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TAXONOMIC STUDY OF EPIDERMIS AND INDUMENTUM FOR SPECIES OF VERONICA L. (PLANTIGNACEAE) IN NORTHERN IRAQ

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ABSTRACT--*The present study aims to study the characteristics of the Epidermis, the midrib area and stem of six species of wild land in northern Iraq belonging to the Plantignaceae family and species: Veronica anagills-aquatica L., Veronica anagilloides, Veronica arvensis L., and Veronica cymbalaria bod. , Veronica persica L. and Veronica Polita Fries. For the rest of the species studied in the world, its studied qualities have been compared with its peers. The results showed that the qualities of the epidermis indumentum, Crystals and venation leaves are of taxonomic importance as all species were special because of the presence of glandular and eglandular hair of the species .In the upper epidermis of Veronica polita.*

Keywords-- *Epidermis, Veronica, Plantignaceae , Northern-Iraq .*

I. INTRODUCTION

The taxonomic studies are based on many evidence and anatomical features.One of these evidence, which in t erms of importance may correspond to Morphological characteristics, its anatomical characteristics are very important because they show a significant heterogeneity in different plant groups (Al-Musawi, 1979).the anatomical characteristics have been used for over a hundred years asused for over evidence of classification (Stace, 1980).The Plantaginaceae is one of the families covered by seeds belonging to the rank of Laminales , which is widespread in the world and comprises 4 general and 276 species .(Elenevskii,1978 ; Willis,1980 ; Mehravarz et al.; 2008) . The genus Veronica belongs to the Plantaginaceae family with more than 300 species and is distributed throughout the Northern Hemisphere and in many Southern Hemisphere regions. While previously known as Scrophulariaceae (Olmstead , 2002) there are many suggestions(problems) specific to this genus ' classification and rearrangement (Albach et al., 2004 ; Jensen et al.,2005). The family includes 120 genera of plants with 7055 scientific names of plants, of which 1614 species names are accepted (The Plant List, 2019). A study indicated (Salehi et al.; 2019) that some species of Veronica that inhibit foodborne pathogens, such as Listeria monocytogenes, but only a few were used in food systems. And some studies suggest that there have been studies of anti-cancer, anti-inflammatory and other bioactivities. Earlier studies in this Acinifolia describe the macromorphological characteristics of the species (Fischer, 1981; Juan et al., 1997).

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The later works report data on morphological pollen characters (Hong, 1994 ; Fernandez et al. 1997 ; Saeidi & Zarrei, 2006), seed characters (Juan et al.,1997 ; Saeidi et al., 2001).The number of chromosomes (Ferakova, 1976 ; Fischer, 1981 ; Aryavand ,1987; Ghaffari, 1987 ; Fernandez et al., 1997 ; Saeidi & Kharabian, 2005) and Chemical characteristics such as flavonoid (Grayer- Barkmeijer, 1978 ; Peev ,1982) and iridoid glucosides (Lahloub , 1991 , 1992)

Most of the Previous researchfrom the plant familfocused mainly on the plants from morphological and anato mical characteristics of seeds and pollen by adding chemical information. Therefore, as available from sources, the research on the anatomical studies of these species has not previously been given a detailed study.

The current research is therefore aimed at studying the anatomical characteristics and attempting to determine the difference between theanatomical characteristics comparison species.

This paper reviews the epidermis characteristics were focused on the surface of the upper and lower epidermis in the leaves, stem and midrib region and the study of the stomata, indumentum of different parts in the plant of their shape, types, the scraptued and type of the base hairs. Also studied was the plants spread in the northern of the country.

II. MATERIALS &METHODS

The present search was carried in north of Iraq (Governorate of Erbil & sulaimaniya).The plant samples were collected during February- May.

The taxonomic of plants selected are based on the flora of Iraq, Turkey and Saudi Arabia. (Davis et al., 1988; Mighad & Hammoud, 1978).

The dry plants were cooked with Lactic-acid solution with a concentration 80% for 3-5 minutes (depending on the plant's nature) to soften and become more tender and ready for analysis and the vegatative plants have been fixed in Formaline-Acetic-Alcohol (F.A.A.) solution after cutting the leaf and stem into the vials until used. Then stripping off epidermis of leaves epidermis, stems & trichomes by forceps and washing epidermis Distilled water, then transfer to clean slide containing drop glycerin 50%, and coverage by cover slide. And examined under the dissecting microscope type Komax and the compound type Olympus compound under power (4x, 10x, 40x). The measurements were taken using the ocular-micrometer eye lens and photographing by the digital camera type Nikon. .(AL-Abide ,2018, Dilcher,1974) .

III. RESULTS AND DISCUSSION

Epidermis Surface View

The results of this study revealed a difference in the epidermis cells ' normal walls and undulated the walls o f the upper epidermis cells in *V. anagills*-aquatica , *V. anagilloides, V. arvensis, V. Cymbalaria* species, and strongly- undulate in both *V. persica* and *V. polita* species. In the species *V.anagills-aquatica, V. anagilloides, V. arvensis, V. persica, V. cymbalaria* and *V. polita*, a difference in the shape of the lower epidermis cells was also found to be very undulate in the surface view. Plate (1, 2).

As a simple difference in the length and width of the upper epidermis cells of the species studied, the shortest cells are 55 μm long and 140 μm longest.

The lowest cell width of 25 μm and the largest of 80 μm and a distinct difference in lower epidermis cells (l ength and width) ranged from 51-110 μm.While the cell length ranged from30-100 μm in the lower epidermis, The values of other cells ranged between these two levels. (table. 1).

Therefore, the average length of the upper epidermis cells in all studied species except *V. anagilloides* and *V . polita* is greater than the average length of the lower epidermis cells

the average length of the upper epidermis cells is lower than the length of the lower epidermis cells, and the uppe r epidermis cell width is greater than the lower epidermis cell width of all species except V. polita.

The current study found a difference in the shape and size of identical and elongated midrib epidermis cells, a nd the cells appeared elongated or prismatic

In all species, But the difference was evident in the walls separating the ends of the cells where the walls were the comma between adjacent cells Oblique in arvensis and orthogonal in both V. anagilloides and V. persica species , and curved oblique-warp in V. anagills-aquatica ,V. cymbalaria and V. polita species (plate. 3).

The length and width of the midrib cells also differed, ranging from 28-400 μm in both V. anagills-aquatica and V. persica species respectively, and varied in widths ranging from 12.5-80 μm in V. anagills-aquatica and V. persica respectively. (table. 1 and Plate. 3).

As the shape and size of the stem cells differed elongated cells appeared in all organisms and the disparity em erged in the walls dividing the ends of the cells, and the walls between the adjacent cells were inclined Oblique i n V. anagills-aquatica and orthogonal in V. anagilloides, V. arvensis and V. cymbalaria, oblique-curved to oblique-warp in V. persica and V. polita. (plate. 3).The length and width of the stem cells ranged between from90-350 μm, varied in width 30-40 μm (table 1. and Plate .4.)

The difference in the walls of the cells is fixed in the form of the species studied and the similarity between the different species, although collected from different locations, indicates that this characteristic is not affected by the environment.

However shaped by genetic factors during the growth and reveal stage and the presence of cell walls with varyin g degrees of ripple Undulation, the origin of the ripple is thought to be due to tensile forces.However shaped by g enetic factors during the growth and reveal stage and the presence of cell walls with varying degrees of ripple U ndulation, the origin of the ripple is thought to be due to tensile forces.Which are exposed to the epidermis of the plant during the stages of disclosure and excellence. (Avery, 1933; Watson, 1999).

The reason for the difference in the structure of the walls was suggested by the nature of the hardening steadiness during the unfolding.

Stomata

The study results showed that the stomatal complex differed depending on the upper and lower surface species of the epidermis in the leaf as well as the midrib epidermis cell and stem were of the diacytic-type in *V. arvensis* and *V. cymbalaria* and *V.polita*. the guard cells are surrounded by two subsidiary cells that are vertical on the guard cells. And the differed type Anisocytic -type or so called cruciferous-type cruciferous, surrounded by guard cells

in three subsidiary cells that are graduated in size from small to large ,but there was a variation in the sizes of subsidiary cells of the other studied species, whether in the epidermis of the leaf or the midrib region (plate .1 & 2-3) .

The stomata focused on the upper and lower epidermis of the upper and lower leaves and differentiated their dimensions in the same species ' upper, lower, midrib, and stem types The length of the stomata ranged between 17.5-30 μm in the upper epidermis and stem of *V. anagills - aquatic* , between 12.5-25 μm in the stem and midrib of *V.anagilloides* as wall as 26.5-35 μm in the lower epidermis and stem in the *V. arvensis* , between 35-50 μm in the lower epidermis and stem in *V. cymbalaria* and between 35-50 μm in upper epidermis, midrib region and stem in *V. persica* and between 17.5 - 35μm in both upper, lower and stem in *V .polita.*

The length and width of the stomata in the upper epidermis ranged between 17.5-40 μm ,the stomata width ranged from 12.5-22.5 μm , and the average size of stomata in the lower surface of the leaf ranged between 17.5-40 μm and the lowest rate of length value in *V .polita* and the highest of maximum length rate in *V.* persica The width of the stomata ranged between 12.5-20 μm was the highest rate in *V. cymbalaria* and *V. persica* and the lowest rate in *V. polita.* The length of the stomata in the midrib wall epidermis ranged from 22,5-50 μm to 10-30 μm in width (Table 2).And the length of the stomata in the stem ranged from 12,5-50 μm to 10-25 μm in width. (table. 2).

The Elliptic-spherical Pore stoma appeared while the Reniform-circular guard cells appeared depending on the length / width of the stomata (Table.3)The mean length / width ratio was 2.3 μm for the upper surface and 2 μm for the lower surface of *V. persica* and 2.5 μm for the mid rib in *V. cymbalaria* and 2.5 μm for the stem in *V. cymbalaria* and *V. persica* (table.3&4).

There was also a variation between the two sides of the leaf in the same form and the different types of data. The higher stomatal index was 72 and the upper surfaces lowest was 62.

The study results also showed a difference in the frequency of the upper epidermis ranging from 1-9 stomata in the *V .polita* and *V. anagills - aquatic* and between 2-5 stomata in the lower epidermis respectively (Table.3). And so on the other sections, and the number of stomata (frequency) In the different parts of the plant of each species ranged between 3-9 stomata in the stem and upper epidermis of the *V. anagills - aquatic* and so on for other species (Table.3).Increases in stomata volume frequency and directory may be due to environmental conditions such as drought or increased sunlight exposure

(Croxdal, 2000). There was a difference between the size of the surface area of the leaf in relation to the stem and the difficulty of the function of each plant member when comparing the evidence from the stem index with the evidence from the leaf.

IV. TRICHOMES

The emphasis in this research was on the characteristics of epidermal hair. the length, the width, the apex and the shape of the base, as well as the trichomes ground made a clear difference. The types studied in the trichomes group are identical. The research included the distribution of different parts of the plant where they were identified in all studied species on different parts of the plant.. The multicellular - curved hairs in V. Polita, while the multicellular - Erect in V. cymbalaria.

-Glandular trichomes (unicellular stalk and bicellular head) emerged in all species studied as well as multicellular stalk and single-cell head in the stem of V. anagills – aquatic and V. persica species. (plate. 5).

- The overall hair length ranged from 700 μm maximum V. persica and

315 μm minimum V. anagills-aquatic value (Table. 4).

-Apex hairs: The trichomes resembled the presence of a sharp acute in all species as well as the acuminate apex of V. arvensis . The coil apex appeared in V. persica and V. cymbalaria the acute - obtuse apex in V. anagills - aquatic. (plate.7).

-Base hairs:the focus was on the base type and degree of immersion in the epidermis, where are similar of V. anagills - aquatic and V. cymbalaria.

The base appeared in the V. persica circular and more elongated as well as the appearance of bristles with a base surrounded by the collar of epidermal cells. (plate 8; Fig. 1-3).

-The hair surface: There was a clear similarity in the hair surface wall and was mostly smooth in all types except the V. persica , characterized by a warty surface. (plate 7; Fig. 1-3).

Table1: A quantitative feature of the upper, lower, mid rib and stem epidermis.

Characters / species	Upper epidermis of blade (μm)		Lower epidermis of blade (μm)		Epidermis of mid rib (μm)		Stem epidermis (μm)	
	Length	Width	Length	Width	Length	Width	Length	Width
V. anagills – aquatic	55	25	51	33.5	28	12.5	150	40
V.anagilloides	60	25	75	30	100	15	180	30
V. arvensis	140	40	85	50	200	45	150	30
V. cymbalaria	140	45	100	65	185	45	350	30
V. persica	130	40	75	100	400	80	200	40
V .polita	75	80	110	65	115	25	90	30

Table 2: A quantitative feature in the stomata of upper, lower, mid rib and stem .

Characters / species	Stomata in upper epidermis		Stomata in lower epidermis		Stomata in mid rib		Stomata in Stem pidermis	
	Length (μm)	Width (μm)	Length (μm)	Width (μm)	Length (μm)	Width (μm)	Length (μm)	Width (μm)
V. anagills – aquatic	17.5	12.5	22.5	17.5	22.5	15	30	20
V.anagilloides	17.5	12.5	21.5	17.5	25	10	12.5	10
V. arvensis	32.5	22.5	26.5	17.5	-	-	35	20

V. cymbalaria	40	20	35	20	40	20	50	20
V. persica	35	15	40	20	50	30	50	20
V .polita	17.5	10	17.5	12.5	30	20	35	25

Table 3: Rate length /width the stomata Epidermis in the upper, lower, midrib and stem & stomatal frequency and distribution in different plant parts of the studied species.

Characters / species	upper epider	lower epider	midrib	Stem	stomatal frequency			
					upper	lower	Midrib	Stem
V. anagills – aquatic	1.4	1.2	1.5	1.5	9	5	7	3
V.anagilloides	1.4	1.2	2.5	1.25	7	8	1	1
V. arvensis	1.4	1.5	-	1.7	2	2	1	3
V. cymbalaria	2	1.7	2	2.5	7	5	1	1
V. persica	2.3	2	1.5	2.5	3	5	1	2
V .polita	1.7	1.4	1.5	1.4	1	2	1	3

Table 4: A quantitative and quality characteristics trichomes of the studied specie

Characters / species	Type		Distribution							Size	
	glandular	eglandular	Upper Epidermis	Lower Epidermis	Margin	stem	calyx	petiolate	fruits	Length	Width
. anagills – aquatic	+	+	+	+	-	+	+	+	+	315	30
V.anagilloides	+	-	-	-	-	-	-	-	-	-	-
V. arvensis	+	+	+	+	+	+	+	+	+	600	30
V. cymbalaria	+	+	+	+	+	+	+	+	-	50	30
V. persica	+	+	+	+	+	+	+	+	+	700	40
V .polita	+	+	+	+	+	+	+	+	+	17.5	12.5

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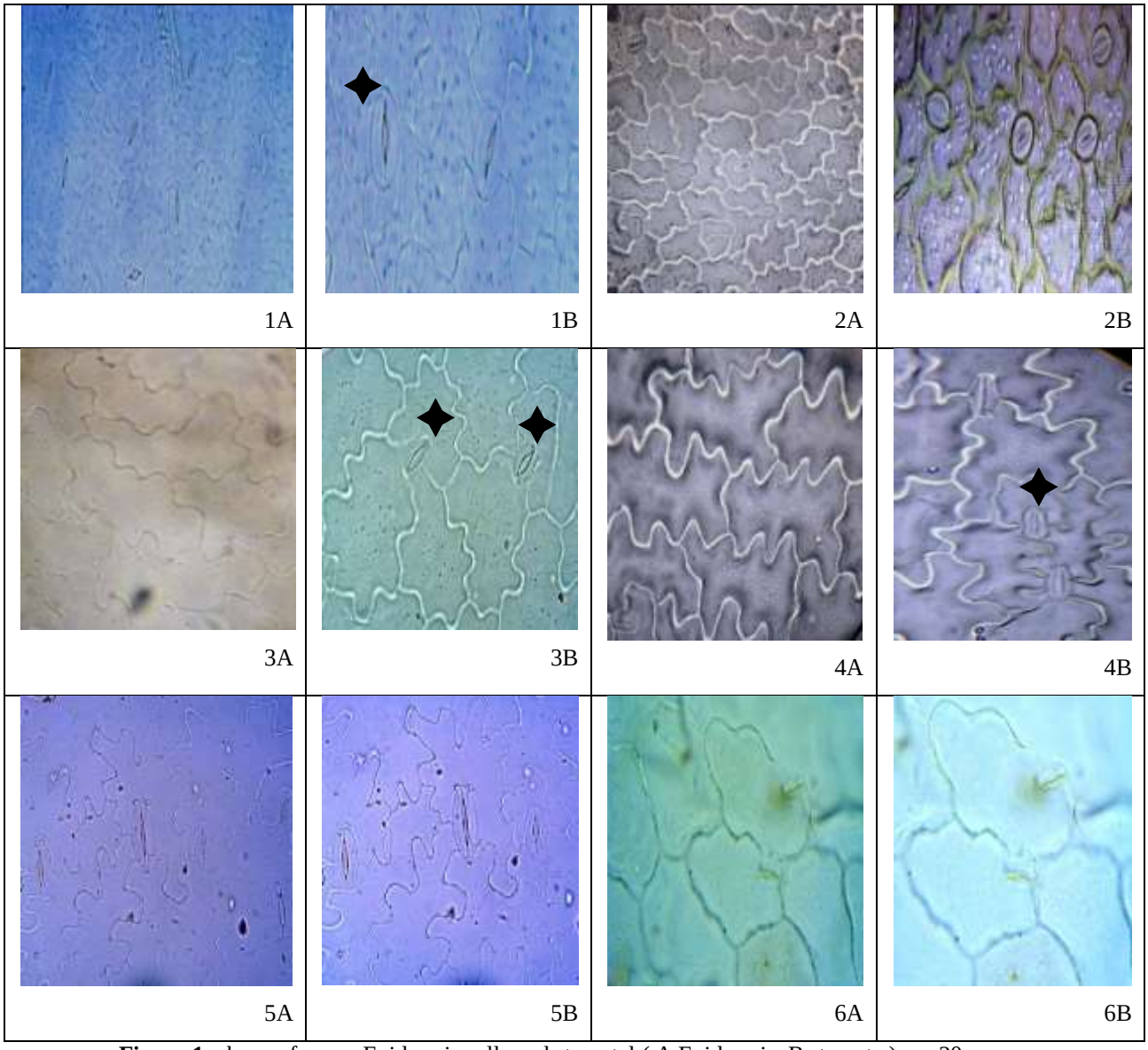
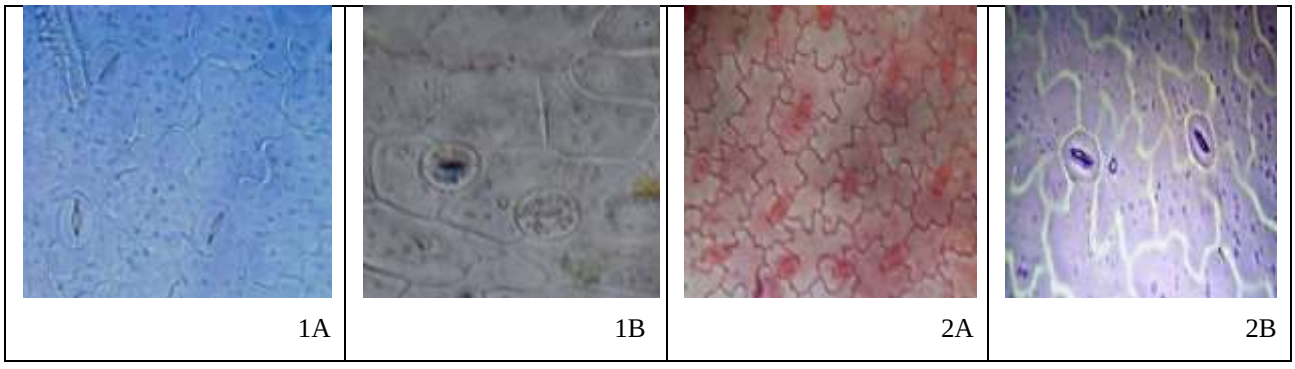


Figure 1: shape of upper Epidermis cells and stomatal (A.Epidermis ;B.stomata). 20µm

1- *V. anagills – aquatic* 2- *V.anagilloides* 3- *V. arvensis* 4- *V. cymbalaria* 5- *V. persica* 6- *V .polita.*



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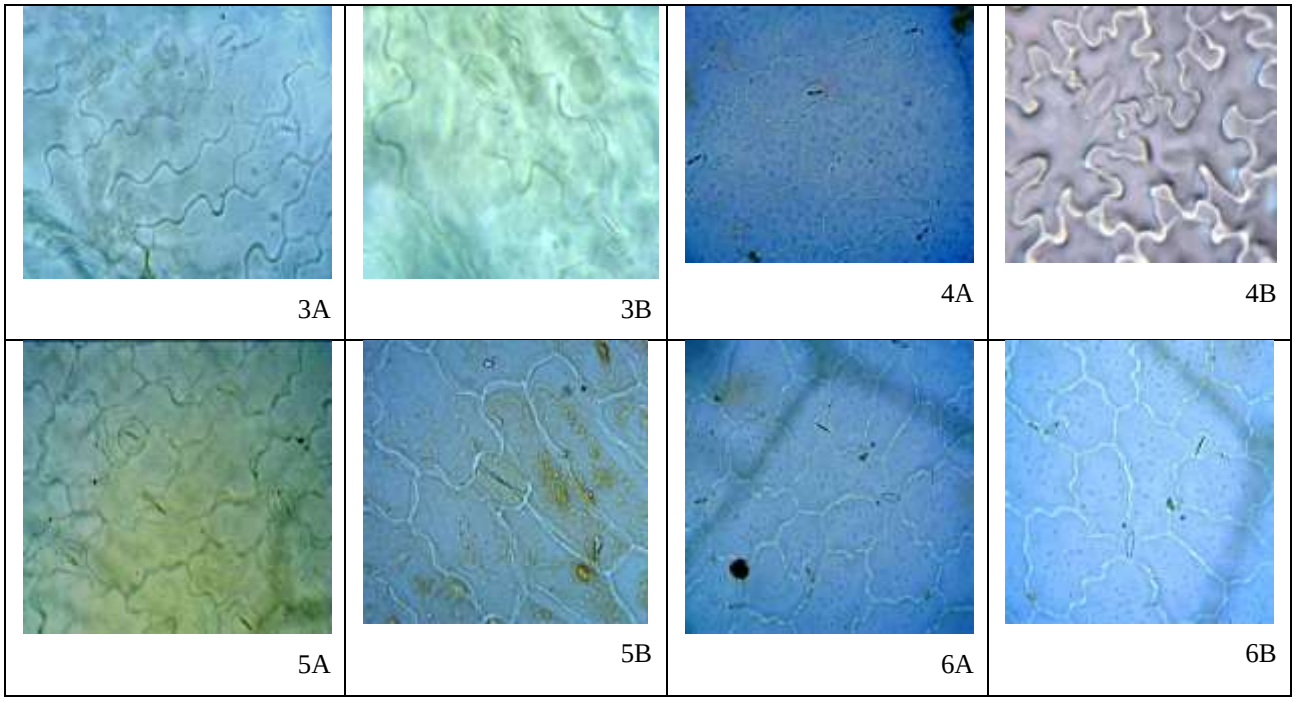

Figure 2: 20µm) A-Epidermis ; B- stomata (Plate.2.shape of Lower Epidermis cells and stomatal

1- *V. anagills – aquatic* 2- *V.anagilloides* 3- *V. arvensis* 4- *V. cymbalaria* 5- *V. persica*

6- *V .polita.*

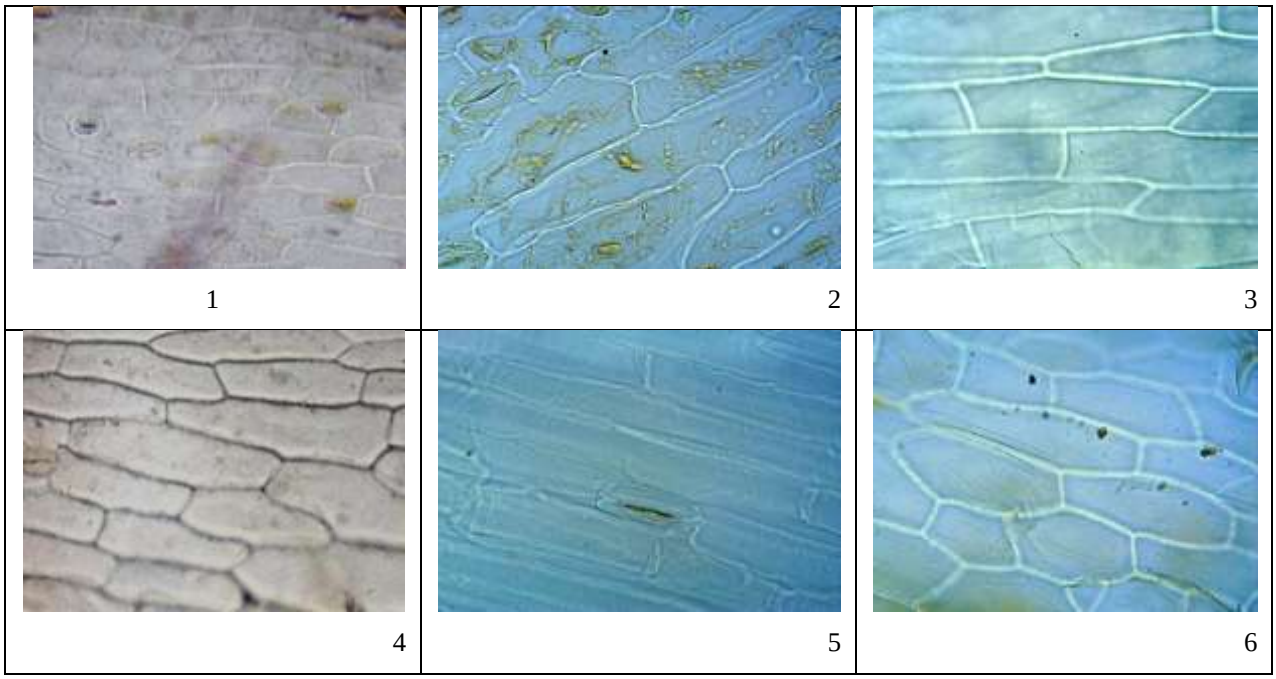

Figure 3: shape of midrib Epidermis cells and stomatal 20µm

1- *V. anagills – aquatic* 2- *V.anagilloides* 3- *V. arvensis* 4- *V. cymbalaria* 5- *V. persica* 6- *V .polita.*

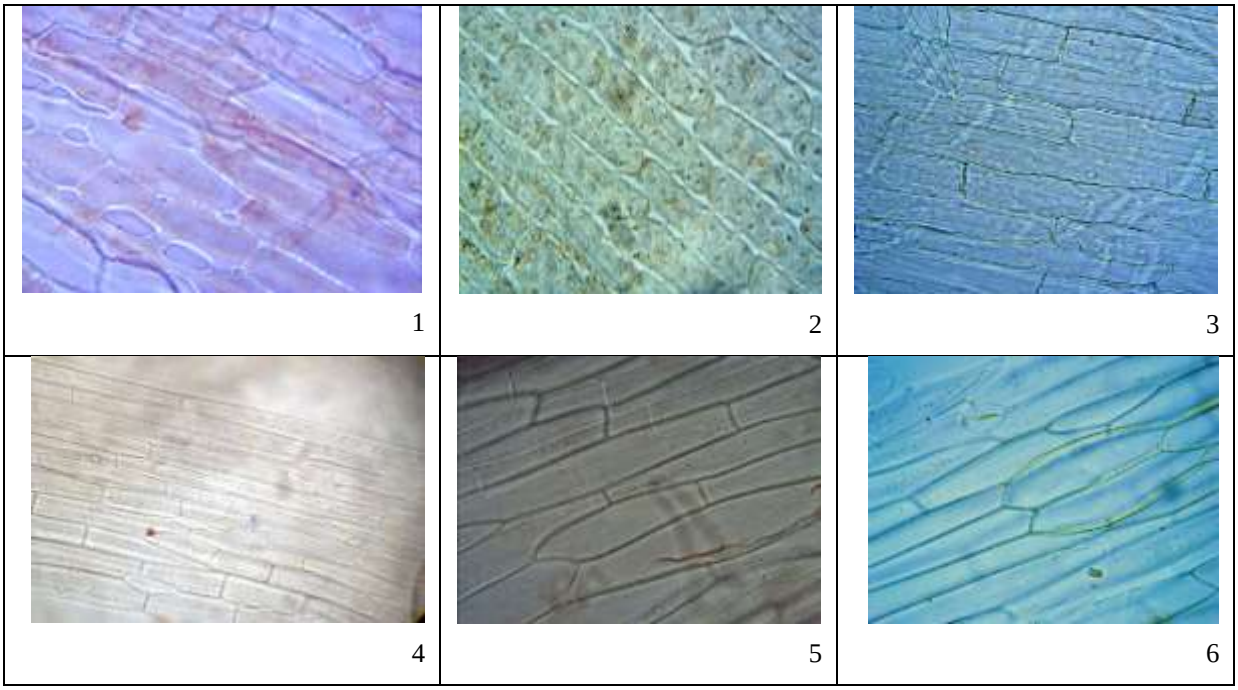

Figure 4: shape of stem Epidermis cells and stomatal 20µm

1- *V. anagills – aquatic* 2- *V.anagilloides* 3- *V. arvensis* 4- *V. cymbalaria* ,5- *V. persica*

6- *V .polita*

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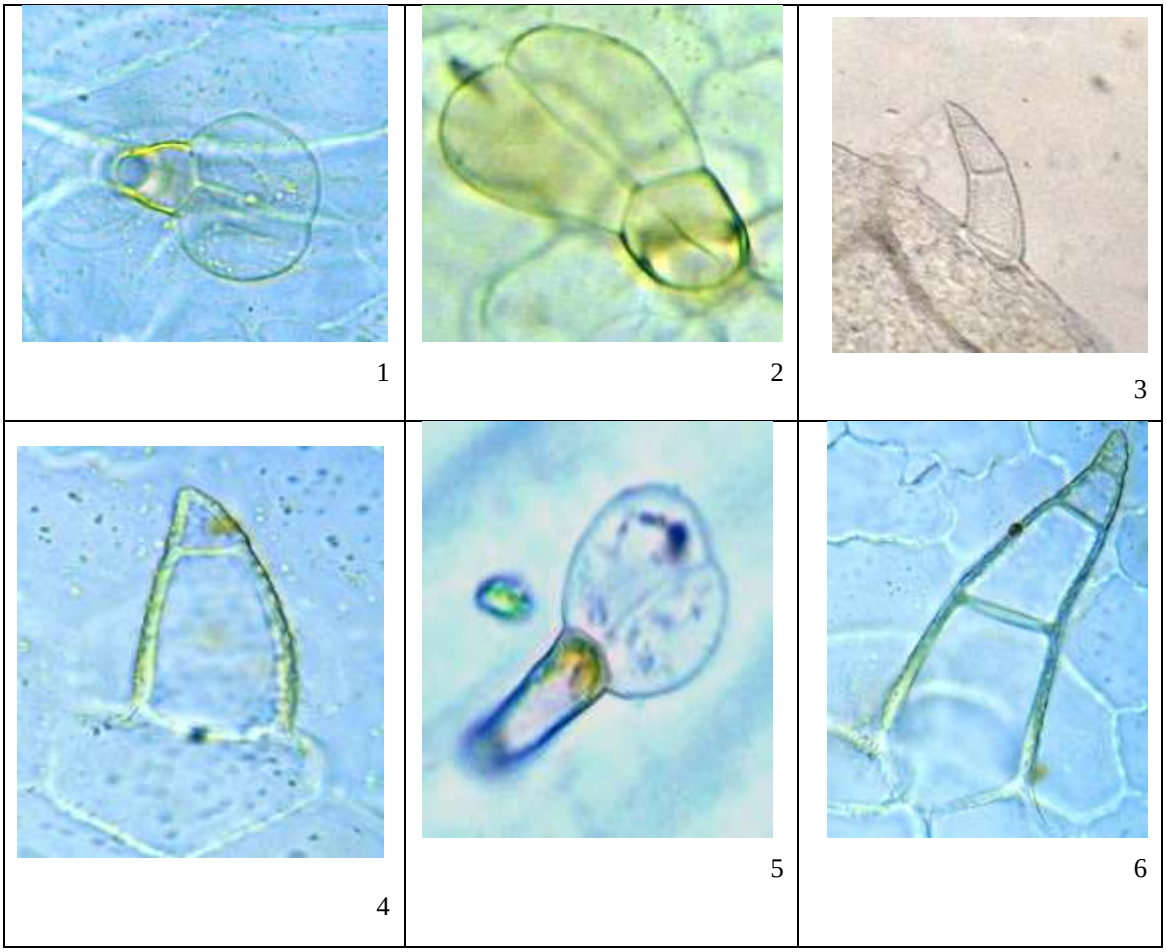

Figure 5: Shape of trichomes in species 20µm

1- 2-*V. anagills – aquatic* 3- *V. arvensis* 4- *V. cymbalaria* ,5- *V. persica* 6- *V .polita.*

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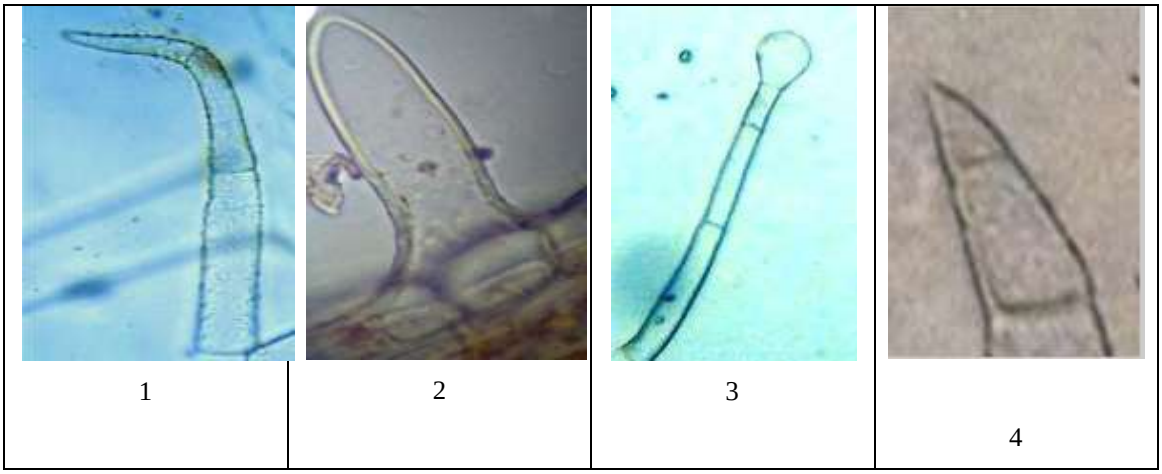

Figure 6: Shape of Apex hairs in species 20µm

1- *V. cymbalaria* 2- *V .polita* 3- *V. anagills – aquatic* 4- *V. arvensis*

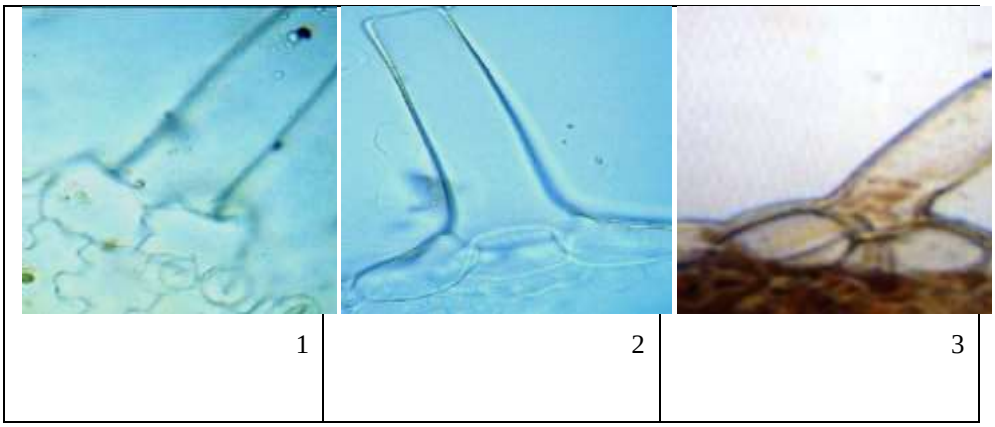

Figure 7: Shape of Base hairs in species 20µm

1- *V. arvensis* 2- *V. persica* 3- *V. cymbalaria*

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