



ORIGINAL ARTICLE

A Systematic Study about the Genus *Ferulago* Boiss. (Umbelliferae) Growing in Kurdistan Region of Iraq

¹Jawhar Fattah Saeed, ²Media Taher Raheem, ³Khazal Dh. Wadi

¹College of Basic Education, Salahaddin University-Erbil, Kurdistan Region, Iraq

E mail: jawhar_saeed@yahoo.com

²Makhmor Education- Ministry of Education-Erbil, Kurdistan Region, Iraq

E mail: media.prangos@gmail.com

³Dep. of Biology-College of science - university of diyala, Iraq

E mail: wadibio@yahoo.com

ABSTRACT

The research a systematic study of gross morphology of plants – which collected during field trips and dry ones for most specimen preserved with Iraqi herbaria – related to the genus *Ferulago* Koch and to identify the unidentified species and rectify the error in. Depending on that the species of the genus in Kurdistan region of Iraq were specified in two species: *ferulagoangulata* (Schlecht) Boiss. and *Ferulagostellata* Boiss. Characteristics of a taxonomic value have been specified for the genus and the two species. The ecology and soil quality where these genus plants grows were specified; and were geographically distributed on natural Iraqi territories for each one. Sketches and diagrams were made in addition to pictures.

Keywords: *Ferulago*, Umbelliferae, Field trips, Systematic study

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INTRODUCTION

Umbelliferae family is considered as a large and complicated family [1]. This family, from their peculiarity of inflorescence from one of the most natural of families and of which almost any individual may be recognized at a glance; but in proportion to this facility of recognition, is the difficulty of ascertaining the genus to which any particular plant may belong [2]. The family Umbelliferae has about 60 genera and 143 species listed in Iraq according to [3]. Boissier [4] indicated 31 species of the genus. Handel-Mazzetti [5] stated only 1 species of the genus. In Iraq, [6], [7] and [8] pointed out to presence of 3 species of the genus were found involving the two studied species. In Syria, Palestine and Sinai, [9] and in Europe, [10] mentioned that 9 species of the genus. In Iraq, [11] and [12] stated that 4 species were found involving the two studied species, as well as [13] also stated that 2 species was found in lowlands of Iraq. In Turkey, [14] also mentioned that 28 species of the genus were found involving the two studied species in North of Iraq. In Iraq, [15] mentioned the distribution of 6 species of the genus were found indicating the districts in which the species are distributed. Blamey and Wilson [1] indicated 3 species of the genus. In Sinjar Mt., [16] stated only 1 species of the genus. In Pira Magrun Mt., [17] also mentioned that 2 species of the genus were found involving the two studied species. In Haibat Sultan Mt., [18] did not mention any species of *Ferulago*. The present study aimed to specify *Ferulago* species in Kurdistan Region of Iraq and to study the morphological characters and the geographical distribution of the species, some ecological notes were pointed out regarding the different environmental types and study of plant specimens found in some Iraqi herbaria to add a small part to the Flora of Iraq.

MATERIALS AND METHODS

Several field trips (about 52 trips) were made to different districts of Kurdistan: Amadyia (MAM), Rowanduz (MRO), Sulaimanyia (MSU), Jabal Sinjar (MJS), Erbil (FAR), Kirkuk (FKI), Nineveh (FNI) and Persian Foot hills (FPF) during Summer season of years 2009-2011 for plant specimens collection, some Iraqi herbaria specimens were used such as Baghdad University Herbarium (BUH), College of Science; Erbil, Iraq: College of Science Herbarium / University of Salahaddin and FAO-Herbarium (Food

Agricultural Organization Herbarium), these specimens were identified by helping of some keys especially in Flora of Turkey, the specimens were made herbarially to become formal specimens. The specimens were studied morphologically in detail from roots to seeds, the study carried out by dissecting microscope Leybold Didactic GmbH. type. Geographical distribution was made by the aid of prepared maps (figure 1); ecological notes were pointed out regarding the different environmental types.

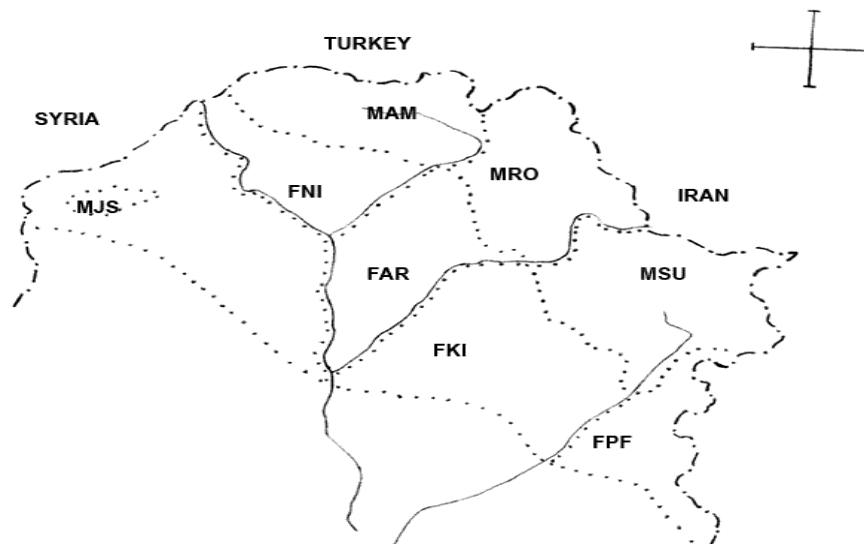


Figure (1) A map showing the distribution of the two species: *Ferulago angulata* *Ferulago stellata*

RESULT

***Ferulago* Koch.:** Nov. Act. Nat. Cur. 12:1 (1824).

Erect perennials; rootstock thick, crowned by a fibrous collar. Basal leaves 3 to 6-pinnate, triangular-ovate to linear in outline, with lanceolate-linear to setaceous lobes; cauline leaves smaller than basal, progressively reduced to sheathing bases or rarely absent. Sheaths linear-lanceolate, slightly inflated. Inflorescence paniculate-corymbose or -thyrsoid. Central umbels fertile, laterals usually sterile, all usually long-peduncled. Bracts and bracteoles usually more than 5, well developed, persistent. Sepals minute. Petals yellow or rarely reddish-purple. Mericarps strongly compressed dorsally, elliptical, dorsal ridges filiform to broadly winged, lateral ridges winged; 0.5-2.5 mm wide; dorsal and commissural vittae 4-30, unequal, distributed throughout both sides of mericarp [14].

1. Leaf segments rigid, setaceous, angular and canaliculated. Fruit has three dorsal ridges only slightly more distant from the laterals than from one another*F.angulata*

'1. Leaf segments brittle, fine setaceous, not angular and channeled. Fruit has three dorsal ridges close together, remote from the laterals.....*F.stellata*

1-***Ferulago angulata* (Schlecht) Boiss.**, Fl. Orient. 2: 1005 (1872); Nab. in Publ. Fac. Sci. Univ. Masaryk 35: 121 (1923); Zoh. in Dep. Agr. Iraq Bull. 31:113 (1946); Blakelock in Kew Bull. 3: 434 (1948); Rawi, ibid. Tech. Bull. 14:92 (1964); H. Pesmen in Fl. Turkey 4:469 (1972).

Syn: ***Ferula angulata* Schlecht.**, Linnaea 17: 125 (1843).

Plant tall, erect, stout herbs, 34-199 cm high. Tap root system, conical, brown-yellow, 67-86x 3.5-4.8 cm. Rootstock crowned with the fibrous remains of those of the previous years. Stem strongly sulcate and angular, solid, branched, 60-126.5x1.5-3 cm, puberulent, greenish-yellow. Basal leaves petiolate, petiole 5-24 cm long. Sheath sulcate, 2.8-10.5x2-6 cm, glabrous. Blade very broadly obdeltate, oblanceolate-broadly obovate in outline, 5-77x1.8-32 cm, glabrous, pinnately to tetrapinnate decompose, about (5-9) pairs of primary leaflets. Lower cauline leaves opposite, petiolate, petiole 7-25.5 cm long, sheaths sulcate, 0.6-4x0.4-2 cm. Blade very broadly obdeltate, oblanceolate-obovate, trullate, very broadly trullate in outline, 9-28x8-36 cm, glabrous, pinnately to tripinnate decompose, about 5 pairs of primary leaflets. Upper cauline leaves opposite and subverticillate, simple. Blade narrowly triangular, triangular in outline, 6-25x1.2-4 mm, glandular, puberulent. Segments rigid, setaceous, angular and canaliculate, 10-40x1.9-2.1

mm, apex mucronate, base cuneate, margin entire. Leaves decreasing up wards in size and number of segments green. Fruiting compound umbels diameter about 3-8.5 cm; peduncle cylindrical, 1-25x1-4 mm, glabrous, brownish yellow. Primary rays 6-26 mm long, (6-12) rays. Secondary rays 2-5 mm long, glabrous, (10-17) rays. Involucral bracts narrowly triangular, triangular, 5.1-10x0.8-2 mm, glandular, puberulent, coriaceous, about (5-6) bracts, apex acuminate, entire with cuneate base, yellow. Involucel bracteoles 0.9-3x0.2-1 mm, about 8 bracteoles, bracteoles like bracts in shape, yellow, type of vestures, patent or reflexed bracts and bracteoles. Flowers diameter 1.5-2.5 mm, zygomorphic. Sepals-5 dentate, membranous. Petals-5 membranous, very broadly ovate, 1-1.2x1-1.2 mm, margin entire, base cuneate, apex acute with curved inward, light yellow. Androecium, 5-stamens alternate to petals. Filaments filiform, 1.9-2x0.1-0.2 mm. Anthers rotund, 0.4-0.5x0.5-0.6 mm, versatile attachment; longitudinally dehiscent, latrors. Gynoecium, 1 pistil; ovary inferior, 2-syncarpous, each 1-locular contain 1-ovule, apical pendulous placentation. Ovary, 1-3x1.2-4 mm, longitudinal ridges do not excluding the wings, brown. The 2-styles 0.5-1 mm long, slender, mostly very short 0.1 mm when in flower. Stylopodium is flattened and margins are very undulation, larger than ovary , 1.3-4.5 mm diameter, brown. Stigma capitate, 0.5-1.5x0.3-1.1 mm, glabrous, yellowish brown. Fruits are characterized shizocarp, cremocarp and composed of 2-mericarps, every mericarp has 1-seeded. Every mericarp has 5 primary ribs (two of them are lateral ribs, one dorsal rib and two intermediate ribs), primary ribs winged. Fruit elliptic, globose, glabrous, yellow, 2.4-4x1.3-2 mm, the three dorsal ridges only slightly more distant from the laterals than from one another. The ribs have narrow wings, 0.2-0.3 mm width. Seeds lanceolate, 1.4-1.5x0.4-0.5 mm, brown, apex apiculate, base rounded (figure 2, plate 1-A).

Type: [N.Iraq] in faucibusaltiorummontiumKurdistaniae, in monteGara, Kotschy 403 (iso. K!) (Flora of Turkey).

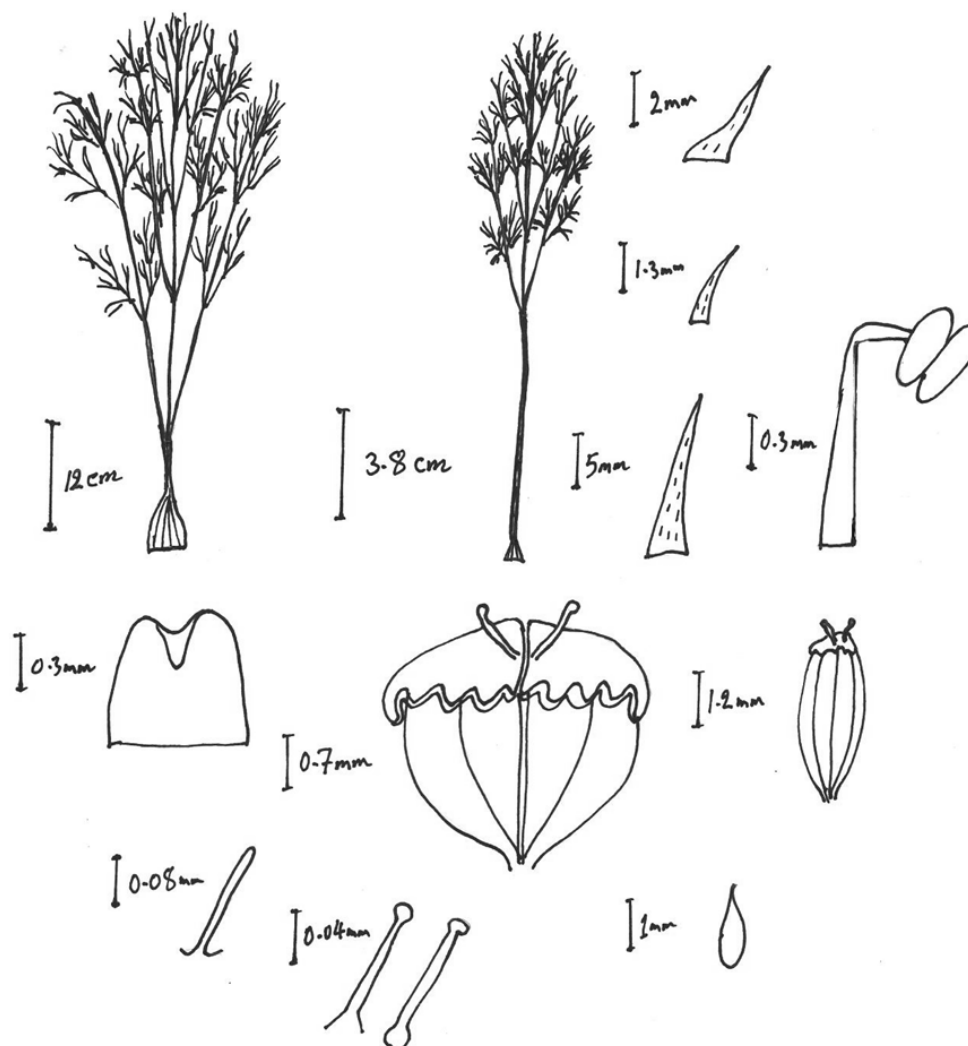


Figure (2): *Ferulago angulata* ; 1. Basal leaf; 2. Lower cauline leaf; 3. Upper cauline leaf; 4. Bract; 5. Bracteole; 6. Petal; 7. Androecium; 8. Gynoecium; 9. Fruit; 10. Seed.

Selected samples from the studied specimens

MAM: ESUH/ Gara Mt., 1200m, 23.5.2009, Al-Dalawi& Al-Makhmuri,7104; MRO: Sakran Mt., 1920m, 20.6.2011, Al-Dalawi&Al-Makhmuri, 7105; MSU: KopiQaradagh Mt., 1400m, 4.6.2010, Al-Khayat, Saeed, Al-Dalawi& Al-Makhmuri, 7106; FPF: Qarachogh Mt., 600m, 20.4.2009, Al-Dalawi&Al-Makhmuri, 7107.

Ecology and geographical distributions

Found as a population, in mountainous region on high rocky slopes, in limestone, rocky, rocky clay, loamy sand and loam soil; altitude: 600-2300 m; flowering period: April-August.

1-*F.angulata*, distributed in Amadyia district **MAM** from Sarsang (Gali-Sarsang), S.E facing slope of Gara Mt., down to Gara, Gali-GariGoo village, Bamarni Mt., Bekher Mt., Zawita, Babelo Mt., SwaraTuka (Ispindar village), Chiya-i-Spi, Shaban Mt., JabalKashan, Sharanish Mt., N. E. Zakho, Amadia Mt., GaliSariseriy, Matin Mt., Peris Mt., and Barogha, Kanimasi, Batufa, Zriza Mt., Aqra Mt. (Akre) 80km N.E.of Mosul. In Rowanduz district **MRO** inKhalkhalan Mt., Sheraswar, HaibatSultan Mt., GaliAliBeg gorge, Rowanduz, Rowar (Rowara)Mt., Bekhal, Zozic Mt., Karokh Mt., Mandau Mt., Sakran Mt., HassariSakran, Sarifaqian, Kodo Mt. S. facing slope, Halgord Mt. S., E. and N. E. facing slope, Qandil Mt., Shaikhan Mt., Bardabook Mt., shirin Mt., Sheladezi, then elongated to Sulaimanyia district **MSU** in PiraMagron Mt., Qula- Rash tope area (Merquli), Dokan, Sekanian Mt., Kolkasomaqa Mt., Qaradagh, Shewasoor near Chamchamal, KopiQaradagh Mt., Pinjwen Mt, Beara, Tawela and Hawraman Mt., in Arbil district **FAR** in Qarachogh Mt. N.facing slope (figure 1).

2-*Ferulagostellata*Boiss., Ann. Sc. Nat. Ser. 3, 1: 323 (1844);Fl. Orient. 2: 1001 (1872); Zoh. in Dep. Agr. Iraq Bull. 31:112 (1946); Blakelock in Kew Bull. 3: 434 (1948); Rawi *ibid.* Tech. Bull. 14: 92 (1964); H. Pesmen in Fl. Turkey 4: 462 (1972).

Perennial, erect or ascending, stout herbs, 20-110 cm high, glabrous. Tap root system, conical, brown-yellow, 14-29x0.6-1.5 cm. Rootstock crowned with the fibrous remains of those of the previous years. Stem strongly sulcate, angular, subterete above, the lower branches are longer than the upper branches that is to say branches length decreased gradually towards the stem top; therefore, they are corymbosal branched above, 16.5-101.5x0.4-1.2 cm, greenish yellow. Basal leaves petiolate, petiole 3.5-18.5 cm long. The petiole is longer than the rachis between the first and the second pairs of primary leaflets, sheath sulcate, 4-5x0.8-1.2 cm. Blade narrowly lanceolate-narrowly ovate in outline, 8.5-30x1-7 cm, pinnately to tetrapinnate decomposed, about (7-20) pairs for primary leaflets. Lower cauline leaves alternate, petiolate, petioles represented by sheaths, sheaths sulcate, 2-75x2-8 mm. Blade narrowly lanceolate-narrowly ovate in outline, 11-23x1-9 cm, pinnately to tripinnate decomposed, about (5-13) pairs for primary leaflets. Upper cauline leaves alternate and subverticillate, subsessile, have very short sheaths 2-20x1-6 mm. Blade narrowly lanceolate-very broadly ovate in outline, 1-4x0.2-5 cm, pinnately to tripinnate decomposed, about 3 pairs for primary leaflets. Segments of leaflets brittle, fine setaceous, 1.5-15 mm long, apex mucronate, base cuneate, margin entire. Leaves decreasing up wards in size and number of segments and leaves have green. Fruiting compound umbels diameter about 8-18 cm, ± stellate; peduncle cylindrical, stout, 3-138x0.1-27 mm, light green or brownish yellow. Primary rays 10-75 mm long, (4-14) rays. Secondary rays 5-11 mm long, (5-45) rays, they are equal or shorter than ripe fruits. Involucral bracts linear, narrowly lanceolate- narrowly ovate, 3-8x0.7-2 mm, coriaceous, about (4-10) bracts, green-yellow, apex acute, base cuneate, margin entire, yellow. Involucel bracteoles linear triangular, narrowly lanceolate, lanceolate, 3-7x0.3-1 mm, about (4-5) bracteoles, bracteoles like bracts in colour, apex, margin and base, patent or reflexed bracts and bracteoles, and usually caduceus in fruiting umbels. Flowers diameter 2.8-4 mm, zygomorphic. The calyx teeth delicate, small. Petals-5 membranous, narrowly ovate-very broadly ovate and rarely lanceolate, 0.8-2x0.3-1.2 mm, margin entire, base cuneate, apex acute with curved inward, bright yellow. Androecium, 5-stamens alternate to petals. Filaments filiform to tap form, 2-2.1x0.1-0.2 mm. Anther narrowly elliptic, broadly elliptic, rotund, 0.5-0.8x0.2-0.4 mm, versatile attachment; longitudinally dehiscent, latrors. Gynoecium, 1 pistil; ovary inferior, 2-syncarpous, each 1-locular contain 1-ovule, apical pendulous placentation. Ovary with longitudinal ridges, 1-1.7x0.5-1.7 mm, brown. The 2-styles 0.3-2 mm long, slender. Stylopodium is flattened and margins are slightly undulation, 0.7-2 mm diameter, brown. Stigma capitate or discoid and rarely spherical, 0.1-0.2x0.09-0.1 mm. Fruits are characterized shizocarp, cremocarp and composed of 2-mericarps, every mericarp has 1-seeded. Every mericarp has 5 primary ribs (two of them are lateral ribs, one dorsal rib and two intermediate ribs), primary ribs winged. Fruit elliptic, narrowly elliptic, brown, 8-17x3-5 mm, tapering at both ends, the three dorsal ridges close together, remote from the laterals. The ribs have narrow wings, straight, 0.2-0.5 mm width, yellow. Seeds have clear longitudinal ribs, 7.7-16.8x1-2 mm, brown, very narrowly elliptic, apex acuminate, base acute (figure 3, plate 1-B).

Type: [W. Iran] in Persia, *Aucher* 3660 (iso. K) (Flora of Turkey).

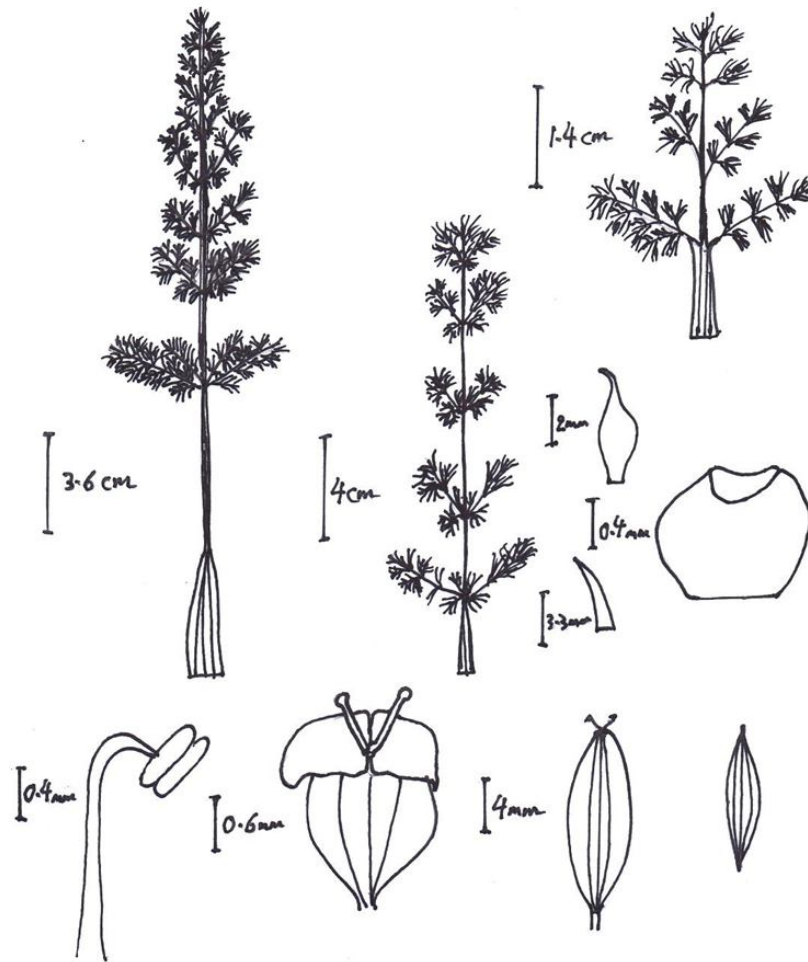


Figure (3): *Ferulagostellata* ; 1. Basal leaf; 2. Lower cauline leaf; 3. Uppercauline leaf; 4. Bract; 5. Bracteole; 6. Petal; 7. Androecium; 8. Gynoecium; 9. Fruit; 10. Seed.

Selected samples from the studied specimens

MAM: ESUH/ Matin Mt., 740m, 2.7.2011, Al-Dalawi&Al-Makhmuri, 7112; MRO: Sakran Mt., 850-2100m, 7.6.2010, Al-Khayat, Saeed, Al-Dalawi&Al-Makhmuri, 7113; MSU: PiraMagrun Mt.,1950m, 16.7.2010, Al-Khayat, Saeed, Sardar, Al-Dalawi&Al-Makhmuri, 7114; FPF: Qarachogh,450 m, 20.4.2009, Al-Dalawi&Al-Makhmuri, 7115.

Ecology and geographical distributions

Found as a population, in mountainous region on high rocky slopes, in limestone, rocky, rocky clay, loamy sand and loam soil; altitude: 450-2100 m; flowering: April-June.

F.stellata distributes in Amadyia district **MAM** in Sarsang, Gara Mt., Gali-Garigoo village, Bamarni, Shaban Mt., Sharanish Mt.-Zakho, Amadia Mt., GaliSarisery, Matin Mt., Peris Mt., Barogha, Ravena village, Deralook, Gonerki village. In Rowanduz district **MRO** in HaibatSultan Mt., Rowanduz, Bekhal, Karokh Mt., Mamaruta Mt., Sakran Mt., Qandil Mt., Kodo Mt., Shirin Mt. then elongated to Sulaimanyia district **MSU** in PiraMagron Mt., Dokan, Sekanian Mt., Bazian Mt., KopiQaradagh Mt., Beara, Tawela, Hawraman Mt., Klora Mt. near Chwarta on Persian frontier, as well as its distribution in Qarachogh Mt. N-facing slope involving Arbil district **FAR** (figure 1).

DISCUSSION

This study dealt with the two species *Ferulago angulate* (Schlecht) Boiss. and *Ferulago stellata* Boiss.(Umbelliferae) from limited aspects including the study of morphological characters as well as the study of environment and their distribution in the studied district.

Within the study of herbarial specimens from some Iraqi herbaria, the researcher found three specimens in PiraMagrun Mt. within MSU district which numbered under 0041000 consigned in Bagdad, Iraq: The University Herbarium, College of Science, and the two numbered specimens 6337, 6338 that consigned in Erbil, Iraq: College of Science Herbarium/University of Salahaddin, all of them have *Prangosferulacea* name. The specimens cleared that they belong to *Ferulago stellata*.

One of *Ferulago* genus characters which have a taxonomical importance is the involucre and involucre reflexed. Another important feature is the plant high which is exceeding up to 150 cm in *F. angulata*, and not exceeding more than 110 cm high in *F. stellata*, Stem width in *F. stellata* is 0.4-1.2 cm while in *F. angulata* is 1.5-3 cm. It seems that the segments of leaflets are setaceous, angular and canaliculated in *F. angulata*, while in *F. stellata* are brittle, capillary, not angular and channeled. The upper cauline leaves in *F. stellata*, are decomposed while in *F. angulata* are simple. Another character which has an important role is the fruit which has three dorsal ridges only slightly more distant from the laterals than from one another in *F. angulata*, and the three dorsal ridges close together, remote from the laterals in *F. stellata*. The other characters did not show any taxonomical importance or have limited taxonomical importance.

During the field trips to the different districts, the specimens of each species were collected. The flowering period extended from the middle of April to the middle of August, and the two species were perennials. The research was somewhat capable to cover the Environment and geographical distributions of the two species that are distributed in the same regions.

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