A morphological and anatomical comparative Study of the Reproductive parts of the genus Veronica L. (Plantaginaceae) in northern Iraq

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Abstract. The present study aims Morphological characteristics studies (for flowers, fruits, and seeds) and anatomical characteristics (petiole fruit, fruits and seeds) of 6 species are: Veronica anagills-aquatica L., Veronica anagilloides L., Veronica arvensis L., Veronica cymbalaria bod., Veronica persica L. and Veronica polita Fries Wild grow in northern Iraq and belonging to the genus Veronica L., which belongs to the Plantaginacea family, which was formerly classified within the Scrophulariaceae family. The results of the morphology study of the flowers showed a distinct difference in the colors of the petiole were violate in V. anagills and pink in V. anagilloides and blue in other species, while all species were similar to the Insertion of the stamens on the petals (Epipetalous), and the pistils on the receptacle. While there was a clear difference in the shape and dimensions of the fruits, the two-lobes were obcordate in species V. anagills - aquatica, V. anagilloides, V. arvensis and trilobed in the V. cymbalaria, V. Persica and tetralobed in V. polita. A variation in the types and shape of Indumentum also appeared, as was their number within the fruit ranged between 2-40 seeds and since their characteristics are constant and unchanged with the environment, so it is one of the most important taxonomic characteristics. The fruit holder has a variation in the thickness of the plant tissues and the way they are arranged, and the thickness of the fruit casing differs according to the species studied, and the thickness and shape of the transverse section in the seeds different from the studied species.

Keywords: Morphological and Anatomical study, Veronica, Plantaginaceae, northern Iraq

Introduction

The genus of the Veronica belongs to the family, Plantaginaceae. This genus has 500 species. Albach [2] and has a wide spread throughout the globe and is characterized by great diversity and high diffusion capacity, distributed in most of the northern and southern parts hemisphere and is found in the waters, Alps and dry steppe. [8, 11] The genus Veronica belongs to the former Scrophulariaceae family. APG [4,5] the Plantaginacea family of the world-wide floral families, formerly comprised of three genus are Bougueria, Plititorallap, Plantago [8] and more than 275 species distribution in Europe, Asia and North America, their herbaceous plants or small shrubs and rarely trees [9,10,17] for the genus 86 species distributed over 4 sectors in Turkey [6], it has 59 species spread over 5 sectors in Iran [7,13,14], and 13 species in southeastern Spain [8] it has 19 species in Iraq [3], and uses the Aerial parts of the plant Veronica officinalis L. In traditional therapies and treatment of various infections, especially rheumatism, and this genus has only been a concern for years. The latter have been interested in
studying and drawing attention to it because of its environmental-resistant proper-ties and the wide variety of modern studies on it [12] and studied seeds by using SEM [16] and study for the Veronica genus vaccine spread in Iran [8] Study pollen grains of the SEM [15] and the study of Chemical compounds by [12]. The aim of the current study is to provide information between the Veronica species. Distributed in the north of the country because of the lack of information about it in Iraq.

Materials and Methods

The botanical specimens for the study of flowers, fruits and seeds were collected from the field directly and from the areas of the country (northern in Salah al-Din/ Kirkuk/ Erbil/ Dohuk), which were accessible during several field travel (10) The studies were conducted during February to May 2018, and enclosed with each sample Label was studied. The fruits and seeds are under the microscope of anatomy dissecting microscope type Optika and the study of fruits and seeds anatomically under the composite microscope Compound microscope The Optika type and were diagnosed in the laboratory based on the phenotypic characteristics of the whole plant and compared with the Turkish, Iranian and Iraqi flora, and then the forms (fruits and seeds) were preserved in veils sought 5 ml in ethanol, 70% concentration until the rest of the anatomical studies. transverse sections are prepared for the fruits and seeds using cut method. AL-Abide [1].

Results and Discussion

*A morphological flowers study

Flowers quad-corolla irregular lobes consist of a very short corolla tube and a largest petal limb, the corolla differs according to the studied plant species, violet color in the V. anagills – aquatic, light pink color in the V.anagilloides and light blue in the species V. arvensis, V. cymbalaria, V. persica and V. polita, and the Inseration above the Corolla (epipetalous) in all studied species and the rate of the filaments length 4mm while the rate length of the anthers was 0.5 mm and the filaments was white and brown in all anthers of colors While the pistil connects directly to the reseptical. (plate.1).

*A Morphological fruit study

The results of the present study showed a clear difference in the dimensions of the fruits, the largest rate of the fruit length 4.5 mm in the V. Polita and the lowest rate of 2.5 mm in the V. anagills – aquatic and V. cymbalaria the values of other species ranged between these two species, while the highest rate of the fruit width 6 mm in the V. Polita and the lowest rate for its width was 2 mm in V. anagills – aquatic and V. anagilloides, as there was a clear difference in the number of ovary lobes consisting of 2 lobes in species V. anagills-aquatic, V. polita, V. anagilloides, and trilobed in V. persica and tetralobed in both species V. cymbalaria and V. arvensis, (plate.2) . It was observed through the study the presence of the beak in all the fruits of the species under study ranged between 0.5-2 mm, the lowest length in V. persica and the height of the length of V. anagills – aquatic and V. anagilloides. The fruits of all species were similar to the species of obcordate shaped side of the lateral opening. (plate .2). The results of the present study were similar to the study Juan [8] of the fruits shape in species V. anagills – aquatic, V. anagilloides, V. cymbalaria and V. Polita. Here it should be noted that the surface covering of the glandular hairs covers the fruits in all studied species, and the presence of the calyx was observed connected with the fruit petiole of the type of the fruiting calyx. The number of seeds in the same fruit differed between 2-40 seeds in the V. persica and V. anagilloides (table. 1).

*A morphological seeds study

The seeds study showed that there was a difference in the shape, size, color and surface sculpturing of the seeds, Its shaped ovoid in V. anagills – aquatic, V. arvensis, V. cymbalaria and V. persica, elongate shape in V. anagilloides and V. polita, Its length ranged between 0.5-1.4 mm in which the least was in V. anagills - aquatic and V. anagilloides species and
largest length in *V. persica* and *V. polita* species. Its width ranged between 0.1-1.1mm in *V. anagills - aquatic.* and *V. polita* species (table 1). A difference in seed color was found in dark brown in *V. anagills – aquatic* and *V. anagilloides* species, light brown in *V. persica* species, and yellowish white in other species. (plate 3). While the seeds were characterized by reticulate in *V. arvensis* and *V. polita* species and faintly reticulate in other species. The results of the present study were similar to the study shehata[16] of the seeds shape.

**Table 1.** The quantitative and qualitative morphological characteristics of the fruits and seeds for Veronica species in mm.

| Characteristics | Fruits size rate | seeds size rate | Color of seed |
|-----------------|-----------------|-----------------|---------------|
|                 | Length of fruits | number of seeds |               |
| Taxon           | Length Width     | length Width    |               |
| *V. anagills – aquatic* | 2.5 2 2 | 0.5 0.1 30 | dark-brown |
| *V. anagilloides* | 3 2 2 | 0.5 0.5 40 | dark-brown |
| *V. arvensis* | 3.5 5 1 | 1.15 0.8 4 | white yellowish |
| *V. cymbalaria* | 2.5 3.5 1 | 1.1 0.9 4 | white yellowish |
| *V. persica* | 3.7 4.5 0.5 | 1.4 1 2 | Light-brown |
| *V. polita* | 4.5 6 1 | 1.4 1 1 4 | white yellowish |

*Anatomical Reproductive parts study*

The study results of the Reproductive parts (fruit petiole, fruit, seed) showed differences in the thickness of the tissues and the way they were arranged and the lowest thickness of 230 µm in *V. anagilloides*, Its highest thickness 460 µm in *V. polita* and the values of other species ranged between these two extremes, A variation in the thickness of the Epidermis, Cortex, Vascular tissues and pith, (table 2), The method of arranging vascular tissues, one central of vascular bundle in *V. persica* and *V. cymbalaria* and were multi vascular bundles, A circular ring in the center of the pith in all other species of plate also showed a distinct difference in the thickness of the transverse section of the fruit pericarp appeared highest thickness in *V. polita* reached 450 µm and less thickness in *V. anagills – aquatic* reached 80 µm while the tissues were marked to the outer pericarp (exocarp (cuticle, epidermis) and mesocarp and Endocarp (table 3). The results of the study of the seed anatomical indicated the variation of its Epidermis thickness ranged from 270-100 µm in *V. anagilloides* and *V. anagills – aquatic* respectively and the section appeared in the same way the Persians in *V. arvensis* and *V. polita* and range in *V. anagills – aquatic* and *V. persica* and crest in other (table 2, 3). and (plate 4, 5).

**Table 2.** The quantitative characteristics in cross section of petiole fruits for Veronica species in µm.

| Taxon               | Thickness cross section | Thickness Epidermis | Thickness Cortex | Thickness vascular bund | Thickness Pith |
|---------------------|-------------------------|---------------------|-----------------|-------------------------|---------------|
| *V. anagills – aquatic* | 420                     | 10                  | 60              | 80                      | 50            |
| *V. anagilloides*   | 230                     | 10                  | 50              | 50                      | 20            |
| *V. arvensis*       | 280                     | 7.5                 | 50              | 40                      | 100           |
| *V. cymbalaria*     | 425                     | 15                  | 115             | 160                     | -             |
| *V. persica*        | 300                     | 20                  | 50              | 250                     | -             |
| *V. polita*         | 460                     | 20                  | 120             | 60                      | 100           |
### Table 3. The quantitative characteristics in cross section of fruits for Veronica species in µm.

| Characteristics | Thickness cross section | Thickness cuticle | Thickness exocarp | Thickness mesocarp | Thickness endocarp |
|-----------------|-------------------------|-------------------|-------------------|-------------------|-------------------|
| V. anagills – aquatic | 80                      | 5                 | 20                | 45                | 10                |
| V. anagilloides   | 100                     | -                 | 10                | 70                | 20                |
| V. arvensis       | 155                     | 10                | 10                | 105               | 30                |
| V. cymbalaria     | 120                     | 10                | 30                | 50                | 40                |
| V. persica        | 100                     | 10                | 20                | 40                | 30                |
| V. polita         | 450                     | 10                | 25                | 300               | 75                |

Plate 1 A morphological Characteristics of flowers for Veronica species.
Plate 2 A morphological characteristics of fruits for Veronica species.

Plate 3 A morphological characteristics of seeds for Veronica species.
Plate 4. Anatomical characteristics of fruits cross section for Veronica species (40X).
Cu: cuticle, Ep: epidermis, me: mesocarp, Vb: vascular bundle, en: endocarp.

Plate 5. Anatomical characteristics of seeds cross section for Veronica species (40x).

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