



Morphological Characterization and Conservation Status for the Herbarium Specimens of Orchidaceae in Kurdistan Iraq

Saman A. Ahmad^{1,2}

¹Department of Biotechnology and Crop Science,
College of Agricultural Engineering Sciences, University
of Sulaimani, Kirkuk Road, Sulaimani, Kurdistan Iraq.

²Kurdistan Botanical Foundation (KBF), American
University of Iraq, Sulaimani (AUIS), Kurdistan Iraq.

saman.ahmad@univsul.edu.iq

Rubar H. M. Salih

Department of Biotechnology and Crop
Science, College of Agricultural
Engineering Sciences, University of
Sulaimani, Kirkuk Road, Sulaimani,
Kurdistan Iraq.

rubar.salih@univsul.edu.iq

Sakar Y. Hama

Department of Biotechnology and Crop Science,
College of Agricultural Engineering Sciences,
University of Sulaimani, Kirkuk Road, Sulaimani,
Kurdistan Iraq.

sakar.rahim@univsul.edu.iq

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Abstract

This study was conducted on Orchidaceae, it is a second largest family in flowering plants, comes after Asteraceae, and approximately has 25,000–30,000 species in 750–800 genera in the world. This study included 10 genera, *Anacamptis* (five species), *Androrchis* (two species), *Cephalanthera* (one species), *Dactylorhiza* (three species), *Epipactis* (two species), *Himantoglossum* (two species), *Limodorum* (one species), *Neotinea* (one species), *Ophrys* (seven species), and *Orchis* (four species). The name abbreviation of authors of plant names follows the International Plant Name Index (IPNI) (<https://www.ipni.org/>). Images of type collections of most species were checked on virtual herbaria (<https://herbarium.univie.ac.at/database/search.php>) and JSTOR Global Plants (<https://plants.jstor.org/>). The taxonomic status, geographical distribution, and the conservation status for all taxa were provided.

Keywords: Orchidaceae, Taxonomy, conservation status, Kurdistan, Iraq.

1. Introduction

Orchidaceae is considered the second largest family after Asteraceae which includes five subfamilies (Apostasioideae, Vanilloideae, Cyripedioideae, Orchidoideae, Epidendroideae) and

approximately 25,000–30,000 species in 750–800 genera [1, 2], many members of Orchidaceae economically very important such as *orchis*, *ophrys*, *Phalaenopsis*, *Dendrobium*, and *Vanilla*. In the last century, efforts have been taken by Townsend and Guest during 1966-1985 [3], to record and publish them, and at that time Orchidaceae are represented by 9 genera and 22 species. Then after, several floristic studies of Kurdistan Iraq have been conducted, of them, Faris [4] studied the vascular plants of Piramagrun mountain, recorded five genera and seven species of Orchidaceae; then, Fatah [5] studied the vascular plants of Haibat Sultan mountain and recorded two genera and four species of Orchidaceae; and the wild plants of Hawraman mountain were studied in details by Ahmad [6], recorded five genera and 10 species of Orchidaceae; moreover, the study of Azmar-Goizha mountain [7], recorded two genera with two species of Orchidaceae; also, the comprehensive floristic study carried out on the Qaradagh mountain [8] was based on three-year field work (2015–2018), in that six genera and 14 species were recorded for Orchidaceae; in addition of the floristic study carried out on the Qaiwan Mountain [9] recorded five genera and six species of Orchidaceae; and lastly, the vascular plants of Gmo mountain was studied in details [10], in that six genera and nine species were recorded of Orchidaceae and for the first time to the mountain.

The Orchidaceae species are well represented in Kurdistan region according to the flora of Iraq, all are teristerial, due to its Mediterranean and Eurasiatic biogeographical affinities [3, 11, 12]. In the field guide work of European and Middle-East orchids conducted by Baumann *et al.* [13] 13 species of Orchidaceae were recorded as endemic to Kurdistan region-Iraq. Forthermore, during the field survey for the first time on orchids in Duhok governorate of Kurdistan region-Iraq [11], 10 orchids taxa were recorded including one species (*Ophrys cilicica*) new for flora of Iraq and Amedi district, and the status of other founded species were discussed regarding the flora of Iraq. In addition, Govaerts *et al.* [14] recorded 27 orchids species for flora of Iraq in the word most recent check list, finally, [15] added two new species which are *Anacamptis papilionacea* and *Dactylorhiza romana* for the first time in Amedi district.

The present study add the new locations for the different taxa and expansion the distribution range of most of the species in kurditan Iraq, in addition to add the detail information about habitat, occurrence, and conservation status. This study was very urgent to conduct because of the rapid loss of natural habitats and disturbance in this region, including industrial and oil development, overgrazing, reforestation of mountain slopes and foothills by nonnative trees, conversion of vast areas to vineyards and fruit orchards, fire, increasing recreation throughout the year, urbanization in some parts of the mountains throughtout the region. Furthermore, the global warming and climate change specially the fluctuation of the precipitation rate become a strong threat. These continued threats would undoubtedly endanger the biodiversity and the landscape of the region [8].

This study mainly based on the survey was conducted by the first auther in the last 15 years in the Kurdistan region in different locations such as Qaradagh, Qaiwan mountain, Azmer-Goizha mountain, Halgurd-Sakran mountain, Hawraman mountain, Amide district, beside the historical date from the different resourses. Furthermore, Intensive study of the plants in the field, libraries, and herbaria. All images and profiles in this paper have been taken by the first author.

2. Materials and Methods

Material originated from herbarium specimens preserved in both Sulaimani university, College of Agricultural Engineering Sciences (SUFA) and Kurdistan Botanical Foundation (KBF) herbaria, from the several field trips made since 2006–2021.

The process of identification and writing descriptions depended on the examination of all specimens and checking various floras, such as flora of Iraq [3], Flora Iranica [16] and Flora of Turkey [17]. Furthermore, illustration photos or published papers were used to prove the identification, such as Kreutz and Colak [18] and Baumann *et al.* [13], Kreutz and Colak [19], and Youssef *et al.* [15].

Name, abbreviation of authors, and plant names follows the International Plant Name Index (IPNI) (<https://www.ipni.org/>). Taxa placements follow Mabberley [20] and the Angiosperm Phylogeny Website (<http://www.mobot.org/MOBOT/research/APweb>). Images of type collections of most species were checked on virtual herbaria (<https://herbarium.univie.ac.at/database/search.php>) and JSTOR Global Plants (<https://plants.jstor.org/>). Distribution of the species outside of Kurdistan Iraq is given primarily for Southwest Asia. Key characters of species in boldface are the most important distinguishing features.

The geographical distribution were mapped by geographic information system application of QGIS (<https://qgis.org>) using the coordinates (Altitude, Longitude, Latitude) recorded during the field works. The key characters of the family highlighted with bold font.

3. Results and Discussions

The field survey, generic and infraspecific identification, environment and geographical distribution, conservation status, and description for new genera and species and the key characters for the subspecies and variety are provided. This study shows that the Orchidaceae represent by 10 genera in Kurdistan Iraq which are *Anacamptis* (five species), *Androrchis* (two species), *Cephalanthera* (one species), *Dactylorhiza* (three species), *Epipactis* (two species), *Himantoglossum* (two species), *Limodorum* (one species), *Neotinea* (one species), *Ophrys* (seven species), and *Orchis* (four species).

Orchidaceae J. J. Wood.

Kurdish name: khezani gia salma, Saeelaba

Herbs perennial, terrestrial, with **rhizomes or tubers or rootstocks with mycorrhizal fungi in roots, roots filiform. Stem leafy.** Leaves simple, 1 to many. Inflorescences racemes, few to many flowered. Flowers bisexual, **zygomorphic**, hermaphrodite; tepals 6, arranged in 2 whorls, differentiated, **one petal much larger and differentiated (labellum)**; stamens united with style to form rostellum; pollen in 2 sacs (pollinia) each with a stalk attached to gland; ovary **inferior**. Fruit capsule, dehiscing by 1–6 longitudinal sutures. Seeds are vnumeros, usually very small.

1- *Anacamptis* Rich.

Entymology: *Anacamptis* (from the Greek *Anakamptein*, to bend back), alluding wither to the reflexed tips of the floral bracts or to the reflexed pollinia.

Herbs perennial. Rootstock tuberous. Stem leafy, glabrous Leaves rosulate and cauline, unspotted. Inflorescence dense, bracts membranous. Flowers purple or light pink. Perianth segments concave, the dorsal sepal and petal connivent to form a helmet, the lateral sepals spreading, glabrous, Labellum spurred, 6–9 mm long, deeply 3-lobed, flat, glabrous, with 2 longitudinal calli at the

base, spur filiform 12–15 mm long, Column short, Stigmas 2, clearly separated by and lying on either side of the anther on the column.

Distribution: Kurdistan Iraq, Iran, Asia, Europe, N. Africa.

1- *Anacamptis collina* (Banks & Sol, ex Russell) R.M.Bateman, Pridgeon & M.W.Chase. (Figure 2.3)

Herbs perennial. Tubers ovate-oblong. Stems up to 30 cm tall, often red or purplish above. Leaves 2–6, mostly rosulate or 2–3 spreading on stem, dark green, sometime spotted brown, ovate or ovate-lanceolate. Inflorescences 4–15-flowered, oblong or cylindrical, 5–15 cm long. Flowers purple-violet, brownish or greenish purple to dull olive-green; sepals oblong to ovate, obtuse, 0.9–1.2 cm × 3–4 mm, margins irregularly undulate; dorsal sepal ca. 10 mm long, oblique lanceolate, ca. 1.2 cm long, petals oblanceolate, narrowly ligulate or narrowly ovate; labellum ovate, ovate-oblong, obovate or orbicular, entire; ovary oblong, 5–10 mm long.

Habitat: Oak woodlands, foothill side, among grassland, clay and sandy soil; elevation 835–1562 m.

Flowering : March – April

Occurrence: occasional. (Supp. Fig. 1-A)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Cyprus, Mediterranean Europe, C. Asia, Algeria, Libya.

Conservation issues: The most critical threats on this species are the expansion of Agriculture lands, and reforestation of slopes by nonnative trees, conversion of vast areas to vineyards and fruit orchards, most likely this species will be disappear in near future.

Collections: QaraDagh Mt. near Jafaran Village, Saman A. Ahmad, et al. 15-674 (KBF); QaraDagh Mt. on the road to Naramsin, S. A. Ahmad et al. 16-127 (KBF); QaraDagh Mt., S. A. Ahmad et al. 16-279 (KBF); QaraDagh Mt., S. A. Ahmad et al. 16-539 (KBF); QarDagh Mt., S. A. Ahmad et al. 16-797 (KBF); QaraDagh Mt., S. A. Ahmad et al. 16-996 (KBF); Qaiwan Mt., S. A. Ahmad et al. 19-144 (KBF); Zewe, S. A. Ahmad et al. 2007-1623 (KBF).

2- *Anacamptis coriophora* (L.) R.M.Bateman, Pridgeon & M.W.Chase.

Common name (Eng.): Bug Orchid

Herbs perennial. Tubers subglobose or ellipsoid, shortly stipitate. Stems robust, up to 60 cm tall, often red or purplish above. Leaves 4–10, mostly rosulate or 2–3 spreading on stem, dark green, sometime spotted brown, linear or lanceolate, occasionally oblong. Inflorescences many-flowered, oblong or cylindrical, 5–15 cm long. Flowers dark purple, brownish-purple, reddish-purple; sepals ovate-elliptic to oblong, free at apex, obtuse, 0.9–1.2 cm × 3–4 mm, margins irregularly undulate; dorsal sepal ca. 10 mm long, lateral sepals whitish centrally with dark green mid-vein, oblique lanceolate, ca. 1.2 cm long, petals linear-lanceolate; labellum ovate, ovate-oblong, entire, 5–10 mm long.

Habitat: mountainsides, oak woodlands, grassy wetlands, eroded rocky place; elevation 950–1543 m.

Flowering : May–June.

Occurrence: frequent. (Supp. Fig. 1-A)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Cyprus, Mediterranean Europe, N africa.

Conservation issues: This species highly impact by loss the ecological condition of the wetlands in the forest zone.

Collections: QaraDagh Mt., S. A. Ahmad et al. 16-310 (KBF).

- subsp. *coriophora*

Helmet acute, Labellum 6–8 mm long, the midlobe only a little longer than the lateral lobes, Flowers foetid.

-subsp. *fragrans* (Pollini) K.Richt.

Helmet acute, labellum 6–11 mm long, the midlobe distinctly longer than the lateral lobes. only a little longer than the lateral lobes of flowers foetid.

Habitat: wetlands and grassy places, open hillsides, clay soil; elevation 600–1450 m,

Flowering : May–June.

Occurrence: occasional. (Supp. Fig. 1-B)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Cyprus, central and Mediterranean Europe (Portugal, Spain and France to the Balkans, S. W. Russia), Armenia, Azerbaijan, Georgia,, N. Africa.

Collections: Zhala, S. A. Ahmad et al. 5/2010; Qaradagh S. A. Ahmad et al. 1399–2012.

3- *Anacamptis laxiflora* (Lam.) R.M.Bateman, Pridgeon & M.W.Chase.

Herbs perennial. Tubers subglobose or ellipsoid, subsessile or shortly stipitate. Stems robust, up to 80 cm tall, often red or purplish above. Leaves 4–8, mostly cauline, linear to lanceolate, somewhat conduplicate, sheathing at the base, acute, erect to slightly spreading, unspotted. Inflorescences 8–20-flowered, oblong or cylindrical, 5–25 cm long, bracts 1.5–2.5 cm long, narrowly elliptic. Flowers redish purple, to violet with a pure white central area usually extending from the base to the apex of the; sepals ovate-elliptic to oblong, free at apex, obtuse, 0.9–1.2 cm × 3–4 mm, margins irregularly undulate; dorsal sepal ca. 10 mm long, lateral sepals dark purple vein, oblique lanceolate, ca. 1.2 cm long, petals linear-lanceolate; labellum ovate-oblong, entire, 5–12 mm long.

Habitat: mountain side, moist steppe zone, wetlands, among grasses, streamsides, sandy soil; elevation 800–1600 m.

Flowering : April – June.

Occurrence: occasional.

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and foothills, beside the reforestation of mountain slopes and foothills by non-native trees.

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Channel Islands, Netherlands, France, Portugal, Spain, Switzerland, Italy, former Yugoslavia, Albania, Greece, Cyprus, S. Russia, N. Africa.

- subsp. *dielsiana* (Lam.) R.M.Bateman.

Stem 60–80 cm tall, leaves 8, mostly basal, , linear to lanceolate. Labellum is slightly trilobed: the centre of the lip is white into the base without mottled and much shorter than the side lobes; Spur approximately is half as long as ovary.

Habitat: upper forest zone, wetlands, streamsides, sandy-clay soil; elevation 1200–1700 m.

Flowering : April–May.

Occurrence: rare

Distribution: Kurdistan Iraq, Iran, Turkey.

4- *Anacamptis papilionacea* (L.) R.M.Bateman, Pridgeon & M.W.Chase. (Figure 1.1)

Herbs perennial. Tubers subglobose, subsessile or shortly stipitate. Stems erect, up to 35 cm tall, often red or purplish basal part. Leaves 6, rosulate, linear to linear-lanceolate, lowermost leaves often recurved. Inflorescences many-flowered, cylindrical, ca. 10 cm., dense; bracts 2–3 cm long. purple, linear-lanceolate, acute, membranous, with 3 main parallel yellow-green nerves. Flowers white, pink with red spots; Sepals concave, acuminate; with helmet shape at the apex; dorsal sepal ovate-lanceolate, ca. 12 mm long, lateral sepals sepals dark purple vein, oblique lanceolate, ca. 1.2 cm long, petals linear-lanceolate; Labellum spurred, spatula-shaped, crenate, ca. 9 mm long; with 2 prominent, dark purple, narrow, erect calli at the base, extending from the mouth of the spur toward the center of the labellum and acting as guide-plates for insects.

Habitat: mountainside, wetlands, clay soil; elevation 1000–1600 m.

Flowering : April–July

Occurrence: occasional. (Supp. Fig. 1-B).

Distribution: Kurdistan Iraq, Iran, Turkey.

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and foothills.

Collection: Rania, S. A. Ahmad et al. alt., 1334 m. , 15/5/2010 (SUFA).

- **subsp. *schirwanica* (Woronow) H.Kretzschmar.**

Distribution: Kurdistan Iraq, Europe, Asia, and NAfrica.

Habitat: open oak woodlands, among grasses; elevation 800–1250 m.

Flowering : April–May.

Occurrence:

Distribution: Kurdistan Iraq, Iran, Turkey.

5- *Anacamptis pyramidalis* (L.) Rich.

Common name (Eng.): Pyramidal orchid

Herbs perennial. Tubers ovoid or subglobose, subsessile or shortly stipitate. Stems erect, up to 75 cm tall, often red or purplish basal part. Leaves 3–6, rosulate, linear to linear-lanceolate, elliptic, lowermost leaves often recurved. Inflorescences many-flowered, cylindrical, ca. 12 cm long, dense; bracts 2–3 cm long. purplish-pink, linear-lanceolate, acute, membranous, with 3 main parallel yellow-green nerves. Flowers pale pink to dark reddish-pink, rarely bright blood-red or white; Sepals concave, acute, 6–8 mm long; dorsal sepal oblong-ovate to ovate-elliptic, loosely connivent with the petals; Lateral sepals obliquely narrowly elliptic to oblong-ovate; Labellum broad, ca. 10 mm long, flat. than long flabellate-cuneate, 3-lobed, 6–9 x 8–12 mm. flat.

Habitat: foothills, oak woodlands, wetlands, ; elevation 500–800 m.

Flowering : April–May

Occurrence: very rare. (Supp. Fig. 1-B)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Cyprus, Palestine central and Mediterranean Europe (S. Scandinavia and Britain to Greece, Aegean Island, W. Russia and Crimea), Armenia, Azerbaijan, Georgia, N. Africa.

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and moist steep zone. The occurrence of the species is very rare and phytogeographical range of the distribution in Kurdistan region is very limit and it might be disappear in the near future.

- **subsp. *pyramidalis*** (L.)Rich.

This subspecies is recorded by Youssef (*et al.* 2019) in Kurdistan region.

Flowers pale pink to dark reddish-pink, rarely bright blood-red or white. Flowers very long, spur thin. Labellum three elongated lobes.

Habitat: forest zone, wetlands, shady places streamsides ; elevation 500–850 m.

Flowering : April–May.

Occurrence: rare.

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Cyprus, Palestine central and Mediterranean Europe (S. Scandinavia and Britain to Greece, Aegean Island, W. Russia and Crimea), Armenia, Azerbaijan, Georgia, N. Africa.

2- *Androrchis* D.Tyteca & E.Klein.

Notes on the genus: Tyteca and Klein [21, 22] proposed splitting genus *Orchis* into two genera, *Orchis*, which incorporated all species with a so-called "anthropomorphic" lip, i.e., the *O. militaris* group, and *Androrchis* Tyteca and Klein. with all the remaining "non-anthropomorphic" species, i.e., the *O. mascula* group. However this results from Tyteca and Klein [21, 22] is not accepted by neither IPNI nor Govaerts [23] and the Angiosperm check list [24], but there are other accepted synonyme of "*Orchis mascula* subsp. *mascula*" treated under the genus *Androrchis*, i.e., *Androrchis pinetorum* (Boiss, and Kotschy) D.Tyteca & E.Klein. *Androrchis tenera* (Landwehr) D.Tyteca and E.Klein. In addition, there is one species "*Orchis anatolica*" which is treated under the genus *Orchis* is now moved to the genus *Androrchis* and became "*Androrchis anatolica*" conferred by the IPNI.

Herbs perennial. Rootstock tuberous, tubers 2 or 3, globose, ovoid or ellipsoid, entire, sessile or stipitate, Stem erect, up to 50 cm tall. Leaves basal, rosulate, spotted or unspotted, oblong, oblong-linear, acute to obtuse. Inflorescence cylindrical to broadly cylindrical, sparsely to densely flowered. Flowers in various shades of red, purple, pink or yellow, rarely greenish yellow, reddish brown or white; dorsal sepal usually erect, free, green, pale green, violet; lateral sepals spreading, erect or connivent with dorsal sepal and petals to form a hood, all glabrous; petals entire, free, usually porrect, linear, lanceolate, narrowly lanceolate; labellum pale yellow, or sometimes white, large, triangular, cuneate, convex at the base, expanded into 3–4 linear-filiform lobed.

1- *Androrchis anatolica* (Boiss.) D.Tyteca & E.Klein. (Figure 1.2)

Herbs perennial. Tubers subglobose or ovoid, sessile or shortly stipitate. Stems up to 40 cm tall, dark pink to purplish red. Leaves 3–5, rosulate, narrowly elliptic or oblong to obovate. Inflorescences 8–14-flowered; bracts dark pink to purplish red, greenish white in albino forms. Flowers pink to purple; sepals pale green to violet, oblong-ovate or narrowly elliptic; petals oblong

to obliquely ovate, Spurs 13 mm long, cylindrical, petals pale green, linear to narrowly lanceolate, 1 veined, pale green, 12–16 x 2–3mm; labellum 6 mm long, pale pink to purple occasionally white, with a white central area spotted and flecked with purplish red, obovate or suborbicular in outline, 3-lobed; spur pale pink to purple, linear-cylindrical, ca. 2 cm long; ovary cylindrical, 0.8–1.4 cm long.

Habitat: grasslands, among open oak woodlands, sandy soil, elevation 860–1480 m.

Flowering: April–May.

Occurrence: occasional. (Supp. Fig. 2-A)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Greece, and Cyprus.

Conservation issues: This species is highly impacted by human use, and overgrazing especially in the areas close to villages.

Collection: QaraDagh mountain, S. A. Ahmad et al., 15-961 (KBF).

2- *Androrchis spitzelii* (Saut, ex W.D.J.Koch) D.Tyteca & E.Klein.

Herbs perennial. Tubers ovoid, sessile or shortly stipitate. Stems up to 40 cm tall, dark pink to purplish red. Leaves 3–5, rosulate, oblong-ovate to ovate- or oblong-lanceolate. Inflorescences dense, 8–14-flowered; bracts dark pink to purplish red, linear-lanceolate or lanceolate. Flowers pink to purple; sepals pale green to violet, oblong-ovate to narrowly elliptic; petals oblong to obliquely ovate, Spur 13 mm long, cylindrical, petals pale green, linear to narrowly lanceolate, pale green, 10–13 x 2–3 mm; labellum 8 mm long, broadly ovate, purple occasionally white, with a white central area spotted and flecked with purplish red, obovate or suborbicular in outline, 3-lobed; spur pale pink to purple, linear-cylindrical, longer than labellum

Habitat: above timberline, thorn-cushion zone, open dwarf shrublands rocky soil; elevation 1750–2300 m.

Flowering: April– May.

Occurrence: rare.

Distribution: Kurdistan Iraq, Iran Turkey.

Conservation issues: This species is highly impacted by human use. It is considered an endangered species due to the increasing ethnobotanical activities by local collectors.

- **subsp. *latiflora*** (B.Baumann & H.Baumann) W.Foelsche & Jakely

Inflorescence lax, many-flowered, flowers pink-purple; Labellum large, 3-lobed, broadly obovate 13–16 mm long, 3-lobed Spur short, slightly curved and oriented downward.

3- *Cephalanthera* L. C. Rich.

Herbs perennial. Rootstock rhizomatous, rhizome short, creeping, horizontal or perpendicular. Leaves cauline, flat to plicate, unspotted. Inflorescence usually few-flowered, lax or rather dense; bracts leafy towards base of the inflorescence. Flowers medium to large, showy; sepals subequal, ± connivent, concealing the labellum, glabrous or puberulous. petals slightly shorter than the sepals. Labellum spurred (in Kurdistan Iraq) or unspurred, bipartite; column long, slender, erect, rostellum absent, stigma rounded, slightly concave, Viscidia absent, Bursicles absent. Pollinia crescent-shaped. Ovary sessile or subsessile, not twisted.

Distribution: Europe, N. Africa and W, Asia, extending eastwards via the Himalayas to China, Indo-China and Japan, with one saprophytic species native to the N.W, United States: only 1 species occur in Iraq.

1- *Cephalanthera kurdica* Bornm. ex Kraenzl. (Figure 2.1)

Herbs perennial. Stems 10–70 cm tall, erect, somewhat flexuose. Rhizomes short, up to 5 cm long. Leaves 3–5, elliptic or ovate-elliptic, 3.5–5 × 1.6–2 cm., amplexicaul. Inflorescence few to many-flowered, often dense, sometimes elongated and lax. Flowers bright pink, rarely white; sepals lanceolate or oblong-lanceolate, 1.8–2.2 cm × 6–7 mm glabrous, slightly spreading; outer sepal cucullate, lateral sepals slightly oblique; petals lanceolate or lanceolate-oblong, oblong or narrowly-oblong, apex obtuse and rounded, 1.4–1.6 cm × 6–7 mm; ., Labellum divided into a pale rose-pink hypochile and a whitish epichile, 13–156 mm long; ovary sessile, narrowly fusiform-cylindric, slightly twisted, glabrous or with minute scattered hairs.

Habitat: mountain side, oak woodlands, sandy-clay soil; elevation 910–1750 m

Flowering : April–June.

Occurrence: frequent. (Supp. Fig. 1-C)

Distribution: Endemic to Kurdistan.

Conservation issues: This species is significantly impacted by the rapid loss of the ecological condition mixed forest zone.

Collections: Azmer Mt. Khamza, S. A. Ahmad et al. 15-770 (KBF); Azmer Mt., S. A. Ahmad et al. 15-924 (KBF); QaraDagh Mt. Sagrma, S. A. Ahmad et al. 15-1450 (KBF); QaraDagh. Smaila, S. A. Ahmad et al. 15-960 (KBF); QaraDagh Mt., S. A. Ahmad et al. 15-1879 (KBF); QaraDagh Mt. near Jafaran Village, S. A. Ahmad et al. 15-675 (KBF); QaraDagh Mt. Near dara zardaka, S. A. Ahmad et al. 15-1305 (KBF); QaraDagh Mt. Sagrma, S. A. Ahmad et al. 16-1688 (KBF); QaraDagh Mt. above waziara picnic area, S. A. Ahmad et al. 16-1711 (KBF); QaraDagh Mt., S. A. Ahmad et al. 16-1901 (KBF); QaraDagh Mt. Darbandy Astel, S. A. Ahmad et al. 16-2471 (KBF); QaraDagh Mt. near Hamay Hawas village, S. A. Ahmad et al. 17-192 (KBF); Qaiwan Mt. Kollard village, S. A. Ahmad et al. 17-392 (KBF); Qaiwan Mt. the mountain above Kollard village, S. A. Ahmad et al. 17-544 (KBF); Qaiwan Mt., S. A. Ahmad et al. 19-364 (KBF). *Cephalanthera kurdica*, Sharbazher area, alt., 1287, 10/5/02010, SUFA; Sharbazher area / bnawela, alt., 955, 2010, SUFA; Qaradagh/ Jafaran, alt., 987, 26/4/2005, SUFA.

4- *Dactylorhiza* Neck. ex Nevski.

Herbs perennial. Rootstock tuberous, 2 or 3, Ovoid, oblong-cylindrical or cylindrical to napiform. Stem erect or flexuose, fistular or solid, glabrous. Leaves basal, rosulate and or cauline. Inflorescence many-flowered, bracts leafy, rather fleshy; sepals glabrous; dorsal sepal and petals often connivent, forming a helmet; lateral sepals free, spreading or deflexed, very rarely connivent; labellum entire or 3-lobed, spurred, the surface either flat, convex, undulate or deflexed, without calli at the base, glabrous or papillose, correct to deflexed, Column short, anther-connective absent, Viscidia 2, placed in a simple bursicle,

This genus represented by ca. 40 species, mainly distributed in Europe, the Mediterranean and Asia (extending to Japan), with two species in N. America; two species in Kurdistan Iraq.

1. *Dactylorhiza iberica* (M.Bieb. ex Willd.) Soó.

Herbs perennial. Tubers 2–3-fid, cylindrical to napiform, sessile,. Stems up to 65 cm tall, thin, weakly ridged, fistular, with several membranous sheaths below, bearing subterranean stolons at the base, just above the tubers. Leaves 3–6, rosulate, cauline, linear or narrowly lanceolate. Inflorescences few-many-flowered; bracts dark pink to purplish red, greenish white in albino

forms. Flowers pink to purple; sepals oblong ovate, ovate-elliptic, narrowly elliptic; petals oblong to obliquely ovate; labellum spotted and flecked with dark purple, obovate or suborbicular in outline, 3-lobed; spur pale pink to purple, spur narrowly cylindrical, slender, ± acute, shorter than the ovary; ovary cylindrical, slightly curved, twisted, glabrous.

Habitat: above timberline, subalpine, wet places among shrublands, rocky-clay soil; elevation 1700–2600 m.

Flowering: June–July.

Occurrence: very rare.

Conservation issues: This species significantly impact by ecological condition, human use, and overgrazing in late season in high mountain. Ggeographical range of the species is very restrict and it might be desapear in very near future.

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Greece, and Cyprus, Armenia, Azerbaijan, Georgia.

2. *Dactylorhiza umbrosa* (Kar. & Kir.) Nevski.

Herbs perennial. Tubers 2–5-fid, elongated, napiform, sessile. Stems up to 80 cm tall, thin, weakly ridged, fistular, with several membranous sheaths below, bearing subterranean stolons at the base, just above the tubers. Leaves 4–9, rosulate, lanceolate, narrowly elliptic or oblong-ligulate. Inflorescences few-many-flowered; bracts bracts green or purple-red, leafy, narrowly lanceolate or oblong-lanceolate. Flowers purple-lilac, pale purple, very rarely white; sepals oblong ovate, ovate-elliptic, narrowly elliptic; Petals ovate or lanceolate; Labellum with dark purple spots and irregularly broken loops and lines, 3-lobed; spur pale pink to purple, narrowly cylindrical; ovary cylindrical, slightly curved, twisted, glabrous.

Habitat: wetlands, streamsides, near springs, grassy places, rocky soil; elevation 1000–2550 m.

Flowering: May – June.

Occurrence: occasional.

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Greece, and Cyprus, C. Asia, Armenia, Azerbaijan, Georgia.

Conservation issues: This species significantly impact by ecological condition, human use.

- var. *umbrosa* (Kar. & Kir.) Nevski. (Figure 2.2).

Bracts purple-red, leafy, oblong-lanceolate, acuminate, exceeding the flower, not noticeably elongated, the lowermost 2.5–3 cm long.

Habitt: high oak woodlands, wetlands, streamsides; elevation 1000–2200 m.

Flowering: May–June

Occurrence: occasional. (Supp. Fig. 1-D)

Distribution: Throughout the range of the specie.

Collection: Zawita, S. A. Ahmad et al. 2010, alt., 934, SUFA.

3- *Dactylorhiza romana* (Sebast.) Soó.

Herbs perennial. Tubers 2–3-fid, elongated, napiform, sessile. Stems up to 40 cm tall. Leaves 2–3, rosulate, lanceolate, narrowly elliptic or oblong-ligulate. Inflorescences many-flowered; bracts herbaceous, exceeding the violet-purple, dull red or yellow, whitish, leafy, narrowly lanceolate or

oblong-lanceolate. Flowers purple-lilac, pale purple, very rarely white; sepals oblong; Petals obliquely ovate; Labellum with dark purple spots and irregularly broken loops and lines, 3-lobed; spur pale pink to purple, 10–25 mm long.

Habitat: high oak forest, subalpine zone, wetlands among dense dwarf shrublands, elevation 1650–2500 m.

Flowering: April–June

Occurrence: occasional.

Distribution: Kurdistan Iraq, Iran, Turkey, Armenia, Azerbaijan, Georgia, C Asia.

Conservation issues: This species is significantly impacted by the ecological condition, human use, and overgrazing in the late season in high mountains.

- **subsp. *georgica*** (Klinge) Soó ex Renz & Taubenheim.

Flowers yellow colour; sepals not connivent; labellum usually longer than broad, to 8 mm broad, shortly 3-lobed towards the apex. Spur narrowly cylindrical.

Habitat: Coniferous forest, forest margins, Quercus scrub, alpine meadows.

Flowering: May–June.

Occurrence: frequent.

Distribution: Kurdistan Iraq, Iran, Turkey, Armenia, Azerbaijan, Georgia, C Asia.

5- *Epipactis* Zinn.

Etymology: *Epipactis*, a name used by *Theophrastus* for a plant of uncertain identity possibly a hellebore-which was used by the Greeks to curdle milk.

Herbs perennial. Rootstock rhizomatous, rhizome short, thickened, creeping, horizontal or vertical. Stem erect, robust or slender. Leaves flat to plicate, unspotted. Inflorescence often secund, few-many-flowered, lax to dense; bracts leafy. Flowers spreading or pendent, often partially or totally autogamous; sepals and petals spreading or connivent, arranged into a campanulate perianth. Petals slightly shorter than the sepals; labellum not spurred, ; ovary pedicellate, clavate, glabrous or minutely papillose, slightly twisted. *Epipactis* has ca. 30 species in Europe, eastwards through temperate Asia to Japan, southwards to tropical Africa (Ethiopia), one species native to N. America, and represented by 2 species in Kurdistan Iraq.

Epipactis, a name used by Theophrastus for a plant of uncertain identity, possibly a hellebore-which was used by the Greeks to curdle milk.

Two sections:

Section 1: *Epipactis*, Flowers small to medium-sized, Hypochile semiglobose, concave, Epichile not hinged, connected to the hypochile by means of a rigid fold, Column short, fleshy, [*E. helleborine* (L.) Crantz.].

Section 2: *Cymbochilium* Schltr, Flowers relatively large, Hypochile narrowly cymbiform, Epichile ovate-lanceolate, Column slightly elongate.

Epipactis veratrifolia subsp. *veratrifolia* was discovered by Youssef *et al.* [12] and current study, new morphological, geographical, and collections added for this species and its subspecies to the flora of Kurdistan.

1. *Epipactis helleborine* (L.) Crantz.

Herbs perennial. Stems to 1 m tall, straight or slightly flexuose. Rhizomes short, 2–4 mm in diam. Leaves 8–20, ovate-elliptic to ovate-lanceolate or linear-lanceolate, 5–8 × 1–3 cm. Inflorescences

many-flowered, erect or slightly curved, lax or rather dense, to 20 cm long; bracts leafy, ovate to narrowly elliptic or lanceolate. Flowers 1–1.5 cm in diam, becoming pendulous with age; green or olive-green, sometimes with brownish nerves, ovate-elliptic; petals pale green, suffused rose-violet, ovate or oblong, 0.8–1.2 cm × 4–6 mm, acute; ovary narrowly cylindrical, indistinctly pedicellate. Ripe capsule accrescent, distinctly pedicellate, pendulous.

Habitat: oak woodlands, by streams, riverian woodlands; elevation 900–1400 m.

Flowering: June –August

Occurrence: very rare.

Distribution: Kurdistan Iraq, Iran, Turkey, Cyprus, Syria, Lebanon, Palestine, Egypt, Yemen, Oman, Armenia, Azerbaijan, Georgia, Pakistan, Afghanistan, Himalaya, Europe (including Scandinavia and in the Crimea), C. Asia, N. Africa (Morocco, Algeria). Introduced into N. America.

Conservation issues: This species significantly impact by ecological condition and specially the level of the river and stream.

2. *Epipactis veratrifolia* Boiss. & Hohen. (Figure 1.3)

Herbs perennial. Stems to 1.5 m tall, robust. Rhizomes short, 2–4 mm in diam. Leaves 8–20, ovate-elliptic to ovate-lanceolate or linear-lanceolate, 10–25 × 1–6 cm. Inflorescences few-many-flowered, erect or slightly curved, lax or rather dense, to 30 cm long; bracts leafy, ovate to narrowly elliptic or lanceolate. Flowers 2–4 cm in diam., becoming pendulous with age; sepals green, buff or yellow, with broad reddish brown or dark purple areas; petals pale green with reddish brown or dark purple marginal bands, broadly ovate to ovate-elliptic, 0.8–1.8 cm × 4–8 mm, acute; ovary narrowly cylindrical, indistinctly pedicellate. Ripe capsule accrescent, distinctly pedicellate, pendulous.

Habitat: valley sides, by streams, dense riverian woodlands, in rocky cliffs by waterfall. ; elevation 800–1750 m.

Flowering: June-August.

Occurrence: frequent. (Supp. Fig. 1-F)

Distribution: : Kurdistan Iraq, Iran, Turkey, Cyprus, Syria, Lebanon, Palestine, Egypt, Yemen, Oman, Armenia, Azerbaijan, Georgia, Pakistan, Afghanistan, Himalaya, and tropical Africa (Ethiopia, Somalia).

Conservation issues: This species significantly impact by ecological condition specially the level of river and stream.

- **subsp. *veratrifolia*** Boiss.& Hohen.

Inflorescence lax to dense, flower large 20–40 mm diam., becoming pendulous with age; labellum large; hypochile narrowly boat shaped white, up to 10 mm long, epichile ovate-lanceolate reddish-brown with a purple band and a white apex.

Habitat: valley sides, by streams, dense riverian woodlands, in rocky cliffs by waterfall.; elevation 800–1600 m.

Flowering: May – July.

Distribution: Kurdistan Iraq, Iran, Turkey.

Collections: QaraDagh Mt. Qopi Astel, S. A. Ahmad et al. 15-2079 (KBF); QaraDagh Mt., S. A. Ahmad et al. 15-2940 (KBF); QaraDagh Mt. Darbandy Astel, S. A. Ahmad et al. 16-2448 (KBF); QaraDagh Mt. the qopi above Jafaran village, S. A. Ahmad et al. 16-3905 (KBF); QaraDagh Mt.,

S. A. Ahmad et al. 16-3963 (KBF); QaraDagh Mt. Hamay Hawas Village, S. A. Ahmad et al. 17-241 (KBF). Barzan area, S. A. Ahmad alt., 995, 1/6/2011, SUFA.

6- *Himatoglossum* W. D. J. Koch.

Herbsa perennial. Rootstock tuberous, tubers 2, large, ovoid to subglobose. Stem erect, robust, leafy, glabrous, Leaves often large, oblong-ligulate. Inflorescence many-flowered, dense or lax; bracts membranous, equaling or shorter than the helmet. Flowers large, greenish; sepals and petals connivent to form a helmet. Labellum spurred, 3-lobed, much longer than the helmet; spur short, conical, saccate,

A small genus of about 4 species, distributed in W.C. & S. Europe, N. Africa, eastward in Asia to Turkey, Armenia, Azerbaijan, Georgia and Iran.

1. *Himantoglossum hircinum* (Boiss.) Schltr.

Herbs perennial. Tubers ovoid, oblong or spherical, sessile. Stems up to 1 m tall. Leaves 4–7, the lowermost oblong-elliptic or obovate, 5–25 cm long; uppermost bract-like, acute, amplexicaul. Inflorescence many-flowered, lax to very dense; bracts longer than the ovary. Flowers large; sepals subglobose or ovoid helmet, ovate, ovate-oblong or elliptic; petals pale green or green, linear to linear-lanceolate, acute, slightly shorter than sepals; labellum 3-lobed, coiled and spring-like in bud, mid-lobe ribbon-like, spirally twisted or almost flat

Habitat: mountain sides, open oak woodlands, sandy soil; elevation 900–1220 m.

Flowering: April– June.

Occurrence: frequent. (Supp. Fig. 1-E)

Distribution: W. C. & S. Europe and the Middle East, North Africa (Morocco and Alger).

Collections: QaraDagh Mt. Sagrama, S. A. Ahmad et al. 16-2882 (KBF); Qaiwan Mt. the mountain above Kollard village, S. A. Ahmad et al. 17-543 (KBF); Qaiwan Mt. Kollard village, S. A. Ahmad et al. 17-391 (KBF).

Conservation issues: This species highly impact by habitat loss and overcollecting the tubers and sell as a powder in the local bazaar.

- subsp. *hircinum*

Labellum 3-lobed, coiled and spring-like in bud, a middle lobe brownish green, more or less spirally twisted, ribbon-like, spirally twisted or almost flat, ca. 6 cm long, shortly bifid into 2 acute apical unequal in length lobules; lateral lobes often falcate, undulate, acute, 7.5–8 mm long; spur conical, saccate, acute, decurved, 5 mm., long

Collection: Qaradagh, S. A. Ahmad alt., 1201, 1/5/2011, SUFA; *H. hircinum* subsp. *hircinum*, Hawraman, S. A. Ahmad alt., 1595, SUFA; Shoke-nawshakhan, S. A. Ahmad alt., 1167, 5/5/2010, SUFA. (Supp. Fig. 1-E)

- subsp. *affine* (Boiss.) Sunderm.

Labellum 3-lobed, ca. 8 cm long.; mid-lobe green or dull brownish-green, often suffused dingy brownish-violet, white or whitish with fine pale purple flecks at the base, narrowly ligulate, shortly bifurcate, 2–5 x 0.1–0.2 cm., slightly twisted; lateral lobes dull green, suffused pale violet, short, obliquely-triangular to falcate; spur olive-green, conical, saccate, apex acute and slightly curved, 3.5–5 mm.

Habitat: in the mountains, on limestone, among oak forest or scrub.

Distribution: S. E. Europe (Greece), Syria, Lebanon, Palestine, W. & S. Turkey, S.W. Iran.

var. *affine* (Boiss.) J. J. Wood. (Figure 3.1c,d)

Labellum 3-lobed; mid-lobe green or dull brownish-green, often suffused dingy brownish-violet, white or whitish with fine pale purple flecks at the base, narrowly ligulate, shortly bifurcate, ca. 4 cm long, slightly widen toward the apex, apex rolled to, the apical lobules acute or obtuse, 6 mm long, disc with 2 tiny calli at the mouth of the spur; lateral lobes dull green, suffused pale violet, short, obliquely-triangular to falcate, acute, 6 x 1.5 mm., outer margin undulate.

Habitat: mountain sides, among oak woodlands, grassy places, sandy soil; elevation 900-1500 m.

Occurrence: Frequent. (Supp. Fig. 1-E)

Flowering: May–June.

Distribution: Throughout the range of the species. (Supp. Fig. 1)

- **var. *pseudocaprinum*** J.J.Wood. (Figure 3.1e)

Labellum 3-lobed, ca. 5 cm long; mid-lobe green or dull brownish-green, often suffused dingy brownish-violet, white or whitish with fine pale purple flecks at the base, narrowly ligulate, ca. 5 mm long, twisted, bifurcate; lateral lobes dull green, suffused pale violet, short, obliquely-triangular to falcate, ca. 1 mm long.

Habitat: Shady places under oak trees, clay soil; elevation 800–1200 m.

Flowering: April

Occurrence: rare (Supp. Fig. 1-E)

Distribution: Endemic to Kurdistan Iraq.

2- *Himantoglossum comperianum* (Steven) P.Delforge. (Figure 3.2)

Herbs perennial. Tubers ovoid, oblong or spherical, sessile. Stems up to 80 m tall. Leaves 3–5, oblong-ligulate or oblong-elliptic, uppermost narrowly elliptic, acute to subacute, amplexicaul. Inflorescence many-flowered, lax to very dense; bracts longer than the ovary. Flowers large; sepals olive-green, often suffused brownish purple or rose; Petals pale green, linear-ligulate or narrowly lanceolate, broadest at middle, acuminate; Labellum pale pink or white, triangular-cuneate, convex at base. Column ca. 5 mm long. Anthers brownish purple, acute.

Habitat: mountain sides, dense coppiced oak woodlands, under oak trees, rocky places; elevation 1200–1300 m.

Flowering : May–June.

Occurrence: frequent. (Supp. Fig. 1-E)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Armenia, Azerbaijan, Georgia.

Conservation issues: This species highly impact by habitat loss and overcollecting the tubers and sell as a powder in the local bazaar.

Collections: Azmer Mt., S. A. Ahmad et al. 15-997 (KBF); Azmer Mt., S. A. Ahmad et al. 15-923 (KBF); Azmer Mt., S. A. Ahmad et al. 15-1055 (KBF).

7- *Limodorum* Boehm.

Herbs perennial. Saprophytes with very little or no chlorophyll. Roots rhizomltous, rhizome short and thick. Stem erect, clothed with violet scale-like sheaths, green leaves absent. Peduncle glabrous. Inflorescence an erect, spike-like raceme. Flower purple, dark pink dark blue violet to violet-purple; perianth segments free; dorsal sepal erect or curving forward, convex; lateral sepals

spreading, ±flat, Petals spreading; labellum spurred, entire or obscurely bilobed at the apex, horizontal or deflexed, margin unoulate, ecallose, glabrous.

Distribution: Two species distributed in central and southern Europe, S.W, Asia, N. Africa and represented in Kurdistan Iraq by one specie.

***Limodorum abortivum* (L.) Sw.**

Herbs perennial. Rhizome short, stout, up to 1 cm. Stem violet, to violet-red or bluish-green, erect, robust, thick, rigid, bearing numerous violet to violet-red or bluish-violet, ovate, obtuse sheaths. Leaves absent. Inflorescence raceme, 22 cm long, lax to dense; bracts bluish-green, usually flushed violet, 3 cm long Flowers dark blue, dark pink, violet to violet-purple; sepals pale to dark violet, flushed greyish-violet on the exterior, erect or slightly spreading; dorsal sepal ovate to obovate, obtuse, 2 mm long; sparsely papillose on the dorsal surface, curved forwards, forming a hood over the column; lateral sepals obliquely ovate to broadly elliptic, subacuminate, 2 cm long; petals pale violet distally, whitish proximally, narrowly lanceolate, acuminate, 1.6 x 0.4 cm, glabrous, spreading, labellum violet, fading to dingy-yellow with age, 2 mm long; column 13 mm long, erect, slender.

Habitat: high forest zone, timberline among grasses; elevation 1000–2100 m.

Flowering : June-July

Occurrence: very rare (Supp. Fig. 1-F)

Distribution: Kurdistan Iraq, Iran, Turkey, Lebanon, Palestine, Jordan, Armenia, Azerbaijan, Georgia, Mediterranean Europe (Portugal and Spain to Switzerland, Italy, Yugoslavia, Albania, Greece and Crimea), N. Africa (Morocco, Algeria),

Conservation issues: This species highly impact by habitat loss and digridation of the forest.

- var. *abortivum*

Inflorescence violet to violet-purple large flowers; sepals pale to dark violet while petals are pale violet towards the tip; labellum is entire and dark violet, distinctly constricted between the hypochile (pale violet) and epichile has dark violet longitudinally arranged lines and slightly undulated margins; spur pale violet.

Habitat: Mountainside, oak woodlands, sandy soil; elevation 1280–1900 m.

Collection: QaraDagh Mt. Qopi Smaila, S. A. Ahmad et al. 16–4159 (KBF). Sakran, S. A. Ahmad alt., 1275, 15/5/2011, SUFA.

8- *Neotinea* Rchb.f.

1. *Neotinea tridentata* (Scop.) R.M.Bateman.

Herbs perennial. Tubers ovate-oblong, ovate or subglobose. Stems 15–40 cm tall, often red or purplish above. Leaves 2–8, mostly rosulate, oblong-ligulate or narrowly elliptic, rarely oblong-ovate. Inflorescences many-flowered, oblong or cylindrical; bracts green or suffused rose, lanceolate. Flowers pale rose-violet; sepals oblong-lanceolate, the lateral oblique, acute to acuminate, 7–12 mm long; petals obliquely ligulate or narrowly lanceolate, 6–9 mm long, 1-veined; labellum deeply 3-lobed, cuneate at the base, 6–12 mm long.

Habitat: mountain side, shrublands, , shady meadows and grassy, rocky soil places; elevation 800–1400 m.

Flowering : April-May.

Occurrence: rare. (Supp. Fig. 2-A)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Armenia, Azerbaijan, Georgia, C & S Europe (from Belgium and France to the Danube region and Greece), N. Africa (Morocco to Tunisia).

Conservation issues: This species highly impact by habitat loss and overcollecting the tubers and sell as a powder in the local bazaar.

- *subsp. tridentate*

Inflorescence up to 10 cm long; flowers pale rose ; sepals and petals coherent or connivent, forming a loose helmet with sepals divergent at the top; labellum (7 to 10 mm long) deeply 3-lobed that are devoid of hair white, pale rose or pale reddish-violet, spotted purple, mid-lobe cuneate.

Habitat: mountain side, oak woodlands, grasslands, rocky soil, elevation 1000–1450

Flowering : April

Occurrence: rare (Supp. Fig. 2-A)

Distribution: Kurdistan Iraq, S. Europe to Caucasus (Armenia, Azerbaijan, Georgia),.

- *var. tridentata*

Plant often quite robust, Inflorescence dense, Sepals acute, mostly 6–8 mm long. Labellum mostly 6–9 mm long; lobules of mid-lobe often entire at the apex,

Occurrence: rare (Supp. Fig. 2-A)

Distribution: Kurdistan Iraq, , C. & S. Europe to Armenia, Azerbaijan, Georgia, N. Africa..

***var. commutata* (Tod.) Rchb.f.**

Plant often slender, Inflorescence lax. Flowers rose-violet; sepals acuminate, mostly 8-10mm long; labellum mostly 8–10 mm long; lobules of mid-lobe often denticulate at the apex.

Habitat: Mountain forest, oak woodlands, , sandy soil; elevation 1074–1299 m.

Distribution: Kurdistan Iraq, S. & central Europe. (Supp. Fig. 2)

Collections: QaraDagh Mt. Darband Waziara, S. A. Ahmad et al. 15-353 (KBF); QaraDagh Mt., S. A. Ahmad et al. 16-244 (KBF).

9- *Ophrys* L.

Herbs perennial. Rootstock tuberous, tubers 2–3, globose or ovoid, sessile or stipitate. Stem glabrous Leaves basal, rosulate and/or cauline, unspotted Perianth segments free, ± spreading, the 3 outer sepals larger, usually glabrous, the 2 inner petals smaller, often hirsute, Labellum without a spur, entire or 3-lobed, glabrous or velutinous, often strongly convex; column having a minute rostellum with the position of the staminodes often indicated by coloured points

Some 30 species distributed throughout Europe, W. Asia and N. Africa and Mediterranean region . Represented by seven species in Kurdistan Iraq.

1- *Ophrys bornmuelleri* M.Schulze ex Bornm. (Figure 1.4).

Herbs perennial. Stems 15–40 cm tall. Tubers 2, sessile or stipitate. Leaves 3 or 4, grouped at base, narrowly elliptic to narrowly obovate, 6–12 × 1.3–3 cm. Inflorescences 2–15-flowered; bracts ovate-elliptic, usually longer than ovary. Flowers pale yellow or pale pink; sepals pale green or whitish green, sometimes flushed with pink, ovate oblong or ovate-elliptic, obtuse; petals

triangularovate, 1–2 mm long, pubescent; mid lobe of lip slightly convex or somewhat flattened, broadly ovate to suborbicular, 7–12 mm long; lateral protuberances of lip prominent, to 3 mm long; speculum reduced to a short-branched H-shaped or to 2 spots only; anther connective very short; labellum brown to purplish-brown, becoming paler towards the margin, broadly ovate, suborbicular, quadrate or trapeziform-flabellate and emarginate in outline, 7–12 mm long.

Habitat: mountain side, oak woodland, grasslands, , sandy soil; elevation 750-1300 m.

Flowering : April–May.

Occurrence: very rare. (Supp. Fig. 2-C)

Distribution: Cyprus, Syria, Lebanon, Palestine and southern Turkey.

Collection: Zakho-Kani Mase, S. A. Ahmad alt., 780, 18/5/2010, SUFA.

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and foothills. This species grows in very restricted riverine woodlands, it might be disappear due to climatic change.

- **subsp. *carduchorum*** Renz & Taubenheim.

Sepals pale green, sometimes flushed with pink at the base, ovate-elliptic, obtuse, glabrous; dorsal sepal 6–12 x 4.5–5 mm at the base, curving forward; lateral sepals 9 x 4–5 mm., with 3-nerved, reflexed or spreading. Petals small, elongated triangular, 2 x 0.8–1 mm., yellowish-green to pale pink, the edges somewhat villous, triangular-lanceolate, acute, 1-nerved, pubescent, lower part of margin villose. Labellum brown to purplish-brown becoming pale yellow toward the margin, convex or rather rounded.

Habitat: Mountain cliffs, Foothills, rocky place; elevation 992–1650 m.

Flowering : May.

Occurrence: very rare (Supp. Fig. 2-C)

Distribution: Zagrosian endemic

Collection: QaraDagh Mt. Takia Mt., S. A. Ahmad et al. 16-580 (KBF); QaraDagh Mt. Top of the mountain above Waziara, S. A. Ahmad et al. 16-1770 (KBF); QaraDagh Mt., S. A. Ahmad et al. 16-796 (KBF); QaraDagh Mt. Sagrma Mt., S. A. Ahmad et al. 16-1516 (KBF); Qaiwan Mt. Kollard village, S. A. Ahmad et al. 17-390 (KBF).

2- *Ophrys cilicica* Schltr.

Herbs perennial. Stems 15–40 cm tall. Tubers 2, sessile or stipitate. Leaves 3–5, grouped at base, narrowly elliptic to narrowly obovate, 6–12 x 1.3–3 cm. Inflorescences lax, or dense, 2–12-flowered; bracts ovate-elliptic, usually longer than ovary. Flowers pink; sepals pale green or whitish green, sometimes flushed with pink, ovate-oblong or ovate-elliptic, obtuse; petals triangularovate, 1–2 mm long, pubescent; mid lobe of lip slightly convex or somewhat flattened, broadly ovate to suborbicular, 7–12 mm long; lateral protuberances of lip prominent, to 3 mm long; speculum reduced to a short-branched H-shaped or to 2 spots only; anther connective very short; Labellum deeply 3-lobed, narrowed towards the base, spiculate at apex, without distinct appendix.

Habitat: open oak woodlands, grasslands, riverine woodlands, sand or rocky soil; elevation 800–1100

Flowering : April – May.

Occurrence: rare

Distribution: Kurdistan Iraq, Iran, Turkey.

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and foothills. This species grows in very restricted riverine woodlands, it might be disappear due to climatic change.

3- *Ophrys mammosa* Desf.

Herbs perennial. Stems up to 70 cm tall. Tubers 2 or 3. Leaves 3–5, grouped at base, narrowly elliptic to obovate, 6–12 × 1.3–3 cm. Inflorescences lax, or dense, 6–18-flowered; bracts narrowly ovate-elliptic, usually longer than ovary. Flowers brownish-red; sepals pale green or whitish green, sometimes flushed with pink, ovate-oblong or ovate-elliptic, obtuse; petals triangular-ovate, 1–2 mm long, pubescent; mid lobe of lip slightly convex or somewhat flattened, broadly ovate to suborbicular, 7–12 mm long; lateral protuberances of lip prominent, to 3 mm long; speculum reduced to a short-branched H-shaped or to 2 spots only; anther connective very short; Labellum deeply 3-lobed, narrowed towards the base, spiculate at apex, without distinct appendix.

Habitat: stream sides, shady wet places, , sandy soil; elevation 700–1350 m.

Occurrence: frequent.

Distribution: Kurdistan Iraq, Iran, Cyprus, Greece, Armenia, Azerbaijan, Georgia, E mediterranean.

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and foothills.

- subsp. *mouterdeana* B.Baumann & H.Baumann.

Dorsal sepal greenish, lateral ones half green up, half purplish down. Petals ribbon-like, glabrous or subglabrous, greenish, suffused brownish-rose. Labellum slightly 3-lobed, narrowed towards the base, spiculate at apex, without strong appendix; partially convex, brown to purplish-brown velvety.

Habitat: mountain sides, among oak woodlands, grasslands, , sandy soil; elevation 750–1350.

Flowering : Mar. – May.

Occurrence: rare.

Distribution: Kurdistan Iraq, Iran, Cyprus, Greece, Armenia, Azerbaijan, Georgia, E mediterranean.

4- *Ophrys reinholdii* Spruner ex Boiss.

Herbs perennial. Stems up to 60 cm tall. Tubers 2. Leaves 2–6, grouped at base, narrowly elliptic, oblong or oblanceolate, 8–12 × 1–3 cm. Inflorescences lax, or dense, 3–10-flowered, lax; bracts narrowly elliptic, usually longer than ovary. Flowers brownish-red; Sepals roseviolet, greenish-rose or greenish-white with a green mid-vein, oblong or ovate-oblong; Petals triangular, pale to dark violet-rose, rarely dull olive-green, 5–7 mm long, pubescent; mid lobe of lip slightly convex or somewhat flattened, broadly ovate to suborbicular, 7–12 mm long; lateral protuberances of lip prominent, to 3 mm long; speculum reduced to a short-branched H-shaped or to 2 spots only; Labellum 3-lobed, 12–15 mm., slightly convex; mid-lobe dark brown or blackish-purple, with a paler brown or yellowish-green margin, subrotund or transversely elliptic.

Habitat: dry oak woodlands, rocky and sandy soil; elevation 1650–2100 m.

Distribution: Kurdistan Iraq, Iran, Turkey, Syria.

- **subsp. *reinholdi***

Speculum reduced, usually consisting of two separate spots or commas arising from the sinus between the mid and lateral lobes of the labellum.

- **subsp. *straussii*** (H.Fleischm.) E.Nelson

Sepals often rose, sometimes whitish or greenish-rose with a dark green midnerve, spreading to reflexed; petals ligulate, pink brownish to dark violet-rose; speculum snowy-white, consisting of two spots or parallel lines sometimes joined at base.

Habitat: mountainside, oak woodlands, shady places; sandy soil; elevation 900–1200 m.

Occurrence: very rare.

Distributions: Kurdistan Iraq, Iran, Turkey.

5- *Ophrys schulzei* Bornm.&Fleischm.

Herbs perennial. Stems up to 55 cm tall. Tubers 2. Leaves 5–6, lowermost leaves obovate, upper narrowly elliptic or oblanceolate, 8–14 × 2–4 cm. Inflorescences lax, or dense, many-flowered, lax; bracts narrowly elliptic, usually longer than ovary. Flowers very small for the genus, spreading; sepals bright violet-rose with a green mid-vein, 10 x 4 mm., slightly concave, reflexed; dorsal sepal oblong, obtuse; lateral sepals obliquely oblong-ovate, slightly acute; petals rose-violet, minutes, elongated-triangular, obtuse, 2.5 x 1.8 mm., villous towards the base, otherwise minutely papillose, Labellum distinctly 3-lobed, 11 x 7 mm; mid-lobe dark brown, oval, or round in outline, strongly convex, margin and apex revolute.

Habitat: foothills, dense oak woodlands, wet grassy places; elevation 600–1400m.

Flowering : April–May.

Occurrence: frequent. (Supp. Fig. 2-C)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria.

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and foothills.

Collection: Amedi, S. A. Ahmad *et al.*, 995, 16/4/2011, SUFA; S. A. Ahmad *et al.*, 1087, 15/4/2011, SUFA.

6- *Ophrys sphegodes* Mill.

Herbs perennial. Tubers 2, oblong or ovoid, shortly stipitate or sessile. Stems 20–80 cm tall, erect or slightly flexuous. Leaves 3–6, mostly grouped at base, narrowly to broadly elliptic, sometimes narrowly obovate. Inflorescences 2–12-flowered, lax; bracts ovate-elliptic, obtuse. Sepals yellowish to dull olivegreen, sometimes variously suffused with dull red or reddish purple, oblong to ovate-oblong or elliptic; petals ligulate or linear-ligulate, 7–11 mm long, subglabrous or minutely pubescent; mid lobe of lip strongly convex, broadly obovate, 1–1.6 cm long; lateral protuberances of lip poorly developed or absent; speculum H- or π -shaped. Anther connective short or rostrate, acute.

Habitat: grasslands, among oak woodlands, sandy soil; elevation 900–1650 m.

Flowering : April–June.

Occurrence: Frequent. (Supp. Fig. 2-B)

Distribution: Kurdistan Iraq, Iran, Turkey, Armenia, Azerbaijan, Georgia, and W, C & S Europe (S England, through C Germany to Greece and Crimea).

Conservation issues: This species highly impact by rapid loss the ecological condition in the forest zone and foothills.

Collections: QaraDagh Mt. near Jafaran Village, S. A. Ahmad et al. 15-653 (KBF), QaraDagh Mt. Sagrama, S. A. Ahmad et al. 16-1517 (KBF), QaraDagh Mt., S. A. Ahmad et al. 16-2318 (KBF), QaraDagh Mt. kella barza village, S. A. Ahmad et al. 17-99 (KBF), QaraDagh Mt. Between Jafaran and QaraDagh town, S. A. Ahmad et al. 15-792 (KBF), QaraDagh Mt. near Dara zardaka, S. A. Ahmad et al. 15-1307 (KBF), QaraDagh Mt. Darbandy Sagrama, S. A. Ahmad et al. 15-813 (KBF), QaraDagh Mt. cliff side above Balkha village, S. A. Ahmad et al. 16-2765 (KBF), QaraDagh Mt., S. A. Ahmad et al. 16-994 (KBF), QaraDagh Mt. Smaila, S. A. Ahmad et al. 15-958 (KBF). Peramagroon, S. A. Ahmad alt., 1470, 11-5-2008, SUFA.

- subsp. *sphogodes* Mill.

Sepals olive green to bright purple, oblong or ovoid, obtuse 8–10 mm x 3–3.5 mm., revolute, glabrous, 4–7 x 2–3 mm, dorsal sepal slightly reflexed, reflexed. Petals yellowish-green, narrowly elliptic, 5-7 x 1–1.5 mm, undulate, pubescent at the upper surface, Labellum maroon with yellowish marginal zone, 7–9 x 3–6mm, ovate sub-entire with small incision on the each sides.

Habitat: the typical subspecies, which occurs almost throughout the range of the species, has not found in Iraq, where the species is represented by:

Flowering : March – May.

Occurrence: frequent.

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Cyprus, Armenia, Azerbaijan, Georgia.

- subsp. *transhyrcana* (Czerniak.) Soó.

Sepals dull olive-green, reddish-purple; dorsal sepal appearing distinctly narrow because of the strongly revolute margin, 10–16 x 4-5 mm, when flattened; lateral sepals 10–17 x 4–7 mm, when flattened; petals narrowly ligulate or linear, acute, 7-11 x 2-3 mm., margins somewhat revolute, rarely flat, ± glabrous or very shortly pubescent, often strongly reflexed. Labellum dark brown, broadly obovate, 10-16 x 13 mm..

Habitat: pine forest, foothills, sandy and rocky soil; elevation 500–1500 m.

Flowering : March – May.

Occurrence: frequent. (Supp. Fig. 2-B)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Cyprus, Armenia, Azerbaijan, Georgia.

7. *Ophrys umbilicata* Desf.

Herbs perennial. Tubers 2, oblong or subglobose, shortly stipitate or sessile. Stems 20–40 cm tall, erect or slightly flexuous. Leaves 3–8, mostly grouped at base, narrowly to broadly elliptic, sometimes narrowly obovate. Inflorescences 4–12-flowered, lax; bracts ovate narrowly elliptic or oblanceolate, acute. Sepals pale to olive-green or greenish-white to pale pink, rarely whitish, ovate-oblong or oblong-obtuse, revolute, glabrous; petals ligulate or linear-ligulate, 7–11 mm long, subglabrous or minutely pubescent; Labellum deeply 3-lobed, ovate, oblong or flabelliform in outline, with or without a distinct sinus, between the mid and lateral lobes.

Habitat: mixed oak woodlands, valley sides, dense grasslands, sandy and rocky soil; elevation 800–1100 m.

Occurrence: occasional. (Supp. Fig. 2-C)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Cyprus, E. Aegean Isles (Samos etc.).

Conservation issues: This species highly impact by rapid loss the ecological condition of the wetlands in the forest zone and foothills.

Collection: QaraDagh Mt. near Naramsin, S. A. Ahmad et al. 15-451 (KBF).

- **subsp. *Carmeli*** (H.Fleischm. & Bornm.) J.J.Wood.

Sepals green: dorsal sepal 8–10 mm long; lateral sepals 8–12 mm long; petals olive-green; labellum with a distinctly excised sinus between the mid and lateral lobes. 7–10 mm long, ; speculum reddish-brown with a creamy-white.

Habitat: mountain side, damp places, stream sides; elevation 500–1200 m.

Flowering : April – May.

Occurrence: rare.

Distribution: Kurdistan Iraq, Iran, Turkey, Syria.

- **subsp. *khuzestanica*** Renz & Taubenheim

Etymology: Khuzistan Ophrys (referring its discovery from Khuzistan, Iran).

sepals greenish or green, the dorsal one folded back on the gynostema, petals olive-green coloured; labellum deeply 3-lobed with a distinctly excised sinus between the mid and lateral lobes; lateral lobes protuberances with short horns; middle lobe convex, oblong; speculum complex and large, reddish-brown with a creamy-white border usually encircling only 3 patches; basal field dark brown with a pale violet border.

Habitat: mountain side, oak woodlands, wetlands, rocky soil; elevation 50–1400 m.

Flowering : April–May

Occurrence: occasional.

Distribution: Kurdistan Iraq, Iran, Turkey (endemic to Zagros system).

10- *Orchis* Tourn, ex L.

Herbs perennial. Rootstock tuberous, tubers 2(–3), globose, ovoid or ellipsoid, entire, sessile or stipitate. Stem glabrous. Leaves basal, rosulate and/or cauline, spotted or unspotted. Inflorescence many-flowered; floral bracts thin, membranous. Perianth segments usually concave and connivent to form a helmet, or with the 3 outer sepals more flattened and spreading to deflexed, the sepals and the 2 inner petals either equal in length or the latter shorter, glabrous; Labellum spurred, entire to deeply 3-lobed, porrect to deflexed, the surface wither flat, undulate or bilaterally deflexed, sometimes with subfalcate lobes, with or without calli at the base, glabrous or papillose; column with a 3-lobed rostellum, the median lobe of which is short and lamelliform, Anther-connective absent, Viscidia 2, placed in a simple bursicle.

Some 35 species distributed over Europe, the Mediterranean region and temperate Asia,

Orchis (from Gr, *Orchis*, testicle, referring to the appearance of the plants tubers).

The genus was represented by 8 species in Kurdistan flora of Iraq (Hutchinson, 1959), currently represented by four species.

1- *Orchis mascula* (L.) D.Tyteca & E.Klein, J, Eur, Orch.

Herbs perennial. Tubers 2, ovate-oblong or ellipsoid, shortly stipitate. Stems up to 60 cm tall. Leaves 3–7, blotched or speckled purple-red or unmarked, grouped towards base, narrowly elliptic, ovate-elliptic, oblanceolate, oblong, or obovate. Inflorescences few-many-flowered, cylindrical; bracts purple-red, lanceolate to linear-lanceolate. Flowers purple, lilac, or rose-pink, occasionally white; labellum subrotund, broadly oblong to obovate, cuneate, 3-lobed above middle or sometimes subentire; ovary cylindrical, 5–7 mm long.

Habitat: mountain cliffs, oak woodlands, , rocky soil; elevation 1580–1700.

Flowering : May-July

Occurrence: occasional. (Supp. Fig. 2-D)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Armenia, Azerbaijan, Georgia, N Asia, and N Africa. Collection: QaraDagh Mt. Top of the mountain above Waziara, S. A. Ahmad et al. 16-1769 (KBF).

Conservation issues: This species highly impact by habitat loss and overcollecting the tubers and sell as a powder in the local bazaar.

- subsp. *mascula*

Bracts exceeding the flower, acuminate, dark purple; sepals acute to acuminate, midlobe of labellum spotted, truncate, slightly exceeding the lateral lobes; spur slightly dilated at the apex, equalling the ovary.

Habitat: High mountain forest, wetlands, oak woodlands, shady places, sand-clay soil; 1300–1800 m.

Flowering : May–June.

Occurrence: rare. (Supp. Fig. 2)

Distribution: Kurdistan Iraq, Iran, Turkey, Armenia, Azernbijan, Georgia.

- subsp. *pinetorum*

Sepals rather obtuse, Labellum unmarked or with only a few spots or lines towards the center, shortly cuneate at the base, pointing forwards; midlobe emarginated or slightly bilobed, longer than the lateral lobes; spur dilated at the apex, shorter than or equaling the ovary, gently upwardly curved.

Habitat: High mountain forest, wetlands, oak woodlands, shady places, sand-clay soil; 1300–1800 m.

Flowering : May–June.

Occurrence: rare (Supp. Fig. 2-D)

Distribution: Kurdistan Iraq, Iran, Turkey, Armenia, Azernbijan, Georgia.

- subsp. *longicalcarata* Akhalk., H.Baumann.

Bracts purple-red, linear-lanceolate, acuminate, shorter than the ovary, 23 x 4 mm, membranous; flowers purple, lilac, labellum with a central white area extending around the mouth of the spur which is lined with dark purple and purple spots; dorsal sepal connivent with the petals to form an incomplete helmet, oblong, obtuse, 8 x 3.5 mm, slightly concave; lateral sepals obliquely oblong, obtuse, 10 x 3 mm., erect to spreading or somewhat reflexed; petals obliquely oblong, obtuse, 9 x 2 mm; labellum subrotund, obovate, slightly formed 3 unequal lobes above the middle subentire.

Habitat: dense oak woodlands, stream sides, wetlands, grasslands, clay soil; elevation 700–1800 m.

Flowering : Apr, – May.

Occurrence: frequent. (Supp. Fig. 2-D)

Distribution: Kurdistan Iraq, Iran, Turkey.

Collection: Qaradagh, S. A. Ahmad, 2007 (SUFA), alt., 987; Batif / MAM, S. A. Ahmad 11/5/2011 (SUFA), alt., 749 m.

2- *Orchis palustris* Jacq.

Herbs perennial. Tubers 2, subglobose or ellipsoid, shortly stipitate. Stems up to 1 m tall. Leaves 3–8, cauline, linear to lanceolate, narrowly elliptic, ovate-elliptic, oblanceolate, oblong, or obovate. Inflorescences 5–50-flowered, cylindrical; bracts green suffused with pale reddish-purple, narrowly elliptic, acute, enclosing and usually equaling the ovary, the lowermost exceeding the ovary. Flowers dark purple, sometimes pink, rarely pure white, petals sometimes yellowish; labellum obovate, triangular-obovate, transversely oblong or obcordate in outline, cuneate at the base, 3-lobed, sometimes entire or subentire, 9–15 mm long, flat or slightly convex.

Habitat: valley and hillside, grasslands, caly soil; elevation 835–1050 m.

Flowering : May–June.

Occurrence: Frequent. (Supp. Fig. 2-E)

Distribution: Kurdistan Iraq, Iran, Turkey, Lebanon, Palestine, Jordan, Armenia, Azerbaijan, Georgia, C. Asia, W. C. & Mediterranean Europe (Sweden, Belgium, France, Spain & Portugal to W. Russia, Greece etc.), N. Africa (Morocco, Algeria).

Conservation issues: This species highly impact by habitat loss and overcollecting the tubers and sell as a powder in the local bazaar.

Collection: QaraDagh Mt. Darbarw village, S. A. Ahmad et al. 16-1148 (KBF).

3- *Orchis simia* Lam.

Herbs perennial. Tubers 2, ovoid or ellipsoid, stipitate. Stems up to 60 cm tall. Leaves 3–8, glossy green, unspotted, oblong, oblong-elliptic, oblong-ovate or narrowly elliptic. Inflorescences many flowered, cylindrical; bracts green suffused with pale reddish-purple, narrowly elliptic, acute, enclosing and usually equaling the ovary, the lowermost exceeding the ovary. Flowers dark purple, sometimes pink, rarely pure white; sepals ovate to narrowly elliptic, sometimes oblong-elliptic, the lateral oblique petals sometimes yellowish; Petals linear, acuminate, 9–12 mm long; pale pink or white with tufts of purple papillae at the base and centre, with dark purple or pinkish-violet lobes, rarely entirely white or pink, distinctly 3-lobed.

Habitat: mountains forest, grasslands, sandy-clay soil; elevation 850–1050 m.

Flowering : April–May.

Occurrence: occasional. (Supp. Fig. 2-E)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Greece, and Cyprus, Mediterranean Europe, Armenia, Azerbaijan, Gergia, N. Africa (Libya).

Conservation issues: This species highly impact by habitat loss and overcollecting the tubers and sell as a powder in the local bazaar.

- subsp. *simia*

Monkey orchid has two elongated ovoid or ellipsoid tubercles. ; bracts triangular-ovate to elliptic ; sepals and petals are coherent or connivent in a loose helmet, sepals are whitish to pale greyish-pink outside but purple spotted inside, like petals; labellum is deeply four-lobed

Habitat: Mountain side, Oak woodland, rocky soil; elevation 1285–1700 m.

Flowering : April – May.

Occurrence: rare. (Supp. Fig. 2-E)

Collection: QaraDagh Mt. near Dara zardaka, S. A. Ahmad et al. 15-1306 (KBF).

4- *Orchis punctulata* Steven ex Lindl.

Herbs perennial. Tubers 2, oblong or ellipsoid, stipitate. Stems up to 75 cm tall. Leaves 3–9, glossy green. unspotted. mostly rosulate except for 1 or 2 just above the main rosette, oblong. oblong-ligulate or narrowly elliptic. Inflorescences many-flowered, cylindrical; bracts green suffused with pale reddish-purple, narrowly elliptic, acute, enclosing and usually equaling the ovary, the lowermost exceeding the ovary. Flowers dark purple, sometimes pink, rarely pure white; sepals yellowish-green. yellow or brownish-yellow. rarely flushed with pink; Petals yellowish-green. linear ob oblong, 8–9 mm long yellowish-green at the base. ochre to brown or brownish-violet towards the ends of the lobes. with numerous tufts of violet-red papillae.

Habitat: Foothill side, oak woodlands, silty soil; elevation 600–837 m.

Flowering : March– April.

Occurrence: very rare. (Supp. Fig. 2-E)

Distribution: Kurdistan Iraq, Iran, Turkey, Syria, Lebanon, Palestine, Jordan, Greece, and Cyprus, SE Europe, Armenia, Azerbaijan, Gergia, N. Africa (Libya).

Conservation issues: This species highly impact by habitat loss and overcollecting the tubers and sell as a powder in the local bazaar.

Collections: Qaiwan Mt. near Mokaba, S. A. Ahmad et al. 16-149 (KBF).

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Websites

ANGIOSPERM PHYLOGENY: <http://www.mobot.org/MOBOT/research/APweb>

INTERNATIONAL PLANT NAMES INDEX: <http://www.ipni.org/>

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WORLD WILDLIFE: <http://www.worldwildlife.org/ECOREGIONS/PA0812>

VIRTUAL HERBARIA (<https://herbarium.univie.ac.at/database/search.php>)



Figure1: 1. *Anacamptis papilionacea* (L.) R.M.Bateman, Pridgeon & M.W.Chase. subsp. *Schirwanica*, 1a. Inflorescence, 1b. Tubers; 2. *Androrchis anatolica* (Boiss.) D.Tyteca & E.Klein., 2a. Habit, 2b. dissect flower; 3. *Epipactis veratrifolia* Boiss. & Hohen., 3a. Part of Inflorescence, 3b. dissect flower; 4. *Ophrys bornmuelleri* M.Schulze ex Bornm., 4a. habit, 4b. flower.

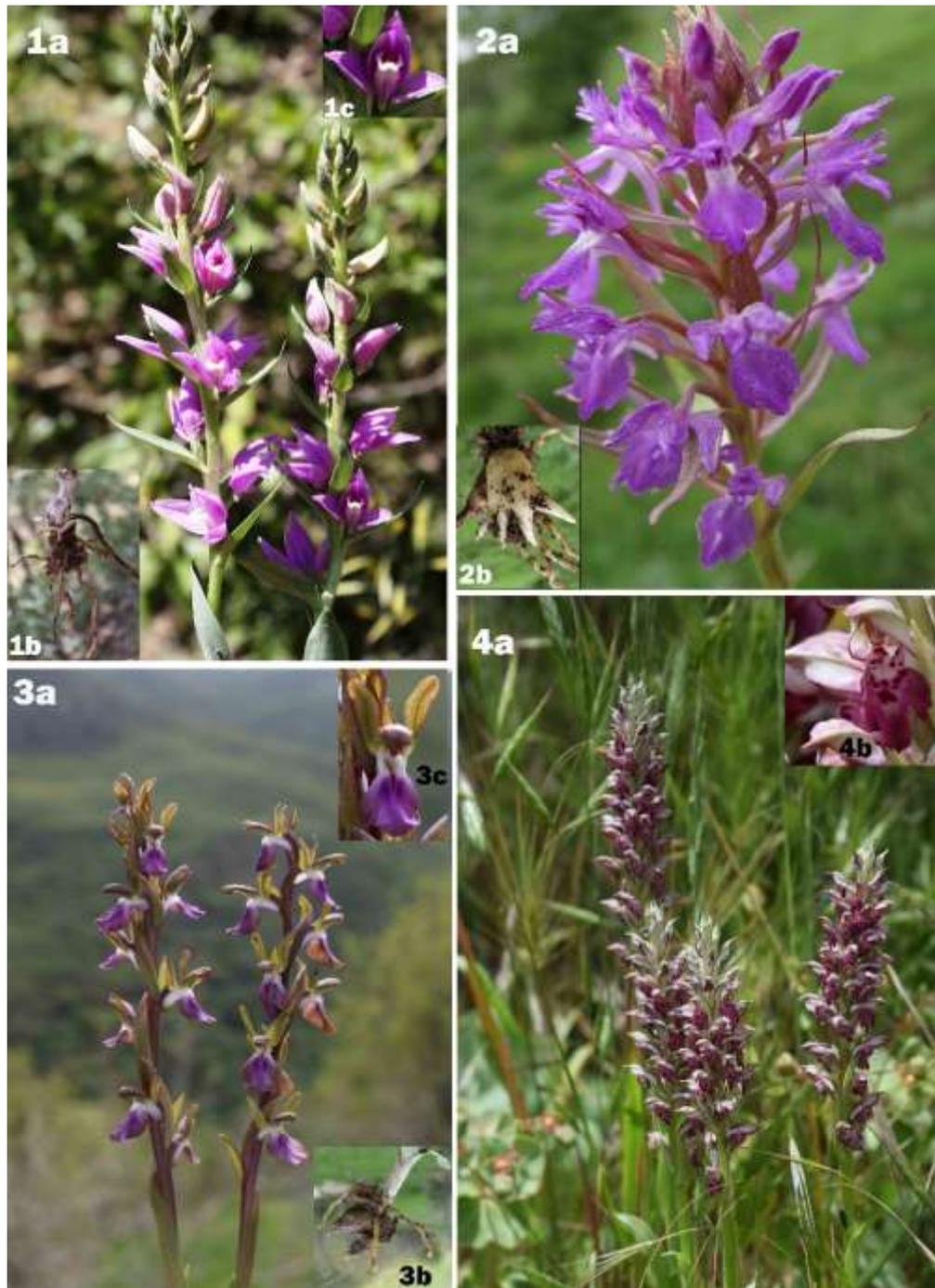


Figure 2: 1. *Cephalanthera kurdica* Bornm. ex Kraenzl., 1a. Inflorescence, 1b. Rhizome, 1c. flower; 2. *Dactylorhiza umbrosa* (Kar. & Kir.) Nevski. var. *umbrosa*, 2a. Inflorescence, 2b. Tubers; 3. *Anacamptis collina* (L.) R.M.Bateman, 3a. Inflorescence, 3b. Tubers, 3c. Flower; 4a, *Anacamptis coriophora* (L.) R.M.Bateman, Pridgeon & M.W.Chase. subsp. *Fragrans*, 4a. Habit, 4b. flower.

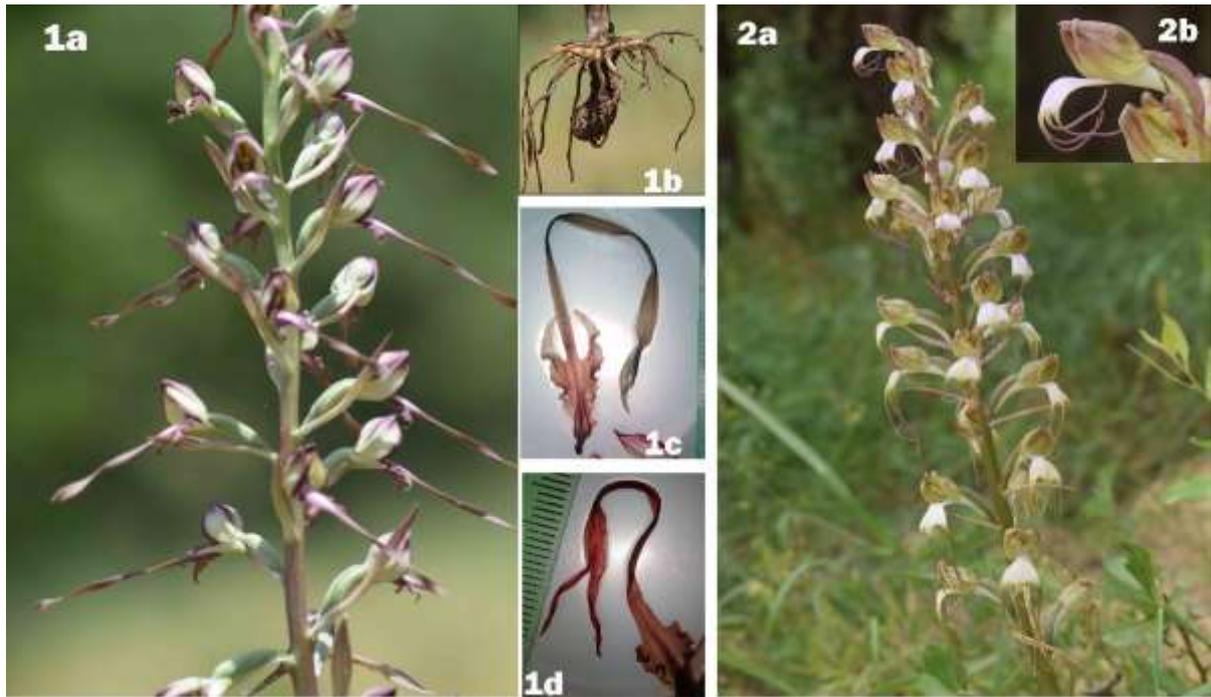
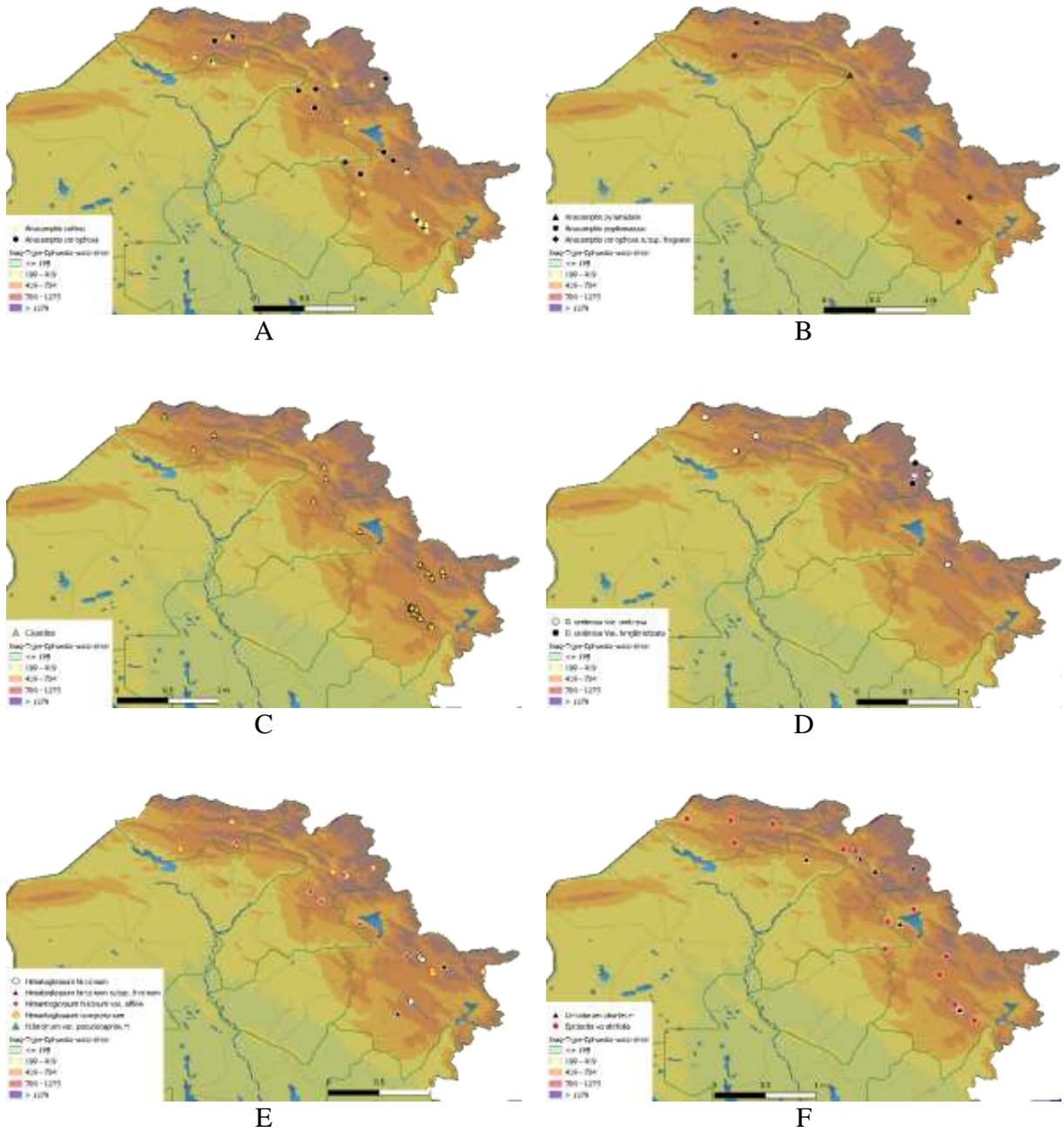
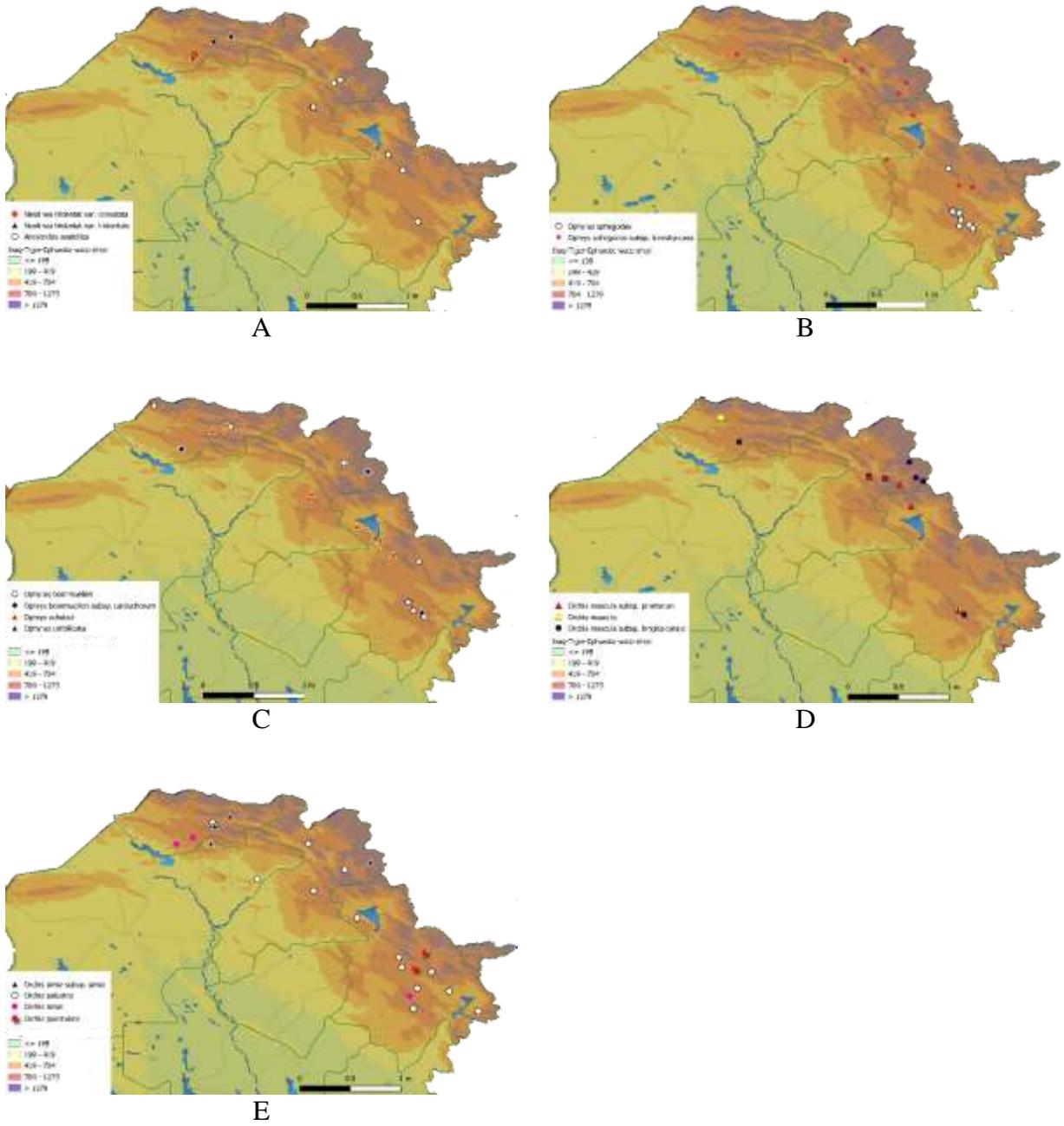


Figure 3: *Himantoglossum hircinum* (Boiss.) Schltr. subsp. *affine* var. *affine*, 3a. Part of inflorescence, 3b. Tubers, 1c & 1d. Labellum; 2a. *Himantoglossum comperianum* (Steven) P.Delforge.; 2a Part of inflorescence, 2b. flower.



Supplementary **Figure 1:** Geographical distribution of the different taxa in Kurdistan Iraq.



Supplementary Figure 2: Geographical distribution of the different taxa in Kurdistan Iraq.

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