Iranian *Pimpinella* L. (Apiaceae): A taxonomic revision

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**Abstract**

In the family Apiaceae subfamily Apioideae, the genus *Pimpinella* L. with about 150 species is one of the largest genera. This widespread and taxonomically complex genus has 20 species distributed throughout Iran, of which, eight species are endemic. The resolution of relationships among these approximately 20 species remains largely obscure. In this study, Morphological analyses were conducted using NTSYS to assess relationships among *Pimpinella* species with emphasis on Iranian *Pimpinella*. Based on the most significant morphological characters, a dendrogram was sketched ending up giving the following results: In phenon line 0.54 and 0.56, two clusters are clearly distinct. In the first cluster three distinct branches could be observed: (1) annual species of genus *Pimpinella*, although *P. affinis* shows similarity to them, (2) four species includes *P. anisactis*, *P. khorasanica*, *P. khayyamii* and *P. tragium* and (3) Reutera group (*P. aurea*, *P. deverroides*, *P. tragioides*, *P. dichotoma* and *P. pastinacifolia*). At 0.56 the second cluster separated *P. kotschyana*, *P. oliveroides*, *P. olivieri* and *P. gedrosiaca* from the second subcluster which includes *P. peucedanifolia*, *P. rhodantha*, and *P. saxifraga*. Morphologically speaking, these species exhibit blatant differences compared with others. In addition, the identification key is also provided to represent the similarities and relationships between the species. This study presents a complete description, general distribution and its distribution in Iran for each species as well as some distribution maps for all Iranian species.

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Introduction

Apiaceae Lindl. (Umbelliferae Juss.) is a family of some 455 genera and is widely distributed in Central Asia (Pimenov and Leonov, 1993). The largest and most taxonomically complex subfamily, Apioideae, comprises 404 genera and 2827–2935 species (Pimenov and Leonov, 1993). South-West Asia as a whole is a region of high diversity for the family; after China and Turkey, Iran is the third Asian country with the greatest biodiversity (Pimenov and Leonov, 2004). Some of the endemic genera of Apiaceae in Iran are: Szovitsia Fisch. & C.A.Mey., Rhabdosciadium Boiss., Dicyclophora Boiss., Thecocarpus Boiss., Hausknechthia Boiss., Polypodium Boiss., Kelussia Mozaff., Opsicarpium Mozaff., Lomatopodium Fisch. & C.A.Mey.

Among the genera of Apiaceae, Pimpinella L. has 150 species all over the world and it is one of the largest genera of this family (Pimenov and Leonov, 1993). Taxonomically, this genus is placed in subfamily Apioideae and the major constituent of tribe Pimpinelleae Spreng. (Downie et al., 2010). Pimpinella is distributed in most part of Iran especially in the north and west. As stated in Flora of Iran (Mozaffarian, 2007) genus Pimpinella L. totally includes 22 species in Iran, with P. anisum L. as a cultivated species; but anatomical studies confirm morphological differences between P. anthriscoides Boiss. and other species of Pimpinella. Therefore, this species is affiliated into a distinct, new genus Pseudopimpinella anthriscoides (Boiss.) F.Ghahrem., Khajepiri & Mozaff.(Khajepiri et al., 2010). In this regard, according to Zakharova et al., 2012 new combinations of this species are published: Pseudopimpinella anthriscoides (Boiss.) F.Ghahrem. & al. is transferred to Aegopodium L., as Aegopodium tribracteolatum Schmalh.; and Pseudopimpinella anthriscoides var. cruciata (Bornm. & H.Wolff.) F.Ghahrem. & al. shows true affinity with the Balkan – Near Eastern-Caucasian genus Tamamschjanella Pimenov & Kljuykovso this variety is to be excluded from Pimpinella and transferred to Tamamschjanella as Tamamschjanella cruciata (Bornm. & H.Wolff.)

Pimenov & Zakharova.

Eight Iranian endemic species are as follows: P. anisactis Rech.f., P. deverroides Boiss., P. khayyamii Mozaff., P. khorasanica Engstrand, P. pastinacifolia H.Wolff., P. tragioides (Boiss.) Benth. & Hook.f., P. gedrosiaca Bornm. & P. dichotoma H.Wolff. (Mozaffarian, 2007). Some of the most important morphological characters in this genus are: duration, stem indumentum, presence of the fibrous collar, shape and division of basal and cauline leaves (pinnate or rarely simple), existence or nonexistence of sheath and petiole, presence of bracts and bracteoles and number of them, relative size of rays and pedicels and their indumentum, petal color, fruit shape and stylopodium type in maturity, presence of indumentum (include: hair, papilla, vesicle) and their distribution in mature fruit.

In this paper, the most important characteristics for the separation of the species, the relationships between the species, an identification key and distribution maps (Fig. 1) for all Iranian species are presented.

Materials and methods

Plant material

For this research, all required plant specimens of genus Pimpinella L. were provided from several herbaria. For this reason, at first, all specimens of Iranian species of this genus were studied at the department of Botany of Naturhistorisches Museum Wien (W). In addition all Pimpinella L. specimens which are deposited at TARI, FAR, T, TUH and FUMH herbaria also examined.

Morphological analysis

Analysis of morphological data was conducted using NTSYS-pc version 2.02e (Rohlf, 2000). Morphological data were converted into a similarity matrix, using the simple matching coefficient (Sneath and Sokal, 1973) with the SIMQUAL function. A dendrogram was generated from the similarity matrix by the unweight pair-group method using arithmetic
averages (UPGMA) (Sokal and Michener, 1958) with the SAHN function. Distribution maps are sketched by means of Map Source software.

A description of genus *Pimpinella* L. follows

Plant herbaceous, annual, biennial or perennial, sometimes woody at base, pubescent, puberulous or glabrous, fibrous collar present or absent. Basal leaves ovate, oblong or triangular, simple or 1-4-pinnate, petiolate. Cauline leaves ovate or triangular-ovate, simple or 1(-3)-pinnate, petiolate or sometimes only with sheath. Inflorescence a compound umbel. Bracts and bracteoles absent or present. Flowers bisexual; Calyx teeth inconspicuous; Petals all equal, white, yellow or rarely pinkish or purple, ovate, obovate or cordate, with inward curved tip, glabrous or hairy on the outer side. Fruit ovate, elliptic, oblong or subglobose, slightly compressed laterally, pubescent, puberulous, glabrous or rarely tuberculate; Stylopodium conical, mamillate or depressed; Styles erect, divergent or recurved, glabrous or rarely puberulous.

**Geographical distribution**
Asia, Europe, Africa and North America.

**Distribution in Iran**
North, West, South, East, Center (Fig. 1A).

**Identification key**

1. Plant annual ................................................................. 2
   - Plant biennial or perennial ........................................... 2

   - Basal leaves simple, lamina round or ovate.................................................. 3

   - Stylopodium in ripe fruit elongate-conical.................................7. *P.eriocarpa* Banks & Soland.

4. Plant monocarpic, with corymbose branches .................................................. 5
   - Plant perennial, not corymbose branched .......................................................... 7

5. Ripe fruit tuberculate or papillate, stylopodium mamillate or depressed-conical style glabrous .................................................. 12. *P.olivieri* Boiss.
   - Ripe fruit pubescent, stylopodium depressed, style puberulous ...................... 6

7. Segments of basal leaves without petiolule, lower cauline leaves 1-3-pinnate, petals hairy along the midrib on the outer side ........................................ 10. *P.kotschyanana* Boiss.
   - Segments of basal leaves petiolulate, lower cauline leaves 1-2-pinnate, petals hairy on the outer side.................................................. 11.

*P.oliveroides* Boiss. & Hausskn.

8. Petals yellow or cream ................................................................. 8
   - Petals white, pinkish or purple ........................................................................ 12

9. Basal leaves 2-3-pinnate, lower cauline leaves 1-2-pinnate, ripe fruit subglobose..............
   - Basal leaves 1-pinnate, lower cauline leaves simple or 1-pinnate, ripe fruit ovate-elliptic or ovate-oblong................................. 9

10. Ripe fruit pubescent ........................................................................ 10
    - Ripe fruit puberulous or subglabrous or glabrescent ........................................ 11

11. Lower cauline leaves 1-pinnate, fruit elliptic or ovate, stylopodium mamillate ..........
    - Lower cauline leaves simple, fruit ovate-oblonge, stylopodium conical-mamillate
      .......................................................... 13.

12. Segments of basal leaves with or without petiolule, bracteole absent or present ................
    .......................................................... 18.

*P.tragooides* (Boiss.) Benth. & Hook.f. ex Drude
   - Segments of basal leaves petiolulate, without bracteole ..................................13.

*P.pastinacifolia* (Boiss.) Wolff

13. Plant glabrous or puberulous ........................................................................ 13
    - Plant pubescent ......................................................................... 15

14. Fruit ovate-oblong
Description of species of genus Pimpinella L. in Iran

   = P. reuteriana Boiss. (1849); P. griffithania Boiss., (1856); P. ambigua W.D. Koch ex Wolff, (1921); P. multiradiata (Boiss.) Korov., (1949); P. korovinii R.Kamelin, (1971).

Characteristics

Plant biennial, erect, pubescent or puberulous. Basal leaves oblong, 1-pinnate, with petiole and sheath. Cauline leaves ovate or triangular-ovate or lanceolate, simple or 1(2)-pinnate, petiolate or sometimes petiole absent and only with sheath. Rays 6-30(50), almost unequal; Pedicels 6-35(46), almost unequal. Without Bracts and Bracteoles. Petals white, obcordate, hairy on the outer side. Fruits elliptic or ovate-globose, pubescent; Stylopodium elongate-conical, Divided in ripe fruits; Styles glabrous.

Geographical distribution: Anatolia, Iraq, Iran, Turkmenistan, Afghanistan, Caucasus, Transcaspia.

Specimens seen in Iran

Azerbaijan: Terme, Matine & Zargani 40492-E (W), Mozaffarian & Nowroozi 34901, 34891 (TARI), Rechinger 49012 (W), Sabeti 8819 (TARI), Sabeti 8813 (TAR), Rechinger 43627 (W), Sabeti 2945 (TARI), Sabeti 8812 (TARI); Esfahan: Jardine 794 (W); Fars: Mozaffarian 47002 (TARI); Gilan: Jardine 920-A (W), Wendelbo & Assadi 18396 (TARI), Mozaffarian & Maussoumi 6960 (TUH), Mozaffarian 7117 (TUH), Wendelbo & Assadi 18358 (TARI), Saidi 18625 (TUH), Naqinezhad 27693 (TUH), Wendelbo & Assadi 18566 (TARI), Jamzad 33271 (TARI), Steiner 21 (W); Golestan: Rechinger 6149-a (W), Riazi 8752 (TARI), Hewer 3929 (TARI), Zargani 41668 (W),
Assadi 25561 (TARI), Assadi & Mozaffarian 40990 (TARI), Assadi & Mozaffarian 41049 (TARI); Hamedan: Assadi & Mozaffarian 36707 (TARI); Kermanshah: Rechinger 14592 (W), lashkar Bolooki & Hatami 209 (TARI), Hamzehee & Hatami 1348 (TARI), lashkar Bolooki & Hatami 164 (TARI); Khorasan: Runemark & Sardabi 23483 (TARI), Assadi & Mozaffarian 35560 (TARI), Mozaffarian 48767 (TARI), Mozaffarian 45574 (TARI), Mozaffarian 48991 (TARI), Mozaffarian 39835 (TARI), Mozaffarian 32528 (TARI), Mozaffarian 32198 (TARI), Assadi & Mozaffarian 33211 (TARI), Amin & Bazargan 19596 (TARI), Sabeti in Gauha 893 (W), Mozaffarian 45457 (TARI), Foroughi & Sanei & Amini 12393 (TARI), Wendelbo & Foroughi & Assadi 14468 (TARI). (Fig. 1B).


This species is one of the endemic species in Iran which distributes only in a small part of the east.

**Characteristics**

Plant perennial, erect, pubescent. Basal leaves triangular-ovate, 1-pinnate, petiolate. Cauline leaves ovate or triangular-ovate or linearm-lanceolate, simple or 1(-2)-pinnate, with petiole and very short sheath or sometimes only with sheath. Rays 1-6, totally unequal; Pedicels 3-11, totally unequal. Without Bracts and Bracteoles. Petals white, ovate, hairy on the outer side. Fruit ovate-globose, pubescent; Stylodium conical-depressed; Styles glabrous.

**Geographical distribution:** Iran (Endemic).

**Specimens seen in Iran**

Khorasan: Rechinger 1714, 1739 (W). (Fig. 1C).


= *P. ramosissima* DC., (1831); *Reutera cervariaeafolia* Boiss., (1844) non. Freyn & Sint. (1895); *R. flava* (C.A.Mey.) Boiss., (1844); *R. aurea* (DC.) Boiss., (1872).

**Characteristics**

Plant perennial, erect, pubescent, puberulous or in upper parts subglabrous. Basal leaves ovate, 2(-3)-
pinnate, with petiole and sheath. Cauline leaves narrow ovate or lanceolate or subulate, simple or 1(-2)-pinnate, with petiole and sheath sometimes petiole absent. Rays 2-4(-11), almost equal; Pedicels 4-12(-16), unequal. Bracts and bracteoles absent or very rarely with 1-2 linear-narrow lanceolate bracts. Petals yellow, ovate, hairy on the outer side. Fruit subglobose, pubrulous, subglabrous or sometimes glabrous; Stylopodium conical; Styles glabrous.

**Fig. 3.** A: *P. gedrosiaca*, B: *P. tragium*, C: *P. dichotoma*, D: *P. saxifraga*, E: *P. peucedanifolia*.

**Geographical distribution:** East of Anatolia, Iran, Turkmenistan, Armenia, Georgia.

**Specimens seen in Iran**
Ardebil: Rajamand 8821 (TARI), Mozaffarian 64252 (TARI); Azarbaijan: Rechinger 43783 [=Terme 43783] (W), Mozaffarian & Mohammadi 37403 (TARI), Foroughi & Assadi 13736 (TARI), Mozaffarian & Mohammadi 37719 (TARI), Assadi & Sardabi 24431 (TARI), Sabeti 8837 (TARI), Rechinger 32662, 32679 (W), Zehzad & Siami 3263 (TARI), Zehzad & Siami 3569 (TARI), Kuhafkan & Amini 7446 (TARI), Rechinger 49541 (W), Assadi & Olfat 68629 (TARI), Siami & Zehzad 3654 (TARI); Chaharmahal & Bakhtiari: Mozaffarian 57736 (TARI); Esfahan: Yusefi 1411 (TARI), Yusefi 1603 (TARI), Yusefi 1942 (TARI), Yusefi 1314 (TARI); Khorasan: Rechinger 53734 (W), Assadi & Massoumi 21382 (TARI), Assadi & Massoumi 21371 (TARI), Assadi & Massoumi 21273 (TARI); Khuzestan: Pabot 887 (TARI); Kohgiluye & Boyer Ahmad: Assadi & Abouhamzeh 46069 (TARI), Riazi 8838 (TARI); Kordestan: Rechinger 42741 (W), Rechinger 49203 (W); Markazi: Mozaffarian & Massoumi 48125 (TARI), Mozaffarian 63823 (TARI), Assadi & Shirdelpur 13138 (TARI), Assadi & Mozaffarian
36748 (TARI); Mazandaran: Dini & Arazm 22497 (TARI); Qazvin: Foroughi & Hariri 22180 (TARI); Semnan: Wendelbo & Cobham 13665 (TARI), Assadi & Mozaaffarian 40336 (TARI), Assadi & Mozaaffarian 40483 (TARI), Assadi & Mozaaffarian 40763 (TARI), Wendelbo & Foroughi 12986 (TARI), Assadi & Massoumi 21210 (TARI), Assadi & Mozaaffarian 40422 (TARI); Sistan & Baluchestan: Mozaaffarian 52958 (TARI); Tehran: Aellen 1294 [=Manoutcheri & Aellen 1294] (W), Mozaaffarian 53827 (TARI), Mozaaffarian 54020 (TARI), Dini & Arazm 22119 (TARI), Dini & Arazm 22304 (TARI), Dini & Arazm 22430 (TARI), Amin 22474 (TARI), Mozaaffarian 54147 (TARI), Assadi & Mozaaffarian & Jamzad 33600, 33601, 33602 (TARI), Mozaaffarian 45425 (TARI), Assadi & Mozaaffarian 30815 (TARI), Assadi & Mozaaffarian 30818 (TARI), Bighdeli 78403 (TARI), Mozaaffarian 37344 (TARI). (Fig. 1E).

(Fig. 3. continued) F: P. eriocarpa, G: P. rhodantha, H: P. puberula, I: P. olivieri, J: P. kotschyan.


*Characteristics*

Plant annual, erect, puberulous or subglabrous. Basal and cauline leaves triangular, simple or 1-3-pinnate, petiolate or sometimes in cauline leaves only with sheath; all segments linear-filiform. Rays 2-9, almost equal; Pedicels 6-18, almost equal. Without Bracts and Bracteoles. Petals white or pink, obcordate or obovate, glabrous or rarely hairy on the base of outer side. Fruit ovate, pubescent; Stylopodium conical; Styles glabrous.
Geographical distribution: Iraq, West and South of Iran.

Specimens seen in Iran:
Chaharmahal & Bakhtiari: Koelz 15271 (W), Mozaffarian 54898 (TARI); Fars: Mozaffarian 45849 (TARI), Mozaffarian 45965 (TARI), Mozaffarian 46730 (TARI), Jamzad & Taheri & Javidtash 69311 (TARI), Jamzad & Taheri & Javidtash 69303 (TARI), Riazi 9316 (TARI), Riazi 8829 (TARI), Babek 16 (TARI); Hormozgan: Mozaffarian & Banihashemi & Shahinzadeh 44005 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 44047 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39148 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39315 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39166 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39264 (TARI), Mozaffarian 44388 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 44183 (TARI), Mozaffarian 44881 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39565 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39502 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39488 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 43975 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39738 (TARI), Mozaffarian 44974 (TARI), Babakanlou 23088 (TARI), Mozaffarian 59202(TARI), Mozaffarian 49620 (TARI), Mozaffarian 49805 (TARI), Mozaffarian 49868 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39652 (TARI); Kerman: Edmondson & al 1892 (TARI), Assadi & Miller 25136 (TARI), Assadi & Miller 25240 (TARI); Kermanshah: Safaeian 447 (TARI); Khuzestan: Riazi 9527 (W), Dadashzadeh 753 (TARI), Assadi & Abouhamzeh 38759 (TARI), Pabot 29961 (TARI), Pabot 1110 (TARI); Lorestan: Pabot 2004 (TARI), Veiskarami 24018 (TUH), Rechinger 47872 (W), Jacobs 6789 (W); Tehran: Babakanlou
= *Reutera deverroides* Boiss., (1844).

This species is one of the endemic species in Iran and it grows in west and south parts of Iran.

*Characteristics*
Plant perennial, erect, pubescent or in upper parts subglabrous. Stem dichotomously branched above. Basal leaves oblong, 1-pinnate, petiolate. Cauline leaves ovate, linear or lanceolate, simple or 1-pinnate, with petiole and sheath or in upper leaves only with sheath. Rays 2-6, almost equal; Pedicels 2-8, almost equal. Bracts and bracteoles absent or rarely with 1 linear bract. Petals yellow, ovate or obovate, hairy on the outer side. Fruit ovate or elliptic, pubescent; Stylopodium mamillate; Styles glabrous.

*Geographical distribution:* Iran (Endemic).

*Specimens Seen in Iran*
Esfahan: Auch. 4634 (W), Stapf 1436 (W); Hamedan: Moussavi & Satei 40402-E (W), Mozaffarian 65092 (TUH); Lorestan: Koelz 18491 (W). (Fig. 1G).

(Fig. 3. continued) P: P. anisactis, Q: P. barbata, R: P. affinis, S: P. aurea, T: P. khayyamii.


*Characteristics*

*Geographical distribution:* Iran (Endemic).

*Specimens Seen in Iran*
Kermanshah: Mirabdollahi 2732 (TARI); Esfahan: Mozaffarian 58251 (TARI); Yazd: Foroughi 1920 (TARI); Tehran: Mozaffarian 63816 (TARI); Arak: Mozaffarian 63799 (TARI). (Fig. 1U).
= *P. tenuis* Sieber ex Schultes (1820) non Wolff (1972); *P. moabitica* Post, (1895).

**Characteristics**  
Plant annual, erect, puberulous or in upper parts glabrous. Basal leaves simple, lamina round or ovate, with petiole and sheath. Cauline leaves ovate or triangular or triangular-ovate, 1-3-pinnate, with petiole and sheath or in upper leaves only with sheath. Rays 2-14, almost equal; Pedicels 7-19, almost equal. Without Bracts and Bracteoles. Petals white or pink, obcordate or obovate, hairy on base of the outer side. Fruit ovate, pubescent; Stylopodium elongate-conical; Styles glabrous.

**Geographical distribution:** Southeast of Anatolia, Palestine, North of Syria, Iraq, West and South of Iran.

**Specimens Seen in Iran**  
Bushehr: Runemark & Mozaffarian 26825 (TARI), Runemark & Mozaffarian 26889 (TARI), Runemark & Mozaffarian 27104 (TARI); Chaharmahal & Bakhtiari: Mozaffarian 54668 (TARI), Mozaffarian 54902 (TARI), Mozaffarian 59903 (TARI), Nowroozi 2636 (TARI), Mozaffarian 54480 (TARI); Fars: Kasi 413 (W), Mozaffarian 45839 (TARI), Mozaffarian 45877 (TARI), Wendelbo & Foroughi 17778 (TARI), Assadi & Sardabi 41798 (TARI), Riazi 9285(TARI), Riazi 9305 (TARI); Hormozgan: Mozaffarian 44369 (TARI), Mozaffarian 44686 (TARI), Mozaffarian 44817 (TARI), Foroughi 16154 (TARI), Mozaffarian 59163 (TARI), Ghahreman & Mozaffarian 5598 (TUH), Mozaffarian & Banihashemi & Shahinzadeh 39780 (TARI), Foroughi 16122 (TARI), Mozaffarian 44957 (TARI), Mozaffarian & Banihashemi & Shahinzadeh 39472 (TARI), Foroughi 1174 (TARI), Mozaffarian 49944 (TARI); Ilam: Jacobs 6838 (W); Khuzestan: Riazi 9501 (TARI), Assadi & Abouhamzeh 38767 (TARI), Assadi & Abouhamzeh 38745 (TARI), Assadi & Abouhamzeh 38728 (TARI), Riazi 9421 (TARI), Assadi & Abouhamzeh 39033 (TARI); Kohgiluye & Boyerahmad: Bakhtiar & Iravanzadeh 3 (TARI); Lorestan: Koelz 15721 (W), Veiskarami 24019 (TUH), Raehani 25124 (TARI), Iranshahr & Moussavi 40299-E (W). (Fig. 1H).

= *Trachyspermum gedrosiacum* (Bornm.) Hedge, (1987).

**Characteristics**  
Plant perennial, prostrate, pubescent. Basal leaves triangular-ovate, 3-4-pinnate, petiolate. Cauline leaves similar to basal leaves but reduced, 1-4-pinnate. Rays 5-8, unequal; Pedicels 10-20. Bracts 5, linear-lanceolate; Bracteoles 5-8, linear-lanceolate. Petals white or red, ovate, hairy on the outer side. Fruit ovate, pubescent; Stylopodium conical.

**Geographical distribution:** Iran (Endemic).

**Specimens Seen in Iran**  
Baluchestan: Mozaffarian 53039 (TARI), Mozaffarian 53087 (TARI), Mozaffarian 22844 (TARI). (Fig.1D).


*P. khayyamii* is also one of the endemic species in Iran and its distribution is limited to a small part in east of Iran.

**Characteristics**  
Plant perennial, erect, pubescent. Basal leaves 1-pinnate, ovate or narrow ovate, with petiole and sheath. Cauline leaves absent or reduced, lanceolate or narrow ovate or linear, simple or 1-pinnate, with petiole and sheath or in upper leaves without petiole.  
Rays 3-12, unequal; Pedicels up to 8, unequal. Bracts rarely 1(-2), lanceolate; bracteoles rarely 1, linear. Petals white, obcordate or ovate, glabrous or puberulous. Fruit ovate, glabrous; Stylopodium depressed; Styles glabrous.
Geographical distribution: Iran (Endemic).

Specimens Seen in Iran
Khorasan: Mozaffarian 48943 (TARI), Mozaffarian 48910 (TARI), Mozaffarian 48633 (TARI), Mozaffarian 48672 (TARI). (Fig. 1I).


This species is endemic in Iran and distributes only in the east.

Characteristics
Plant perennial, erect, pubescent or sometimes in upper parts subglabrous. Basal leaves ovate or narrow ovate, 1-pinnate with petiole and sheath. Cauline leaves ovate or triangular-ovate, or lanceolate-subulate, simple or 1-3-pinnate, with petiole and sheath or in upper leaves only with sheath. Rays 5-21, almost equal; Pedicels 7-21, unequal. Bracts (0-1)-5(-7), lanceolate or pinnate; Bracteoles 1-5(-9), linear or lanceolate. Petals white, obcordate, hairy along the midrib on the outer side. Fruit ovate or globose, pubescent; Stylodium depressed; Styles puberulous.

Geographical distribution: Anatolia, North of Iraq, Iran.

Specimens Seen in Iran
Azarbaijan: Lamond & Iranshahr 40841 (W), Rechinger 42130 (W), Mozaffarian 70047 (TARI), Zehzad & Siami 3448 (TARI), Mozaffarian 87417 (TARI), Rechinger 42110 (W), Mozaffarian 70043(TARI), without collector 3011(TARI); Chaharmahal & Bakhtiari: Mozaffarian 57358 (TARI), Mozaffarian 57866 (TARI), Mozaffarian 57499 (TARI); Hamedan: Mozaffarian 65066 (TARI), Mozaffarian 64580 (TARI); Kermanshah: Assadi 60698 (TARI), Hamzehee 1180 (TARI), Attar & Mirtajadini & Sheikholeslami 19878 (TUH), Hamzehee & Hatami 1347 (TARI); Kordestan: Rechinger 49135 (W), Fattahi & Tavakoly & Hatami 2409 (TARI), Rechinger 42748 (W), Fattahi & Khaledian 219 (TARI), Assadi 75263 (TARI), Ghahreman & Mozaffarian 18287 (TARI), Rechinger 42893 (W), Rechinger 42509 (W), Rechinger 42993 (W), Babakhanlou 31032 (TARI), Rechinger 43118 (W); Markazi: Mozaffarian 64081 (TARI), Mozaffarian 63861 (TARI); Tehran: Assadi & Jamzad 55262 (TARI), Rechinger 53815 (W); Zanjan: Sabeti 22068 (TARI). (Fig. 1K).


Characteristics
Plant perennial, monocarpic, erect, pubescent, stem corymbosely branched. Basal leaves oblong, ovate or triangular, 1-3-pinnate, with petiole and sheath.

Geographical distribution: Iran (Endemic).

Specimens Seen in Iran
Khorasan: Iranshahr & Zargani 15356-1 (W), Termeh & Moussavi & Tehrani 41506-1 (W), Iranshahr & Zargani 40398-1 (TARI), Iranshahr 15348-1 (W), Assadi & Masoumi 21371 (TARI), Assadi & Masoumi 21382(TARI). (Fig. 1J).


Characteristics
Plant perennial, monocarpic, erect, pubescent, stem corymbose- branched. Basal leaves ovate-oblong, ovate or triangular-ovate, 1-3-pinnate, with petiole
and sheath. Cauline leaves ovate, triangular-ovate or lanceolate, simple or 1-2-pinnate, with petiole and sheath, sometimes petiole absent. Rays 5-13(-16), almost equal; Pedicels 8-26, almost equal. Bracts 2-9, linear, lanceolate or sometimes pinnate; Bracteoles 5-15, linear or narrow lanceolate. Petals white, obcordate, hairy on the outer side. Fruit ovate or subglobose, pubescent; Stylopodium depressed; Styles puberulous.

**Geographical distribution**: Iran, Iraq.

**Specimens Seen in Iran**

Kermanshah: Attar & Mirtajadini & Sheikholeslami 19928 (TUH); Kohgiluye & Boyerahmad: Behboudi 1191-E (W), Assadi & Mozaffarian 31146 (TARI); Kordestan: Rechinger 43084 (W), Attar & Dadjou & Mehdigholi & Okhovat 14278 (TUH), Mozaffarian 87376 (TARI); Lorestan: Rechinger 47676 (W), Assadi & Mozaffarian 37025 (TARI), Assadi & Mozaffarian 37199 (TARI), Assadi & Mozaffarian 37053 (TARI), Koelz 18445 (W), Koelz 18232 (W); Markazi: Mozaffarian 48290 (TARI). (Fig. 1L).


**Characteristics**

Plant perennial, erect, puberulous or subglabrous. Lower leaves ovate or oblong-ovate, 1-pinnate, with petiole and short sheath. Upper leaves lanceolate or linear-lanceolate, simple or 1-pinnate, usually without petiole and only with sheath. Rays 3-6(-10), almost equal; Pedicels 5-10, almost equal. Without Bracts and Bracteoles. Petals yellow, ovate, hairy on the outer side. Fruit ovate, glabrescent; Stylopodium mamillate; Styles glabrous.

**Geographical distribution**: Iran (Endemic).

**Specimens Seen in Iran**

Kordestan: Haussknecht s.n. (W). (Fig. 1N).


= Reutera pastinacifolia Boiss. (1844).

This is one of the endemic species of Iran and distributes in the West and South.

**Characteristics**

Plant perennial, erect, puberulous or subglabrous. Lower leaves ovate or oblong-ovate, 1-pinnate, with petiole and short sheath. Upper leaves lanceolate or linear-lanceolate, simple or 1-pinnate, usually without petals and only with sheath. Rays 3-6(-10), almost equal; Pedicels 5-15, almost equal. Without Bracts and Bracteoles. Petals yellow, ovate, hairy on the outer side. Fruit ovate, glabrescent; Stylopodium mamillate; Styles glabrous.

**Geographical distribution**: Iran (Endemic).

**Specimens Seen in Iran**

Kermanshah: Farahbakhsh 6126-E (W); Khuzestan: Riazi 9396 (W); Lorestan: Koelz 18628 (W); Markazi: Mozaffarian 11115 (TUH). (Fig. 1M).


**Characteristics**

Plant perennial, erect, in lower parts pubescent, in upper parts subglabrous. Basal leaves ovate-oblong, ternate-pinnate, with petiole and sheath. Cauline leaves ovate, triangular-lanceolate or linear, simple or 1-2-pinnate, usually only with sheath. Rays 4-10(-17), unequal; Pedicels 5-15, unequal. Bracts and bracteoles absent, or rarely with 1-2 linear or lanceolate bracts. Petals white or pink, ovate, glabrous or hairy on the outer side. Fruit oblong-ovate, glabrous; Stylopodium mamillate; Styles glabrous.

**Geographical distribution**: Turkey, Iran, Soviet Units.
Specimens Seen in Iran
Azarbaijan: Mozaffarian 72750, 74894 (TARI), Akbarzadeh 41 (TARI), Zehzad 3214 (TARI), Sabeti 8804 (TARI), Mozaffarian 77150 (TARI). (Fig. 1O).


Characteristics
Plant annual, erect, pubescent. Basal leaves simple, lamina round or ovate, with petiole and sheath. Cauline leaves ovate or triangular, simple or 1-4-pinnate, with or without petiole. Rays 3-26, unequal; Pedicels 5-25, unequal. Without Bracts and Bracteoles. Petals white, obcordate, hairy on the outer side. Fruit ovate or ovate-globose, pubescent; Stylpodium depressed; Styles glabrous.

Geographical distribution: Southeastern of Anatolia, Jordan, Iraq, Iran, Turkmenistan, Afghanistan, Northwestern of Pakistan.

Specimens Seen in Iran
Azerbaijan: Lamond & Terme 9926 (W). (Fig. 1Q).


Characteristics
Plant perennial, erect, glabrous or puberulous. Basal leaves oblong-ovate, 1-2-pinnate, with petiole and sheath. Cauline leaves ovate or narrow ovate, 1-2-pinnate, with petiole and sheath or only with sheath. Rays 9-20, almost equal; Pedicels 12-20, almost equal. Without Bracts and Bracteoles. Petals white or pink, obcordate, glabrous or hairy on the outer side. Fruit ovate, glabrous; Stylpodium depressed; Styles glabrous.

Geographical distribution: Eastern part of Anatolia, Northern part of Iran, Armenia.

Specimens Seen in Iran
Azerbaijan: Lamond & Terme 9926 (W). (Fig. 1Q).


Characteristics
Plant perennial, erect, puberulous or subglabrous. Basal leaves oblong-ovate, 1-pinnate, with petiole and sheath. Cauline leaves ovate or linear-lanceolate, simple or 1-pinnate, without petiole and only with sheath. Rays 5-18, almost equal; Pedicels 7-25, almost equal. Bracts absent or rarely up to 5, linear or subulate; Bracteoles absent or rarely up to 5, linear. Petals white, obcordate or obovate, glabrous or hairy on the outer side. Fruit ovate or elliptic, glabrous; Stylpodium depressed-mamillate; Styles glabrous.

Geographical distribution: Europe to center and southwestern part of Asia.

Specimens Seen in Iran
Azerbaijan: Mozaffarian & Jamzad 33573 (TARI), Bighdeli 78405 (TARI), Sabeti 22026 (TARI). (Fig. 1P).

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Azarbaijan: Terme 13654-E (W), Akbarzadeh 10 (TARI), Runemark & Assadi 21886 (TARI). (Fig. 1R).


This is one of the other species in Iran and it distributes in North, West and Center of Iran.

**Characteristics**

Plant perennial, erect, usually glabrous sometimes in lower parts pubescent. Basal leaves oblong, 1-pinnate, with petiole and sheath. Cauline leaves ovate or linear-subulate, simple or 1-pinnate, with petiole and sheath or sometimes only with sheath. Rays 2-11, almost equal; Pedicels 3-13, almost equal. Bracts and bracteoles absent or rarely with 1-2 linear bracteoles. Petals yellow, ovate, glabrous or hairy on the outer side. Fruit ovate-elliptic, glabrous or puberulous; Stylopodium mamillate; Styles glabrous.

**Geographical distribution:** Southern and Central part of Europe, Northern part of Africa, Southwestern of Asia.

**Specimens Seen in Iran**

Ardabil: Lamond 4709 in Rechinger 44044 (W), Said Amini 24140 (TARI), Rajamand 8853 (TARI), Mozaffarian & Nowrozi 34212 (TARI), Mozaffarian & Nowrozi 35000 (TARI), Rechinger 43483 (W), Wendelbo & Assadi 18453 (TARI), Mozaffarian & Mohammadi 37757 (TARI), Zehzad & Jamzad & Taheri & Izadpanah 70490 (TARI); Azarbaijan: Rechinger 49346 (W), Tarighi 11174 (TUH), Rechinger 48874 (W), Termeh & Moussavi & Habibi 38801 (W), Runemark & Assadi 21857 (TARI), Assadi & Sardabi 24192 (TARI), Mozaffarian & Nowrozi 35177 (TARI), Mozaffarian & Mohammadi 37400, 37509 (TARI), Rechinger 43904 (W), Mozaffarian & Mohammadi 37675 (TARI), Rechinger 43547 (W), Olfat & Jabbari 284 (TARI), Rechinger 49345 (W), Mozaffarian 69927 (TARI), Rechinger 41861 (W), Assadi & Taheri & Izadpanah 68477 (TARI), Rechinger 48738 (W), Rechinger 43940 (W), Assadi & Olfat 68911 (TARI), Assadi & Mozaffarian 30466 (TARI); Chaharmahal & Bakhtiari: Mozaffarian 57254 (TARI), Mozaffarian 57221 (TARI), Mozaffarian 57586 (TARI), Mozaffarian 57526 (TARI), Mozaffarian 58112 (TARI); Esfahan: Rechinger 47653 (W); Fars: Mozaffarian 45790 (TARI), Gilan: Hariri & Foroughian 22148, 22149 (TARI); Golestan: Rechinger 6060 (W), Amini 8814 (TARI), Wendelbo & Foroughi 3133 (W), Wendelbo & Cobham 14244 (TARI), Wendelbo & Foroughi 12670 (TARI), Assadi & Masoumi 21506 (TARI); Hamedan: Mozaffarian 64966 (TARI), Safaeian 693 (TARI); Kermanshah: Hamzehi 1244 (TARI), Assadi 60698 (TARI); Khorasan: Rechinger 1666, 4785 (W), Rechinger 1639 (W), Mozaffarian 48850 (TARI), Edmondson 1291 (TARI), Assadi & Masoumi 21437 (TARI), Mozaffarian 48738 (TARI), Mozaffarian 48424 (TARI), Mozaffarian 48495 (TARI), Saghaei & Mohamadzadeh 87 (TARI), Rechinger 53547 (W); Kohgiluye & Boyerahmad: Assadi & Abouhamzeh
Dicussion

After taxonomical studies on genus *Pimpinella* L. in Iran some of the most important characters are selected (Table 1).

Based on these characters and by means of NTSYS, a dendrogram was sketched giving the following results (Fig. 2):

In this dendrogram two major clusters are seen:
The first (upper) cluster falls into two subclusters including 13 species. The second one in turn, has two subclusters, including seven species.

In the upper cluster and in the first subcluster four species (*P. affinis*, *P. barbata*, *P. eriocarpa* and *P. puberula*) can be separated from the others at 0.54. *P. barbata*, *P. eriocarpa* and *P. puberula* are the annual species of genus *Pimpinella* in Iran whereas *P. affinis* is a biennial one. These are mainly distributed in western and southern parts of Iran. However, *P. puberula* is also distributed in central and eastern parts. Among these annual species, *P. barbata*, can be distinguished by linear-filiform leaf segments. Other two species were placed close to each other in a recent research (Tabanca *et al.*, 2005) based on DNA sequence data. The main difference between them is that the stylopodium shape in ripe fruit is depressed in *P. puberula* and elongate-conical in *P. eriocarpa*. These two species are separated at 0.90.

In addition, these two species were placed close to each other in a recent research (Tabanca *et al.*, 2005) based on DNA sequence data. The main difference between them is that the stylopodium shape in ripe fruit is depressed in *P. puberula* and elongate-conical in *P. eriocarpa*. These two species are separated at 0.90.

The second subcluster of this cluster includes nine species which are categorized in two groups. In this clade *P. anisactis, P. khorasanica, P. khayyamii* & *P. tragiurn* forms the first group. These four species have some common morphological similarities. In addition, the first three species are ecologically very close to each other. They are endemic to Iran and are distributed only in a small part of Khorasan province. On the other hand, the first two species (*P. anisactis*
and *P. khorasanica*) are separated from the other two at 0.75. The characteristics of *P. khayyamii* and *P. tragium* are: absence of petiolule in lower cauline leaves, absence or presence of bract and bracteole and relative size of rays (equal or almost unequal) which can be considered as the differences between these two species and *P. anisactis* - *P. khorasanica*. The dissimilarity between *P. anisactis* and *P. khorasanica* is in basal leaves shape (triangular-ovate in *P. anisactis* and ovate or narrow ovate in *P. khorasanica*), length of petiolule of basal leaves (7-15 mm in *P. anisactis* and 1-7 mm in *P. khorasanica*), division type of lower cauline leaves (1-2-pinnate in *P. anisactis* and 1-pinnate in *P. khorasanica*) and division type of upper cauline leaves (simple or 1-pinnate in *P. anisactis* and simple in *P. khorasanica*). These two species are separated from each other at 0.84. On the other hand *P. tragium* can be distinguished from *P. khayyamii* at 0.90 by absence of petiolule in basal leaves and pubescent fruits.

The species of the second group belong to Reutera group and the most important difference between these species and others is their yellow petals. Here, at first *P. aurea* is discerned from others at 0.80 due to its 2-3-pinnate basal leaves, 1-2-pinnate lower cauline leaves and subglobose ripe fruits. Then other two species, *P. deverroides* and *P. tragioides* can be distinguished at 0.90 based on pubescent ripe fruits in *P. deverroides* while in *P. tragioides* ripe fruits are puberulous or subglabrous. At 0.92, *P. dichotoma* and *P. pastinacifolia* are also discriminated based on pubescent ripe fruits in *P. dichotoma* and glabrescent ripe fruits in *P. pastinacifolia*.

The second (lower) major cluster consists of seven species in two subclusters: four of them (*P. kotschyana, P. oliveroides, P. olivieri* and *P. gedrosiaca*) are in one subcluster and three other species (*P. peucedanifolia, P. rhodantha* and *P. saxifraga*) are in the second one. These two subclusters are discerned at 0.56. In the first subcluster, at 0.67, *P. gedrosiaca* is well-defined from the other three species by its characteristic of prostrate life form. In the same way, in the group of three species, *P. olivieri* can be clearly discerned at 0.77 based on presence of vesicle or papilla instead of hair in its fruits. *P. kotschyana* and *P. oliveroides* can be separated at 0.87. The differences of *P. oliveroides* and *P. kotschyana* are: absence of petiolule in basal leaves and distribution type of hair in petals (only along the midrib on the outer side) in *P. kotschyana* while *P. oliveroides* has petiolulate basal leaves and its petals are hairy at whole outer side. In the last group of the second subcluster, *P. peucedanifolia* is clearly separated from *P. saxifraga* and *P. rhodantha* by ovate oblong fruits. On the other hand *P. saxifraga* and *P. rhodantha* are separated from each other at 0.80. These are morphologically similar. Also it has been presented that the DNA sequence data strongly support *P. saxifraga* and *P. rhodantha* as sister taxa (Tabanca et al., 2005). But they can be distinguished by division type of their basal leaves (1-pinnate in *P. saxifraga* and 1-2-pinnate in *P. rhodantha*), petiolule of basal leaves (absent in *P. saxifraga* and present in *P. rhodantha*), absence of bract and bracteole and pinkish petals that are rarely seen in *P. rhodantha*.

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