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A COMPARATIVE SYSTEMATIC STUDY OF THE GENUS *SYMPHYTUM* L. (BORAGINACEAE) WITH NEW FIRST RECORD OF THE SPECIES *SYMPHYTUM TUBEROSUM* L. FROM IRAQ.

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Abstract

The current study includes a comparative morphological study of the genus *Symphytum* L. within the family Boraginaceae in relation to the phenotypic study, the study of the external manifestations of pollen, the environment and geographical distribution. The study included the study of the characteristics of roots, stems, leaves, flowers, inflorescence, fruits and nutlets. Variation in characteristics was discussed and it was noted that the characteristics of flowers were more important in taxonomic terms in identification and isolating studied species. The study also indicated that the pollen of all studied species varies in form and size and have characteristics of taxonomic significance that may be adopted in the isolation and diagnosis of these species which studied for the first time in Iraq. The research has succeeded in surveying the Iraqi geographical districts to reveal the distribution of these taxa. Therefore, the researcher obtained a large number of samples and new sites were identified for the distribution of the studied taxa. All samples collected and those recorded in the Iraqi herbaria were studied. . *Symphytum kurdicum* Boiss. & Hausskn in Boiss. was found to be widely distribution, while *Symphytum tuberosum* L. was limited. Based on morphological and pollen characteristics of the studied taxa, *Symphytum tuberosum* was first recorded in refined in this study as it was added as a new first record of this species to flora of Iraq.

Key words: New first record, palynological characteristics, geographical distribution, Iraq.

Introduction

Family Boraginaceae are annual, biennial or perennial herbs, shrubs or trees, usually with hairs especially on the leaves. Alternate leaves, simple. Inflorescence initially a scorpioid or helicoid cymes that uncoils at anthesis. Flowers generally regular, bisexual or less often irregular. Calyx 5-lobed, often enlarging in fruit. Corolla 5 -lobed, salver, funnel form or campanulate. Stamens 5, epipetalous, alternating with the corolla lobes, equal or unequal. Filaments exerted beyond the corolla tube or not. Ovary contain four parts. Style gynobasic, stigma usually simple (Gottschling *et al.*, 2001 and Diane *et al.*, 2005). There are many authors has been estimated for recognizing the numbers of genera and species of Boraginaceae, according to (Ge-ling *et al.*, 1995) Boraginaceae rearranged in 156 genera and 2500 species are distributed through the Mediterranean and tropical region. Boraginaceae is one of the largest angiosperm families, comparison approximately 2000 species and almost 100 genera distributed thought the worldwide (Taia, 2006). But Hilger *et al.*, 2004 and Akçin *et al.*, 2013) are say that Boraginaceae comprises to 131 genera including 2500 species. The species of this family occur in dry, open habitats and mountains valleys. Economic importance and ornamental plants of Boraginaceae has a great value in medicinal plants and this family has a valuable compound such as pyrrolizidine alkaloids (Wollenweber *et al.*, 2002). The genus *Symphytum* L. native to European, but not common in United Kingdom, the common name in the most countries of the world is "comfrey and black-wort" (Gledhill, 2002). also that the genus *Symphytum* L. in Arabic is "Sanfitun", but in English is "Comfrey and black-wort" and in Turkish is called "Sinfit, Buyuk kara-kafes out" (Bdevian, 2006). Depending on Moradi (2015) *Symphytum* L. in Persian is called "Hmawr kurdi and Gwsh khr"but in Arabic is called "Azan hemar" and the common name used by the English "Comfrey and Kurdish Comfrey". The genus of *Symphytum* L. used like a medicine have a great value

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historically used to treat a wide variety of ailments ranging from bronchial problems, sprains, broken bones, arthritis, acne and skin conditions (Gomes *et al.*, 2007), some of the *Symphytum* species are common garden plants which used as ornamental plants in gardens and parks also used as a source of herbicides for 2000 years (De Jussien, 1789; Gurbuz, 1980 and Baytop, 1984), leaf and root of *Symphytum* species are used by lay public, herbalists and physicians for treatment of broken bones, tendon damage, ulcerations in the gastrointestinal tract, and lung congestion, these species are also rich in many crucial nutrients, such as protein, antioxidant, vitamins especially vitamin B12, and are common component in the diet of certain ethnic groups (Rode, 2002). *Symphytum* L. belongs to the Boraginaceae tribe Boragineae known as the mesophytic, these genus has 40 species distributed in Euro-Siberian region and 18 species from the Turkey with the beigest genus (APG II, 2003) and (Tarýkahya, 2010). The *Symphytum* is oldest genus in the world (Boissier, 1897) and (Kusnetsov, 1910). According to Fadhel *et al.*, (2010) were the most dominant plants at most of the sites and are considered the representative plants of Kurdistan such as Boraginaceae genera *Cynoglossum* Mill., *Solenanthus* and *Symphytum* L. According to De Jussien, 1789 taxonomic categories are:

Class: Angiospermae. Subclass: Magnoliopsida (Dicotyledons). Order: Lamiales. Family: Boraginaceae. Subfamily: Boraginoideae. Tribe: Boragineae G. Don, Gen Genus: *Symphytum* L. **a-** *S. kurdicum* Boiss. &Hausskn.in Boiss. **b-** *S. tuberosum* L. According to Al.Rawi (1964) only one species from the genus *Symphytum* (*S. kurdicum*) has distributed in (MAM & MRO) districts. Whereas Rechinger (1967) in Flora Iranica shared that the genera genus *Symphytum* (*S. kurdicum*) distributed in MAM, MRO and MSU districts of Iraqi Kurdistan region. Davis (1978) in Flora of Turkey stated that the species *Symphytum kurdicum* distributed in MAM, MRO and MSU districts in Iraqi Kurdistan region . According to Faris (1983) the species *Symphytum kurdicum* were recorded in MSU district (Pira Magrun Mountain). Ridda & Daood (1983) cited from (Al-Rawi, 1964) pointed that the species *Symphytum kurdicum* distributed in MAM, MRO and MSU districts.

The aim of this work is to study the genus *Symphytum* belong to Boraginaceae which grow naturally in Iraq especially in Kurdistan region of Iraq, one of them *Symphytum tuberosum* is a new record from Iraq, where some of them grows on very high altitude, more than 695 m to 2700 m which are not studied before, depending on the specimens from Iraqi Kurdistan region districts which has a wide ecological habitats and vegetation regions, also the specimens found in Iraqi herbarium and covered all aspect below:

1- Systematic study and survey of the taxa in different geographical of Iraq .
2- Herbarium and collected specimens of these genera will be identified by morphological study, including (root, stem, leaf, flower, inflorescence and seeds) then the differences and similarities among these species will be discussed depending on the data collected from the field.
3- Study of the pollen grains.
4- Ecological study and geographical distribution.

Materials and methods

Field trips

The study based on the fresh specimens, collected from Iraqi Kurdistan region in a different place, which is started in March 2015 and continued till December 2015, in this study we visit 24 different fields for the survey also collecting all species in this study which belongs to family Boraginaceae. The places visited more than twice trips to known everything's about all the stage life cycle of plants and recorded all the information about the plant name, collector name, soil type, ecological distribution, plant population and measuring height sea level, altitude and latitude by Global positioning system (GPS) during the field trips. The photo of plants has been taken for this study by using camera (Sony, 12.3 Mega Pixel). During the trips for each plant species, 25 specimens have been collected or more in a different place. The study survey for the taxa involved different districts of Iraqi including (MAM, MRO, MSU, FAR, FPF, FNI and FKI Districts).

Drying of the specimens

After the plant collection from the fields, the living plants treated in a Sulaimani polytechnic university-Technical College of Applied Sciences Herbarium (SPUH). The plants have been dried by utilizing newspapers and cardboard in a room temperature for absorbing moisture specimens by newspapers. Repeating the process of drying for 7 days was done to make the herbarium specimens.

Mounting and Labeling of specimens

The specimens were hold very carefully then adhered to the white rectangular boards that have standard size. The labeling was done by giving them special numbers, herbarium name, district name, scientific name, common names, position, date of collection, the altitude, GPS coordination, type of soil and the name of collector with other required information. Then, the samples were saved

in the herbarium of Sulaimani polytechnic university-Technical College of Applied Sciences (SPUH)*.

Morphological study

This study used methods to illustrate, describe and assess the taxonomic significance of morphological features of the genus *Symphytum* Boss. belonging with Boraginaceae. Herbaria used for on this study are listed in (table 1) and the terminologies which employed are in accordance with the followings: De Jussien (1789), Zohary (1946), Blakelock (1949), Lawrence (1951), Rechinger (1964), Guest (1966), Rechinger (1967), Davis (1978), Mill (1979), Al-Musawi (1987), Al-Zubaidy (1989), Musa (1989), Saeed (1990), Abbas (1991), Al-Mashhadani (1992), Stace (2010) and Cohen (2014). This study depended on the specimens which collected by many Researcher from all over districts of Iraqi Kurdistan region and depended on the herbarium specimens of the (BUH), Baghdad university herbarium, (BAG), National herbarium of Iraq, (BUNH); National History Research Center and Museum, (ESUH); Education College of Salahaddin University Herbarium, (SUFA); Suleimani University Faculty of Agriculture Sciences Herbarium and (SPUH) Suleimani Polytechnic University Herbarium. (table .1.)

Table 1: Herbaria used during the study (Holmgren and Keuken, 1964).

ASUH	Erbil, Iraq: College of Science, University of Salahaddin.
BAG	Baghdad, Iraq: National Herbarium of Iraq.
BUE	Baghdad, Iraq: Dep. of Biology College of Education, University of Baghdad.
BUH	Baghdad, Iraq: The University Herbarium, College of Science.
BUNH	Baghdad, Iraq: National History Research Center and Museum
ESUH	Erbil, Iraq: Dep of Biology College of Education, University of Salahaddin.
SUFA	Sulaimani, Iraq: Sulaimani University Faculty of Agricultural Sciences.

(SPUH)* Sulaimani polytechnic university- Technical College of Applied Sciences herbarium (under construction).

Results and Discussion

Root

The species of genus *Symphytum,* are perennial, plants grows in clay and sandy soil have large root system and increased branches elongation, but those which grow in rocky places, limestone soil and between splits of rocky place has strong and thick roots with few branches (Mahmood, 2008). The root system of *Symphytum* species are different by having type of root system, have different types of root system regular or irregular and variation in a dimensions of roots and branches extension. Plants with taproots included *Symphytum kurdicum*, length ranged 6-19 cm with width root ranged 4-9 mm and black to brown color with villous Indumentums. the species of *Symphytum tuberosum* L. with Tubular roots, the length ranged (12-18) cm with width root ranged (6-11) mm and Light-green coverd with hirsute-pilose. (fig. 1).

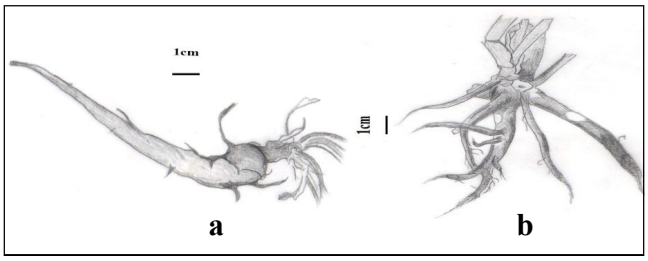

Fig. 1: Roots morphology: a- *Symphytum tuberosum*; **b-***Symphytum kurdicum.*

Stem

The stems in all species of this study are hairy, erect with different colors, this information was obtained from the present results, also that stems in *Symphytum tuberosum* is cylindrical when *Symphytum kurdicum* with quadrangular stem, however variation were appeared in dimension, mode, branches number, color and indumentums. the length of the stem is ranged between 32-51.5 cm with *S. tuberosum* as a minimum and *S. kurdicum* as a maximum, but the width ranged between 3.5-6 mm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum.

Leaf

The leaves of all studied species from genus *Symphytum* are simple and alternate arrangement in all species, leaves show high differences in blade shapes, margin, indumentums, apex, base, petiole and having variation in dimensions depending on positions (lower, middle, and upper cauline leaves). The shape of lower cauline leaves in the genus *Symphytum* are elliptic, elliptic to ovate bases cuneate and the margin are entire and undulate but the blade length ranged between 8.25-9.5 cm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum and width ranged between 2.5-4 cm in *S. kurdicum* as a minimum and *S. tuberosum* as a maximum, while the petiole length ranged between 4.5-6 cm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum, with puberulent and hispid. (fig. 2a, b). Middle cauline leaves are ovate to lanceolate, elliptic to lanceolate, margin

is crenate, entire, apex acute and cuneate bases, while the blade length ranged between 6.5-7.5cm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum, but width ranged between 2-2.25cm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum with the length petiole ranged between 3.5-6.5cm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum. The middle and upper cauline leaves of all studied genera also showed important taxonomic variation in their vegetative characters in shape, margin, apex, base, indumentum and dimensions of blade and petiole (fig. 2c, d). In all studied taxa in present study the shape of upper cauline leaves are sessile and alternate. The shape of upper cauline leaves in the genus *Symphytum* are elliptic, elliptic to ovate, acute apex, crenate margin and entire, while the blade length ranged between 6-6.25cm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum, with width ranged between 1.75-2cm in *S. kurdicum* as a minimum and *S. tuberosum* as a maximum. (fig. 2e, f). The shape of bracts in the genus *Symphytum* is elliptic or ovate, also that the margin crenate and entire, while the blade length ranged between 4.5-5cm in *S. kurdicum* as a minimum and *S. tuberosum* as a maximum, with the width ranged between 1.75-2.25cm in *S. kurdicum* as a minimum and *S. tuberosum* as a maximum. All the studied species are non-bracteolate. (fig. 2g, h).

Inflorescences: Boraginaceae Family members have cymose inflorescences, the cymes being scorpioid or circinnate or rarely thyrsoid, cymes bracteate or ebracteate and terminal or axillary inflorescence (Mill, 1979; Akçin *et al.*, 2013). Inflorescence system in the genus *Symphytum* inflorescence terminal, cymes bracteate, with a few flowers the number of flower in each inflorescence ranged between (8-9) flowers in *S. kurdicum* as a minimum and in *S. tuberosum* as a maximum, with the various dimensions inflorescence which ranged between (7.5- 10.5) × (4-4.75) cm in species *S. kurdicum* as a minimum and in *S. tuberosum* as a maximum, but the peduncle dimensions ranged between (3-4) × (0.15-0.2) cm in *S. kurdicum* as a minimum and in *S. tuberosum* as a maximum and the pedicle length ranged between (0.6-0.75) cm in *S. kurdicum* as a minimum and in *S. tuberosum* as a maximum (fig..3 a1, b1).

Flowers and flowering Calyx

The flower in all studied taxa are perfect, bisexual, determinate inflorescence and actinomorphic symmetry. Concerning the shape of flowering Calyx in all studied taxa can be divided into two groups. (fig. 3: a2, b2).

A- Sepals divided from the base for five sepals included the species *S. tuberosum* , each sepals are liner-

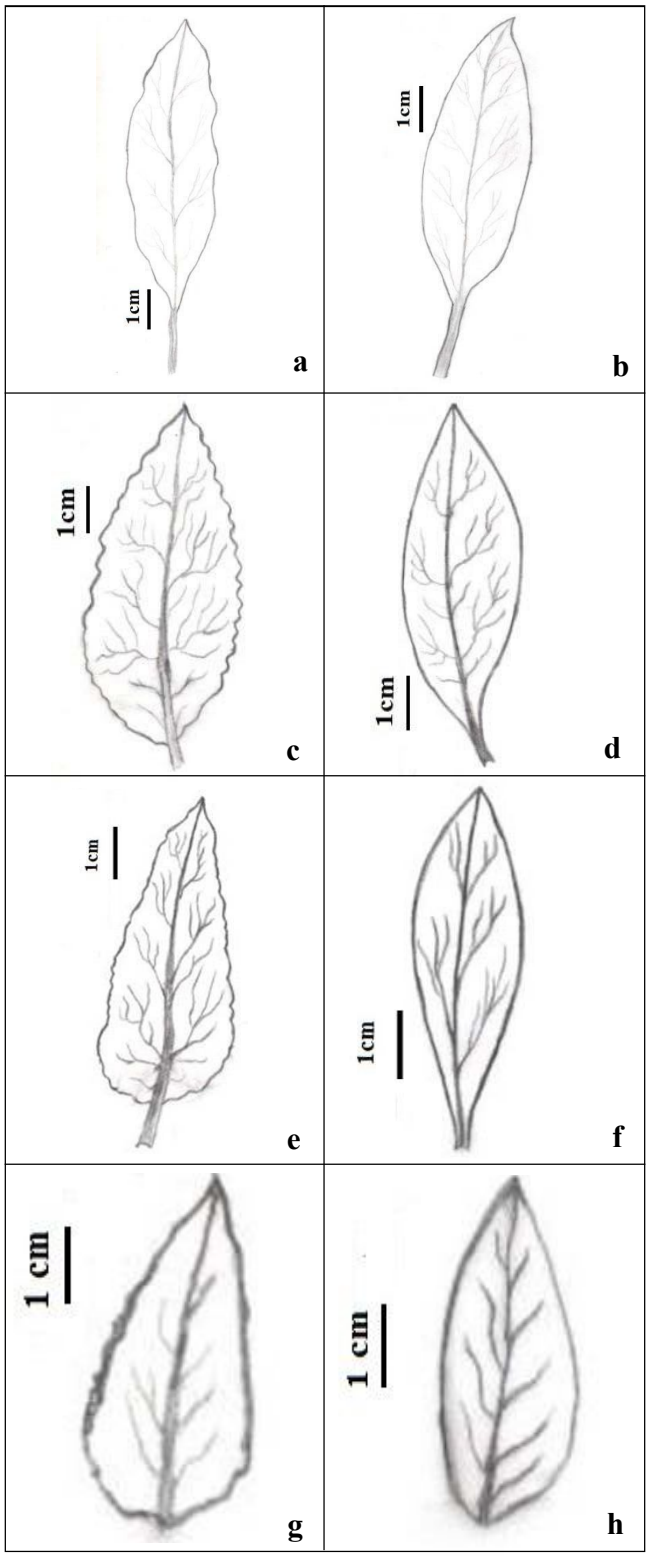

Fig. 2: Cauline leaves & Bracts morphology: Lower cauline leaf:**a-** *Symphytum kurdicum* **b-** *Symphytum tuberosum*; **Middle cauline leaf: c-***Symphytum kurdicum* **d-** *Symphytum tuberosum*; **Uper cauline leaf: e-** *Symphytum kurdicum* **f-** *Symphytum tuberosum*; **Bracts: g-** *Symphytum kurdicum* **h-** ***Symphytum tuberosum* .**

lanceolate, obtuse apex and average dimension are 5.5×2 mm.

B- Sepals divided near the middle of calyx have teeth just in the species S. kurdicum the average length of tube is 2.5 mm, with the calyx teeth dimensions' average 3.5×1 mm.

Corolla

Corolla in all studied taxa have five petals, alternate with the sepals, different colors and various shapes, the shape of corolla is narrowly clavate to sub-cylindrical and tubular, with the white and cream or yellow color the length petals ranged between 14-17.25 mm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum, but the width corolla ranged between 3.75-4 mm in the species *S. kurdicum* as a minimum and species *S. tuberosum* as a maximum, however the corolla tube length ranged between 12.25-16 mm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum, but the width tube ranged between 2.25-3.5 mm, with the comparative limps in *S. tuberosum* sharped thin to the species *S. kurdicum* while the dimensions of the limps ranged between 1-1.5×1.25-2 mm in *S. kurdicum* as a minimum and *S. tuberosum* as a maximum (fig. 3: a2, b2).

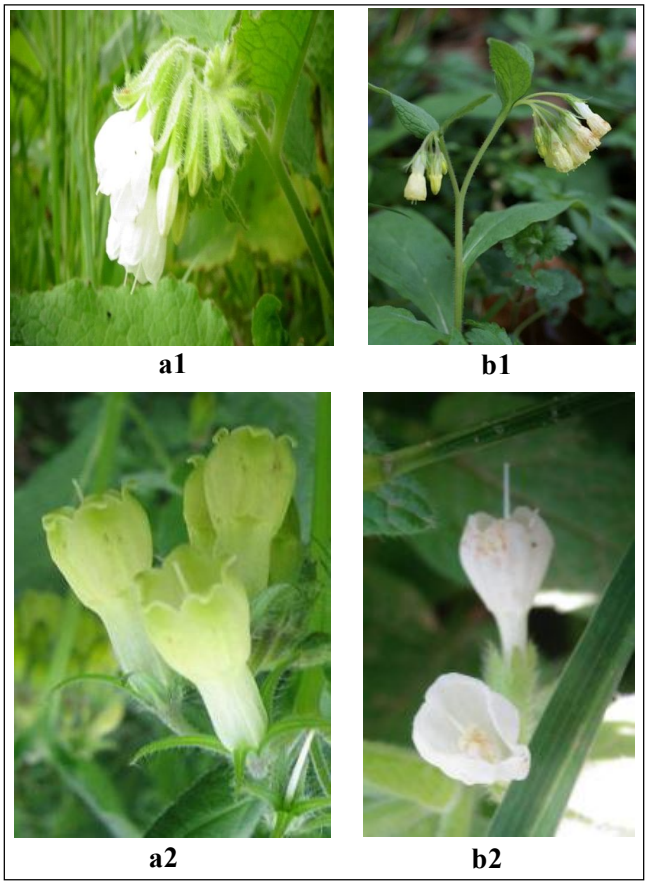

Fig. 3: Inflorescence & Flowering Calyx with corolla morphology: a1, 2- *Symphytum kurdicum*; b1, 2- *Symphytum tuberosum* .

Androecium

There are five epipetalous stamens attached to the corolla at the same level and alternate with the petals, usually free anthers, longitudinally dehiscence and sometimes in sided or exerted in all studied taxa. The filament is characterized by fill form shape and cylindrical, with the various lengths, white color in all studied taxa. The filament of *Symphytum* is ranged length between 1.25-2.75 mm in the species *S. kurdicum* as a minimum and *S. tuberosum* as a maximum. The anthers in the genus *Symphytum* dimensions ranged between (2.25-2.5) × (0.65-0.75) mm in *S. kurdicum* as a minimum and *S. tuberosum* as a maximum, with the common shape are oblong, sagittal and the filament in sided corolla. (Figure 4).

Anther

All studied taxa have five anthers, staminod with different attachments and the color is yellow, lightly yellow, brown, bilobed, line longitudinally dehiscence and oblong or ovoid to elliptic or reniform and sagittal shapes. In *Brunnera* the anther dimensions' average is 0.75×0.4 mm, while the anthers shapes reniforme. In the genus *Choriantha* the dimensions of anther are 4×0.7 mm the anthers are sagittal and longitudinally dehiscence. The anthers in the genus *Cynoglossum* dimensions average 2.5×1.25 mm, while the common shape is ovoid to elliptic. In the genus *Solenanthus* dimensions of anthers are ranged between (2-2.5) × (1-1.25) mm in the species *S. circinnatus* as a minimum and species *S. stamineus* as a maximum, the common shape oblong and yellow color, but the anthers exerted to corolla. The anthers in the genus *Symphytum* dimensions ranged between (2.25-2.5) × (0.65-0.75) mm in *S. kurdicum* as a minimum and *S. tuberosum* as a maximum, with the common shape are oblong, sagittal and the filament in sided corolla (fig. 4).

Filament

The filament is characterized by filliform shape and cylindrical, with the various lengths, white color in all studied taxa. The filament of *Symphytum* is ranged length between 1.25-2.75 mm in the species *S. kurdicum* as a minimum and *S. tuberosum* as a maximum (Figure 4).

Gynoecium

The special character in this family Boraginaceae are style gynobasic or terminal Ovary superior, entire or 4-lobed and fruit has separated four Nutlets. (De Jussien, 1789; Al-Musawi, 1987). Stigma in all studied taxa is simple, dry, and different of color lightly yellow, lightly brown, brown and violet, with the Clavate shapes. the

length of stigma is ranged between (0.5-0.6) mm in *S. tuberosum* as a minimum and *S. kurdicum* as a maximum. In all studied taxa ovary is superior, divided into four lobes, with one ovule and one style gynobasic, with axial placentation, color is yellow and lightly yellow color, with the style dimensions are ranged between 7-9 × 0.3-0.4 mm in the species *S. tuberosum* as a minimum and species *S. kurdicum* as a maximum. Style in all studied taxa is single, filliform, glabrous and colors are lightly yellow, chaffy cream, light brown and cream, with terminal style attached with ovary "gynobasic style". the color is yellow and lightly yellow color, with the style dimensions are ranged between 7-9 × 0.3-0.4 mm in the species *S. tuberosum* as a minimum and species *S. kurdicum* as a maximum (fig. 4).

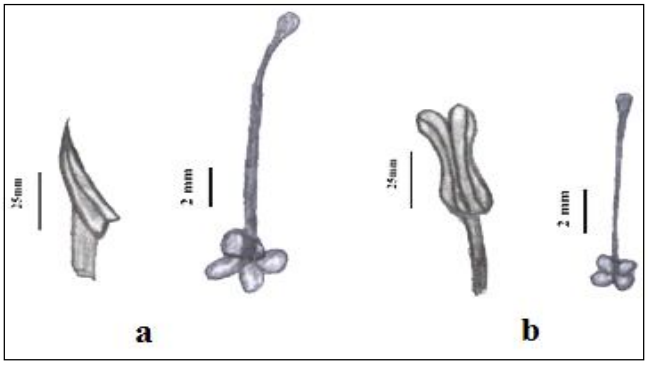

Fig. 4: Androecium & Gynoecium morphology: a- *Symphytum kurdicum;* b- *Symphytum tuberosum.*

Pollen grains

The study was based on the pollen morphology in all studied taxa and used the pollen grains obtains in the anther from the specimens which collected during the field trips in the various locations in Iraq . Anthers were maintained with added some drops of Glycerin jelly and stained safranine (Al-Mayah, 1983 & Abdul-Razaq, 2008). Then they were opened by two minute anatomical needles and crushed to extract the pollen, and exposed to the pigment, after this, it was transferred to clean slide and covered gently by cover slide. Twenty-five to thirty measurements of diameter of pollen in polar (P) and equatorial (E) (minimum and maximum) view were taken with the exine thickness, number of colpate and the colpate length, was under the power zoom (40) X supplied with the ocular micrometer of a compound light microscope type Olympus. All of which were photographed by modern digital camera SONY (12 mega pixels). The terminology was used accordance with (Erdtman, 1969; Hoen, 1999 and Hesse *et al.*, 2009). The pollen grains in all studied taxa are different shapes and dimensions in equatorial and polar view, with the colpates length and numbers. Pollen grains in *Symphytum* species are medium size, the length of colpates are ranged between 13.3-14.2 ìm in the species *S. kurdicum* as a minimum and in species *S. tuberosum* as a maximum, the length value of polar view ranged between 34.5-37.95 ìm and equatorial view ranged between 25.2-26.05 ìm in *S. kurdicum* as a minimum and in *S. tuberosum* as a maximum, with the pollen grains shape circular in polar view and prolate ellipsoied in equatorial view in both species, *Symphytum* species have two differences colpate number they are ten in *S. kurdicum* and six in *S. tuberosum*. (fig. 5, 6).

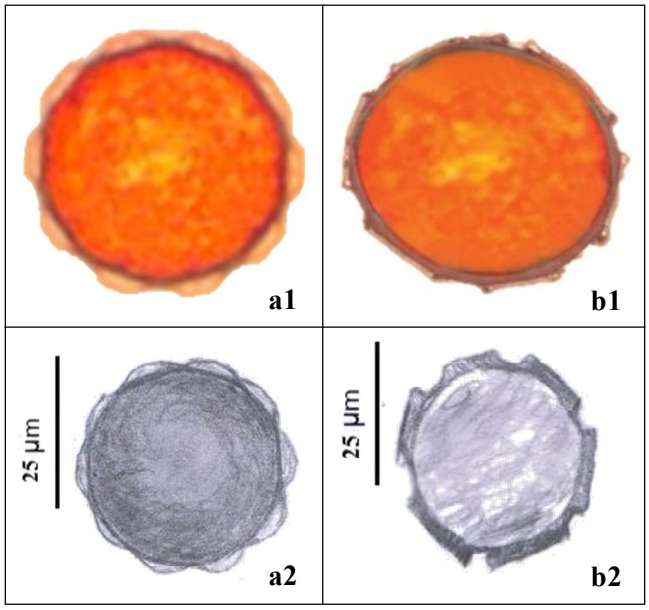

Fig. 5: Polar view of the pollen: a1, 2- *Symphytum kurdicum.* b1, 2- *Symphytum tuberosum.*

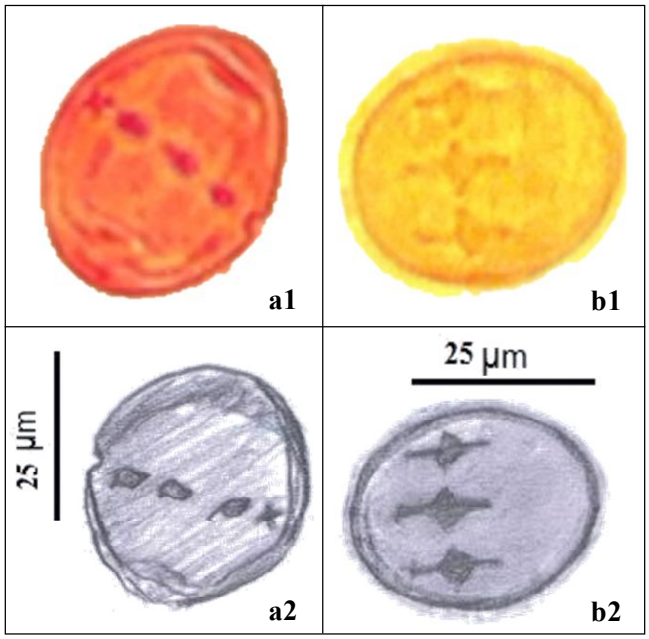

Fig. 6: Equatorial view of the pollen: a1, 2- *Symphytum kurdicum.* b1, 2- *Symphytum tuberosum.*

Fruiting Calyx

The fruiting calyx in all studied taxa have five lobes, indumentum and accrescent into fruiting. The dimensions of the fruiting calyx are ranged between 7.5-10 × 4-6 mm in the species *S. tuberosum* as a minimum and species *S. kurdicum* as a maximum, with the indumentums are hirsute and villous pilose. (fig. 7).

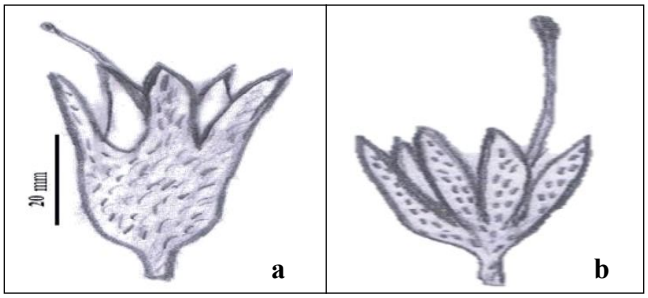

Fig. 7: Fruiting calyx : a - *Symphytum kurdicum;* b- *Symphytum tuberosum.*

Nutlet

In this family the Nutlet is important characters for identification especially in tribes and genera. Some taxonomist used Nutlet for separating tribes and genera, some researchers proved Nutlet studies and its morphology to be important for differentiation of these taxa at the infrageneric categories (Akcin & Baki, 2009; Selvi *et al.*, 2011). Nutlet shape obliquely curved with cream and brown color, the dimensions are ranged between 2.75-3.5 × 2-2.5 mm in species *S. tuberosum* as a minimum and species *S. kurdicum* as a maximum. the hilum position is basal, circular and brown color, the stalk scar is cleared in the *S. kurdicum*, but absent in *S. tuberosum* (fig. 8, 9).

Fig. 8: Nutlet morphology: a- *Symphytum kurdicum;* b - *Symphytum tuberosum.*

Flowering period

Flowering period of the genera (*Brunnera, Choriantha, Cynoglossum, Solenanthus* and *Symphytum*) belong to the family Boraginaceae has been studied depending on the information obtained from field trips (survey) that began from March and continued to

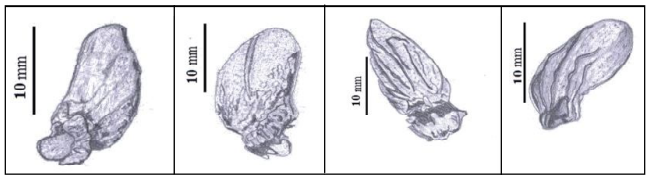

Fig. 9: Nutlet morphology: a - *Symphytum kurdicum;* b- *Symphytum tuberosum.*

December (2016) in Kurdistan region. The flowering period and the fruiting time have been limited, it became clear that the optimum flowering period of studied taxa was between late April to June and the species *Symphytum kurdicum* has longer flowering period which extended from March to August and a perennial herb, The factors of soil habits, temperature and altitude, have affected on the flowering period of these species vary and graduates from plains to elevated regions, from high temperature zones to lower temperature zones, so that the flowering period began early from March in plains and lower zones and delayed to late April or early May in mountain.

Ecology Notes and Geographical Distribution

The data on geographical distribution and ecological observation of the studied species in this investigation was obtained from some herbaria specimens that have previously studied, from literatures and personal filed trips observations throughout 2015-2016 more than 24 filed trips from March to August were collected each one has taken 2-3 days, which include different district in Iraq beside the literatures, which based on (Zohary 1946, Blackelock 1948, Al-Rawi 1964, Gusest 1966) and on some flora such as: Flora of Syria, Palestine and Sinai (Post, 1933), Flora of Lowland of Iraq (Rechinger, 1964), Flora of Turkey (Davis, 1978) and Flora Iranica (Rechinger, 1967). These altitudes and latitudes were measured by GPS, and all the species were studied photographed by digital camera in their nature habitats. *Symphytum* have two species one of them (*S. tuberosum*) is new record from Iraq in this study, these species are distributed on high mountains (790-1950) m and growing on the clay slops, rocky soil, forest fields under the trees and shade wet places, the species *S. kurdicum* is distributed in MAM, MRO and MSU districts , the large population in MAM district they recorded in Sarsang and Kani Masi where elevations are between (1292-1534) m, in MRO district founded in Shaqlawa and Kwkh Safin which elevations between (790-1350) m, in Pshta Shan (1052) m and in MSU district recorded in Penjwen and Qaradakh elevations between (947-1457) m and in Hawraman Hana Nawa and Peramagroon were elevations between (1277-1806) m. but the last species

S. tuberosum distributed individually in MRO districts founded in Rawanduz (942) m. and MSU districts in Peramagroon Mountain (1950) m. (fig. 10, 11).

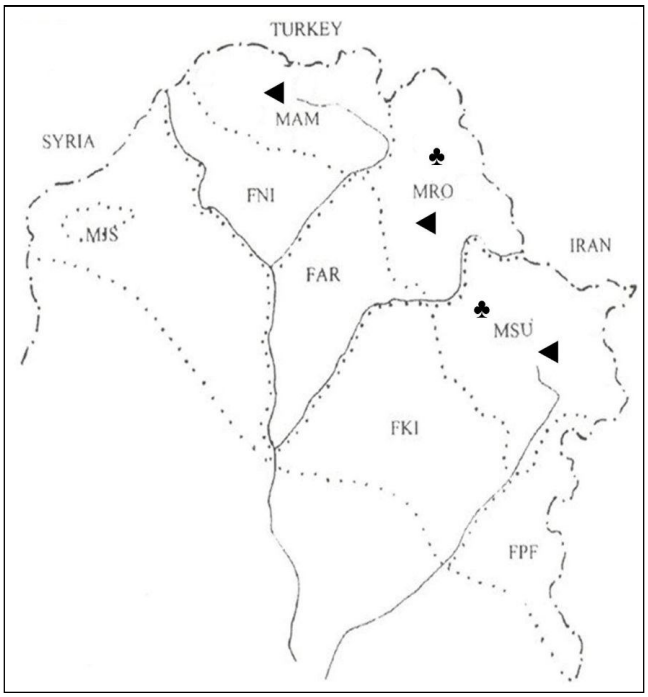

Fig.10: Geographical Distribution map of *Symphytum* taxa. ◀ *S. kurdicum*. ♣ *S. tuberosum*.

a **b**

Fig. 11: a-*Symphytum kurdicum*. b-*Symphytum tuberosum*.

Conclusion

The presence study of the genus *Symphytum* with two perennial species were distributed in Iraq, comparative morphological study of root, stem, leaf, including petiole, inflorescence, flower, fruit, nutlet and study of the external manifestations of pollen grains, the pollen in all studied taxa are Medium size. There are two types of the distribution of studied taxa, such as *Symphytum kurdicum* with widely distributed and Species with rarely distributed such as *Symphytum tuberosum* (new first record to flora of Iraq in this study). The comparative morphology, palynology, environment and geographical distribution of all selected taxa showed variation which were of great value in classification and identification of these taxa so the result of this study can be used for determining taxonomic relationship between taxa belonging to the genus *Symphytum*.

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