998, *Assadi* 78712 (TARI!); *ibid.*, 1930 m, 8 ix 1971, *Riazi* 2769 (TARI!); *ibid.*, 2110 m, 15 iv 1970, *Foroughi* 313 (TARI!); *ibid.*, 2000 m, 19 vii 1984, *Assadi & Maassoumi* 51698 (TARI!); *ibid.*, 2100 m, 21 vi 1974, *Rechinger* 48339 (W!); *ibid.*, 480 m, *Assadi* 76696 (TARI!); *ibid.*, 2200–2600 m, 6–7 vii 1948, *Rechinger & f. Rechinger* 6359 (W!); *ibid.*, 2100 m, 23 vi 1982, *Ghahreman, Aghustin & Shaikhaleslami* 4070 & 7232 (TUH!); *ibid.*, 700 m, 28 iv 1959, *Wendelbo* 409 (W!); *ibid.*, 11 v 1961, *Stutz* 1166 (W!); *ibid.*, 2180 m, 27 vii 1960, *Pabot* 4648 (TARI!); *ibid.*, 2000 m, 7 vi 1960, *Pabot* 3541 (TARI!); *ibid.*, vi 1984, *Ghahreman, Aghustin & Shaikhaleslami* 7231 (TUH!); *ibid.*, 1300 m, 24 v 1974, *Wendelbo & Shirdelpur* 11713 (TARI!); *ibid.*, 1800 m, 17 v 1978, *Runemark & Mozaffarian* 28089 (TARI!); Kandavan to Haraz Road, 1900–2300 m, 23 vi 1979, *Assadi & Mozaffarian* 33032 (TARI!); *ibid.*, 1600 m, 11 vii 1997, *Ghahreman, Attar & Ghahremaninejad* 21224 (TUH!). **East Azarbaijan:** 30 km S Khalkhal, c.1500 m, 1 v 1981, *Forghandust* 36269 (TARI!); Chuli region, 15 km S Herowabad, 21 vii 1970, *Ferguson* 64 (W!). **North Khorassan:** Golestan National Park, 1050 m, 20 vii 1971, *Edmondson* 736 (W!); *ibid.*, 720 m, 30 v 1972, *Foroughi* 6219 (TARI!); *ibid.*, 1770 m, 7 vii 1989, *Vafae, Gazory & Shaikh* 518 (TARI!); *ibid.*, 300 m, 21 vi 1977, *Hewer* 3979 (TARI!); *ibid.*, 1500–1800 m, 8–10 vi 1975, *Rechinger* 53123 (W!); *ibid.*, 1200 m, 5 vi 1975, *Rechinger* 52933 (W!); *ibid.*, 1000 m, *Rechinger* 32569 (W!); *ibid.*, 800 m, 10 viii 1967, *Rechinger* 37636 (W!);

Bojnurd to Gifan, *Ghahreman, Attar & Hamzehee* 36536 (TUH!); *ibid.*, 1200 m, 22 v 1984, *Assadi & Maassoumi* 50312 (TARI!); *ibid.*, 26 viii 2009, *Pooyan* 12010 & 12011 (FAR!); Kopet Dag, 600–700 m, 8 ix 1976, *Vasak* 07766 (W!); *ibid.*, 1800 m, 14–15 vii 1937, *Rechinger* 1730 (W!); Minaloo, 1600 m, 23 v 1984, *Assadi & Maassoumi* 50381 (TARI!). **Razavi Khorassan:** Quchan, Gardaneh Allah-Akbar, 24 vii 1972, *Iranshahr & Zargani* 41199-E (W!); Dargaz, Daroongar village, 1700 m, 13 vi 1988, *Vafae* 280 (TARI!); Robat-e Qozloq, 15 vi 1940, *Koelz* 16215 (W!); Ardak to Tolgor, Mount Hazar Masjed, 1200–1600 m, 7–10 vi 1948, *Rechinger & f. Rechinger* 4967 (W!); Mashhad, Zoshk, 1550 m, 23 v 1972, *Foroughi* 6300 (TARI!); Ghadamgah, Dizbad village, 1700–2200 m, 4 viii 1983, *Mozaffarian* 45576 (TARI!); Mount Binalud, 1600–1900 m, 11 vii 1988, *Saghafi & Beizai* 34 (TARI!); *ibid.*, 2500 m, 26 vii 2001, *Assadi & Ranjbar* 82265 (TARI!); *ibid.*, 1600–1900 m, 17 vi 1981, *Assadi & Mozaffarian* 36036 (TARI!); Esfarayen, Mount Shah-Jahan, 1400–2500 m, 8 vi 1984, *Mozaffarian* 48602 (TARI!); *ibid.*, 1400–1800 m, 28 vi 1984, *Mozaffarian* 48679 (TARI!); Kotal-e yekn Chenar, v 1940, *Koelz* 16724 (W!). **Semnan:** Azadshar to Shahrud, Khush Yeilaq, 2000–2200 m, 17 v 1948, *Rechinger & Rechinger* 5405 (W!); Gorgan to Shahrud, Chahar-Bagh road, 2200 m, 12 vii 1976, *Assadi & Maassoumi* 21180 (TARI!); *ibid.*, 2700 m, 12 vii 1976, *Assadi & Maassoumi* 21161 (TARI!); *ibid.*, 2300 m, 24 vii 2001, *Assadi & Ranjbar* 82155 (TARI!); *ibid.*, 2300–2700 m, 31 vii 1982, *Assadi & Mozaffarian* 40796 (TARI!); *ibid.*, 2300 m, 20–26 vi 1948, *Rechinger & Rechinger* 5888 (W!); Shahrud, Kuh-e Abr, Kuh-e Ghatri, 2500 m, 23 vi 1974, *Wendelbo & Foroughi* 12940 (TARI!); 30 km N Mehmandust, 2700–3000 m, 22 vi 1975, *Moussavi & Karavar* 33591-E (W!); Tazareh village, 2500–3000 m, 24 vii 2001, *Assadi & Ranjbar* 82189 (TARI!); Kiasar to Semnan, 1400–1500 m, 30 v 1975, *Rechinger* 52392 (W!); *ibid.*, 2200–2400 m, 20 vi 1975, *Moussavi & Karavar* 33596-E (W!); *ibid.*, 2300 m, 11 vii 1959, *Wendelbo* 1357 (W!); *ibid.*, 2400–2700 m, 29 vii 1982, *Assadi & Mozaffarian* 40720 (TARI!); *ibid.*, 2000–2150 m, 9 viii 1978, *Termeh, Mossavi & Tehrani* 39431 (W!). **Tehran:** Semnan to Firuzkuh, 2000–2600 m, 24 v 1994, *Safavi* 80610 (TARI!); Rineh to Damavand, 2410 m, 8 viii 1971, *Panahi* 2534 (TARI!); *ibid.*, 1850–1950 m, 15 v 1978, *Mozaffarian* 32264 & 32329 (TARI!); *ibid.*, 2350–2400 m, 25 vii 2007, *Mohebbi* 90774 (TARI!); *ibid.*, 6–26 iii 1946, *Ganjalizadeh* 4007 (TUH!); Shemshak, 2000 m, 19 vi 1972, *Dini & Azarm* 16169 (TARI!); *ibid.*, 2200 m, 2 viii 1972, *Babakhanlou, Amin & Bazargan* 16170 (TARI!); *ibid.*, 1930 m, 12 vi 1973, *Babakhanlou & Amin* 16175 (TARI!); Fesham to Zayegan, 2200 m, 30 v 1990, *Zarre* 69598 (TARI!); Fasham road, 5 viii 1990, *Bafandeh* 12049 (T!); Chitgar, National Botanical Garden, 1320 m, vi 1983, *Ghahreman & Aghustin* 7233 (TUH!); *ibid.*, 10 v 1988, *Gauba* 3727 (KAR!). **Alborz:** Karaj to Chalus, 1750 m, 18 vi 1973, *Babakhanlou & Amin* 16173 (TARI!); *ibid.*, 2080 m, 5 vi 1973, *Babakhanlou & Amin* 16174 (TARI!); *ibid.*, 1560 m, 3 vi 1973, *Babakhanlou & Amin* 16176 (TARI!); *ibid.*, 1800 m, 22 vii 1967, *Babakhanlou* 24097 (TARI!); *ibid.*, 1900–2350 m, 3 vii 1985, *Assadi & Jamzad* 55227 (TARI!); *ibid.*, 2100 m, 1 vi 1991, *Assadi & Shahsavari* 69634 (TARI!); *ibid.*, 1800 m, 25 vi 1974, *Amin & Bazargan* 19279 (TARI!); *ibid.*, 2010 m, *Assadi* 76675 (TARI!); *ibid.*, 1200–1500 m, 16 v 1956, *Schmid* 5703 (W!); *ibid.*, 1700 m, 26 v 1937, *Rechinger* 523 (W!); *ibid.*, 2000–2200 m, *Bornmüller* 6621 & 6622 (P!); Karaj, Kuh-e Dasht, 1600 m, 7 vi 1937, *Rechinger* 765 (W!). **Qazvin:** Qazvin to Alamut, 2000 m, 25 vii 1970, *Babakhanlou* 16172 (TARI!); *ibid.*, 1990 m, 26 vii 1970, *Foroughi* 763 (TARI!); *ibid.*, 1240 m, 6 v 1973, *Babakhanlou & Amin* 16177 (TARI!); *ibid.*, 1460 m, *Foroughi* 657 (TARI!).

2b. *Colutea* sect. *Rostrata* subsect. *Gifana* Pooyan, F.Ghahrem. & Assadi, **subsect. nov.**

Rami corticibus fibrosis demum grisei vel cremei, opaci. Foliola rotundata, elliptica vel late obovata, supra et subtus glabra. Inflorescentia foliis suffultis quam 1.5-plo longiora, 2–5-flora. Flores c.20 mm longi; alae carinam aequantes, geniculatae. Dentes calycis tubum aequantes. Legumen magnum. – Type species: *Colutea gifana* Parsa

Shoots after peeling grey or cream, opaque. Leaflets glabrous on both sides. Inflorescence at least 1.5 times longer than supporting leaves, with 2–5 flowers. Flowers large, c.20 mm long; wings equal to keel, geniculate. Calyx teeth equal to tube. Fruit large.

2b(i). *Colutea gifana* Parsa, Kew Bull. 1: 21 (1947). – Type: Iran, Khorassan, Gifan, Parsa 238 (K n.v.). **Figs 1, 3.**

Colutea gifana has previously been included in *Colutea* sect. *Rostrata* subsect. *Centralasiaticae* (Browicz 1963a, 1984). However, *Colutea gifana*'s two-year-old shoots are not red or red-brown and lustrous but rather grey or cream and opaque. Also, in *Colutea gifana*, the leaves are mostly alternate and the wings are mostly equal in length to the keel, unlike most other species of *Colutea* subsect. *Centralasiaticae*. With its large flowers and its tomentose ovary it also doesn't have the characters of *Colutea* subsect. *Orientalis*. Therefore, we place it in its own subsection, *Colutea* subsect. *Gifana*.

Distribution. Endemic to Iran.

Specimens studied. **North Khorassan:** Bojnurd, near Ghezelghan, 947 m, 29 iv 2008, *Memariani & Zengooei* 39615 (FUMH!); *ibid.*, 1004–1010 m, 21 v 2011, *Pooyan* 13211, 13212, 13213 & 13214 (FAR!).

2c. *Colutea* sect. *Rostrata* subsect. *Uniflora* Pooyan, F.Ghahrem. & Assadi, **subsect. nov.**

Rami corticibus fibrosis demum rubro-fusci, nitentes. Foliola rotundata, lanceolata vel oblonga, comparate crassa, supra et subtus pubescentia. Inflorescentia foliis suffultis breviora, uniflora. Flores c.15 mm longi; alae carina breviores vel aequantes, falcatae. Dentes calycis tubo 2–3-plo breviora. Legumen parvum.
– Type species: *Colutea uniflora* G.Beck

Shoots after peeling red-brown, lustrous. Leaflets in comparison to others thick, pubescent on both sides. Inflorescence shorter than supporting leaves, 1-flowered. Flowers small, c.15 mm long; wings shorter than or equal to keel, falcate. Calyx teeth 2 or 3 times shorter than tube. Fruit small.

2c(i). *Colutea uniflora* G.Beck ex Stapf, Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 51: 332 (1886). – Type: Iran, Qazvin, *Pichler* s.n. (W!). **Figs 1, 3.**

Although *Colutea uniflora* has been called a weakly spinescent shrub and been placed in *Colutea* sect. *Armata* (along with the other spinescent shrubs) (Browicz, 1963a, 1984), based on our herbarium and field investigations it should rather be categorised as an unarmed species. The remains of the previous year's branches in this taxon resemble those in species of other sections, but not the taxa of *Colutea* sect. *Armata*. In other characters, mostly its beaked keel, falcate wings and c.15 mm long flowers, it can be placed in *Colutea* sect. *Rostrata*. Moreover, as *Colutea uniflora* has c.15 mm long flowers, tomentose ovaries and mainly elliptic leaflets, it doesn't have the characters

of *Colutea* subsect. *Orientalis*, *C.* subsect. *Centralasiaticae*, or *C.* subsect. *Gifana*. A new subsection is established to accommodate it.

Distribution. Endemic to Iran.

Specimens studied. **Gilan:** Rudbar, Manjil, 10 v 1935, *Gaub* 3728 (KAR!); Qazvin to Lowshan, the old road, 3 v 1882, *Pichler* s.n. (W!); *ibid.*, c.1200 m, 13 v 1902, *Bornmüller* 6623 (P!, W!); *ibid.*, *Gaub* 601 & 602 (W!); *ibid.*, 570–600 m, 6 v 2011, *Pooyan* 12037, 13201, 13202, 13203, 13204, 13205 & 13206 (FAR!); *ibid.*, 26 iv 2012, *Pooyan* 14153, 14501, 14502, 14503, 14504 & 14505 (FAR!).

3. *Colutea* sect. *Armata* Browicz, *Monogr. Bot.* 14: 22, 111 (1963). – Type species: *Colutea armata* Hems. & Lace

Spinescent shrubs. Leaves with 1–4 pairs of leaflets; leaflets small, pubescent on both sides. Inflorescence with 1–2 flowers. Flowers shorter than 15 mm long; keel ending with a beak at the apex. Fruit broad obovate to spindle-shaped, short pointed.

3(i). *Colutea komarovii* Takht., *Zametki Sist. Geogr. Rast.* 9: 22 (1940). – Type: Republic of Nakhichevan, Circa Ordubad, Sagal Mountain, *Schelkownikov & Kara-Murza* (TBI n.v.). **Figs 1, 4.**

Colutea komarovii was first recorded for Iran by Ghahremaninejad & Ghahremani (2008). Although it can be difficult to distinguish from *Colutea porphyrogramma* the leaves and flowers in *C. porphyrogramma* are generally smaller than in *C. komarovii*.

Distribution. Iran and S Caucasia.

Specimens studied. **East Azarbaijan:** 51 km from Jolfa to Duzal, margin of Aras river, 850 m, 13 vi 2002, *Ghahremani & Imani* 7815 (T!); *ibid.*, 22 vi 2009, *Pooyan* 12041 (FAR!); Jolfa to Norduz, after Siahrood, 560–800 m, 26 v 2010, *Pooyan* 12031, 12032, 12033, 12034, 12035 & 12036 (FAR!); *ibid.*, 7 v 2011, *Pooyan* 13207, 13208, 13209 & 13210 (FAR!).

3(ii). *Colutea porphyrogramma* Rech.f., *Anz. Österr. Akad. Wiss., Math.-Naturwiss. Kl.* 101: 400 (1964). – Type: Iran, Gorgan, Maraveh Tappeh, *Sharif* 2568-E (W!). **Figs 1, 4.**

Distribution. Endemic to Iran.

Specimens studied. **Golestan:** Kordkuy to Hajiabad, 1800–2000 m, 21 v 1986, *Maassoumi* 55058 (TARI!); *ibid.*, 1700 m, *Maassoumi* 55066 (TARI!); Azadshahr, 9 v 1958, *without collector* 14682-E (W!); Maraveh Tappeh to Ghazanghayeh, 300 m, 22 iv 1986, *Assadi & Maassoumi* 55511 (TARI!); Golestan National Park, 900–1000 m, 5 v 1975, *Rechinger* 52791 (W!). **North Khorassan:** Golestan National Park, 1270 m, 29 v 1972, *Foroughi* 6102 (TARI!); *ibid.*, 920–1000 m, 21 v 1976, *Termeh et al.* 34820-E (W!); *ibid.*, 1500 m, 30 v 1972, *Foroughi* 6101 (TARI!); *ibid.*, 1500 m, 3 v 1998, *Hojjat & Zangoeei* 31150 (FUMH!); *ibid.*, 1250–1300 m, 21 vi 1974, *Wendelbo & Foroughi* 12823 (TARI!); *ibid.*, 19 v 1950, *Sharif* 2568-E (W!); *ibid.*, 950 m, 17 iv 2001, *Joharchi & Zangoeei* 33244 (FUMH!); *ibid.*, 1400 m, 30 v 1984, *Joharchi & Zangoeei* 11403 (FUMH!); *ibid.*, 1000 m, 17 iv 2000, *Joharchi & Zangoeei* 32651 (FUMH!); *ibid.*, 1300 m, 15 v 1988,



FIG. 4. *Colutea* sect. *Armata*. A. *Colutea komarovii*, Jolfa to Norduz, East Azarbaijan; B. *Colutea porphyrogramma*, Golestan National Park, North Khorassan.

Joharchi & Zangooei 16637 (FUMH!); *ibid.*, 1500 m, vi 1984, *Ghahreman & Aghustin* 7229 (TUH!); *ibid.*, 16 iv 2011, *Pooyan* 12039, 12040 & 12042 (FAR!); *ibid.*, 1350 m, *Rechinger* 32554 (W!); *ibid.*, 1200 m, 7 v 1975, *Rechinger* 53001 (W!); *ibid.*, 1100 m, 18 v 1975, *Rechinger* 53739 (W!); Bojnurd to Gifan, Qezelqan, 30 iv 2011, *Pooyan* 12043 (FAR!); *ibid.*, 2010 m, 21 v 2011, *Pooyan* 13215 (FAR!); Bojnurd to Shirvan, 1150 m, 12 v 1992, *Faghihnia & Zangooei* 21742 (FUMH!); *ibid.*, 1450 m, 13 v 1990, *Rashed* 18480 (FUMH!); *ibid.*, 110 m, 30 v 1984, *Assadi & Maassoumi* 50877 (TARI!). **Semnan**: c.35 km N Damghan, Tuyeh, 1850 m, 16 v 1978, *Wendelbo & Assadi* 29485 (TARI!); *ibid.*, 1900–2250 m, 7 v 1977, *Rechinger* 56419 (W!).

4. *Colutea* sect. *Oreophysa* Bunge ex Boiss., Fl. Orient. 2: 196 (Dec 1872 or Jan 1873).
– Type species: *Colutea triphylla* Bunge ex Boiss.

Suffrutescent herbs, unarmed. Leaves with 3 leaflets. Inflorescence 1-flowered. Flowers 10–12 mm long; wings obovate-oblong, keel rounded at the apex.

4(i). *Colutea triphylla* Bunge ex Boiss., Fl. Orient. 2: 196 (Dec 1872 or Jan 1873).
– *Sphaerophysa microphylla* Jaub. & Spach, Ill. Pl. Orient. 1: 126 (1843).
– *Oreophysa triphylla* (Bunge ex Boiss.) Bornm., Bull. Herb. Boiss. sér. 2, 5: 652 (1905), nom. illeg. – *Oreophysa microphylla* (Jaub. & Spach) Browicz, Kew Bull. 16: 493–495 (1963). – Type: Iran, from mountains near Tehran, *Aucher-Eloy* s.n. (P n.v.). **Figs 1, 5.**

A recent molecular taxonomic study has shown that *Oreophysa microphylla*, the name used in *Flora Iranica* (Browicz, 1984), belongs in *Colutea* under the name *C. triphylla* (Kazempour Osaloo *et al.*, 2006). Three specimens have been investigated here, and in reproductive features, as well as in molecular sequence data, this taxon belongs to *Colutea*. Yet unlike other members of *Colutea* the taxon has a suffruticose growth, subdichotomous branches of the shoots, considerable elongation of the internodes, reduced foliage with trifoliolate leaves, and broad wings (Browicz, 1963b). Furthermore, the shoots are in the shape of curved twigs and are not woody.

Distribution. Endemic to Iran. Type from the S slopes of Elburz Mountain.

Specimens studied. **Tehran:** Fasham, Shemshak, 1900 m, 27 vi 1972, *Amin & Mousavi* 16904 (TARI!); Tehran, Darband, 1850 m, 15 vi 1998, *Mazooji* 022932 (T!); *ibid.*, 1800 m, 24 vi 1972, *Mousavi & Amin* 16806 (TARI!); *ibid.*, 1900 m, 24 vi 1972, *Mousavi & Amin* 2381 (TARI!);



FIG. 5. *Colutea* sect. *Oreophysa*. *Colutea triphylla*, NW Karaj, Alborz.

Lashgarak, Zardband, 1900 m, 16 vi 1972, *Dini & Arazm* 16797 (TARI!); Shemiran, 1700 m, *Pabot* 5004 (TARI!); Darakeh, 1850 m, 2 vii 1972, *Amin & Bazargan* 16796 (TARI!); Farahabad, 2200 m, 3 vii 1972, *Bazargan & Amin* 16805 (TARI!); Souleghan, 24 vi 1986, *Jamzad* 57071 (TARI!). **Alborz:** Kalak, 1600 m, 20 vii 1971, *Mousavi* 23506 (TARI!); *ibid.*, 1500 m, 27 vii 1971, *Mousavi* 16800 (TARI!); *ibid.*, 1830 m, 2 vi 1973, *Babakhanlou & Amin* 23519 (TARI!); *ibid.*, 1900 m, 3 vi 1972, *Foroughi* 16804 (TARI!); Karaj, Vasiyeh, 18 vi 1934, *Esfandiari* 3908 (KAR!); Karaj, Kuh-e Karaj, 3 vi 1933, *Esfandiari* 3905 (KAR!); Ali Abad, 18 viii 1933, *Gaub* 3907 (KAR!); Kuh-e Dasht, 1500–2000 m, 19 vii 1979, *Assadi & Mozaffarian* 33325 (TARI!); *ibid.*, 1900 m, 16 vii 1990, *Jamzad & Akhyani* 68149 (TARI!); *ibid.*, 1850 m, 16 vii 1972, *Riazi* 6345 (TARI!); *ibid.*, 1850 m, 20 v 1974, *Dini* 8910 (TARI!); Chalus road, 13 vi 1934, *Esfandiari* 3904 & 3906 (KAR!); *ibid.*, 1700 m, 18 vi 1973, *Babakhanlou & Amin* 16802 (TARI!); *ibid.*, 1400 m, 6 vi 1971, *Foroughi* 1676 (TARI!); *ibid.*, 1500 m, 3 vi 1974, *Foroughi, Sanii & Amini* 12312 (TARI!); *ibid.*, 1600 m, 23 v 1974, *Wendelbo & Shirdeh* 11618 (TARI!); 20 km NW Karaj, 1550 m, 13 vi 1973, *Babakhanlou & Amin* 16801 (TARI!); Baraghan, 1760 m, 2 vi 1972, *Forughian & Hariri* 16421 (TARI!); *ibid.*, *Pooyan* 13219, 13220, 14151 & 14152 (FAR!); Quchak, 1750 m, 25 vii 1972, *Babakhanlou, Amin & Bazargan* 16799 (TARI!).

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