**Journal of Novel Applied Sciences**
Available online at www.jnasci.org
©2019 JNAS Journal-2019-8-2/30-34
ISSN 2322-5149 ©2019 JNAS

# Comparative analysis the structure of the leaf *Crataegus korolkowii* L. (Rosaceae Juss.) common in two different environmental conditions

**Vasila SHARIPOVA**

Institute of Botany Academy of Sciences Republic of Uzbekistan, Tashkent, Uzbekistan

***Corresponding author*:** Vasila SHARIPOVA

**ABSTRACT:** The features of the structure of the leaves of *Crataegus korolkowii* growing in different environmental conditions are studied. *Crataegus korolkowii* species showed plasticity in different environmental conditions. When comparing the morpho-anatomical structure of the leaves of the species *Crataegus korolkowii*, the prevailing xeromorphic features of the species growing in Ustyurt are highlighted.

***Keywords*:** Ustyurt, Crataegus, Mesophyll, Adaptation, Xeromorpha**.**

## INTRODUCTION

In recent years, as a result of the increasing anthropogenic impact, a shortage of plant resources is manifested, their productivity and quality are reduced. The problems of re-vegetation and increasing its productivity imply the implementation of special theoretical developments and their practical solution by selecting certain plant species for introduction into disturbed communities and creating artificial phytocenoses of various economic uses. In order to accomplish this task, it is advisable to study in nature and identify highly adaptive to the harsh conditions of existence of plants of the local flora, based on the study of their environmental and functional features. Among a large number of adaptive properties of plants, the physiological functions of plants, which are closely related to anatomical and morphological features and underlie their adaptation to habitat conditions, are of particular importance.

Representatives of the genus *Crataegus* L. grow in temperate and subtropical regions of the Northern Hemisphere. In the north, the distribution limit of hawthorn is not higher than 60-65$^0$ C. The southern boundary of the distribution of the genus passes through Florida, Asia Minor, Central Iran, Afghanistan, Northern India, South-West China and crosses the central part of Japan [5].

The modern range of *Crataegus* covers Europe, the Southern Mediterranean, and in the east reaches Central Asia.

Many species of *Crataegus* - valuable food and medicinal plants. Mature fruits are soft, mealy and tasty, their medicinal value is not inferior to the hips [2].

## MATERIALS AND METHODS

The objects of study are *Crataegus korolkowii* L. growing in natural conditions of Ustyurt (Eastern Chink) and in Angren. The material is collected in 2 different locations. Studied leaves from plants that are in the flowering phase. Stem leaves from the middle tier of the main shoot. The leaves are fixed in 70% ethanol. Cross sections are made through the average leaf size. The preparations are colored with methylene blue and glued in glycerin-gelatin. Quantitative indicators of signs were measured with a screw-eyed micrometer MOV-15 according to the standard technique [1]. Mathematical processing carried out by the method of GN. Zaitsev [3] using a personal computer (MS Excel). Photomicrographs are made using a computer microplotter with a Samsung digital camera.

## RESULTS AND DISCUSSION

M.V. Sarkisyan [6] carried out an ecological-geographical analysis of the genus *Crataegus* of the Southern Transcaucasia, the distribution of species by altitude, plant types and ecological groups.

V.Yu. Letukhova et al. [4] an inventory of *Crataegus* in the Karadag natural reserve. Specified composition, number of hawthorn and their density of growth in various areas of the reserve.

Comparison of the leaf structure in various environmental conditions will expand the presentation of its adaptive features.

Location tissue sheet, the degree of development and the structural characteristics of their cells are highly variable due to both genetic factors and conditions of plant habitats. Anatomical sheet structure is extremely plastic and responds to changes in environmental conditions, particularly in light and water modes. The structural elements that determine the ecological characteristics of plant species include the thickness of the lower and upper cells of the epidermis, the distribution of stomata in the epidermis, the degree of development of mechanical and conductive tissues. As it is known, signs of xerophytism are the presence of thick cuticle on the leaves, relatively small size of cells and stomata, and a high palisade index.

Structural features of *C. korolkowii* were studied due to their ecological adaptability.

The shape of the *C. korolkowii* leaf plate is wide-triangular-oval, more or less deep-lobed with coarsely toothed margin, from 3.5 to 8.5 cm long and 2.5 to 6 cm wide. Veins protrude from the lower side of the leaf, pinnacular venation.

Comparative anatomical analysis of two representatives of *C. korolkowii*, growing in different environmental conditions, showed their similar and distinctive features. Leaves covered with epidermis-row with wrinkled cuticle. Epidermal cell membranes are very tortuous; the projection of epidermal cells is polygonal, slightly elongated. The adaxial epidermis is thick-walled, larger than the abaxial side. On both sides there are numerous simple, single-celled, styloid hairs. The stomata are numerous on the abaxial side, slightly elevated in relation to the cells of the epidermis, anomocytic, rarely cyclocytic type. The mesophyll of the dorsyventral structure consists of 5-7 layers of cells, of which two palisade tissue and 3-5 spongy (figure 1, table 1).

Palisade mesophyll cells are not the same height, palisade index - 4-5. The row of palisade cells on the side of the upper surface of the lamina is composed of several longer cells than the bottom. Cells spongy tissue varied in shape (from spherical to oblong with processes) and the orientation (horizontal, inclined or almost vertical), they are well developed intercellular spaces. Vascular bundles in the sheet surrounded parenchymal a facing consisting of a thin layer of large colorless cells called the epidermis. Under a facing of phloem and xylem under vascular bundles located sclerenchyma. Lining cells perform a water-saving function. The cells lining vascular bundle, palisade and spongy tissue can detect calcium oxalate crystals in the form of prisms and drusen. The central vein from the abaxial side protrudes. It is located 1 large collateral vascular bundle, it is well-developed mechanical tissue. On both sides, under the epiderm, there are groups of collenchyma cells.

Table 1. Quantitative indicators of leaf blades and petioles of Crataegus korolkowii species from different environmental conditions of growth (n = 30)

| Leaf plate | | | |
|---|---|---|---|
| Indicators | | Ustyurt | Angren |
| Length, cm | | 7,5±0,08 | 5,2±0,07 |
| Width, cm | | 6,2±0,09 | 4,5±0,08 |
| Leaf thickness, µm | | 401,7±3,52 | 341,6±2,82 |
| Thickness outer wall of epidermis, µm | Adaxial | 12,8±0,16 | 12,5±0,17 |
| | Abaxial | 11,8±0,18 | 9,2±0,15 |
| Height of epidermis, µm | Adaxial | 50±0,44 | 58,3±0,51 |
| | Abaxial | 41,8±0,34 | 50,4±0,45 |
| Palisade parenchyma | Height of cell, µm | 85,3±0,71 | 55,5±0,48 |
| | Width, µm | 16±0,19 | 11,2±0,15 |
| | Index | 5,3±0,09 | 4,9±0,08 |
| | Row | 2 | 2 |
| Vessels in the main vein | Number of vessels | 141 | 55 |
| | d – vessels, µm | 35,3±0,28 | 40,2±0,33 |
| Petiole | | | |
| d - petiole, cm | | 0,25±0,07 | 0,15±0,08 |
| Thickness outer wall of epidermis, µm | | 16,7±0,19 | 15,5±0,19 |
| Height of epidermis, µm | | 41,5±0,35 | 47,4±0,39 |
| d - parenchyma cells, µm | | 52,5±0,47 | 48,5±0,41 |
| d - vessels, µm | | 40±0,35 | 30,7±0,27 |

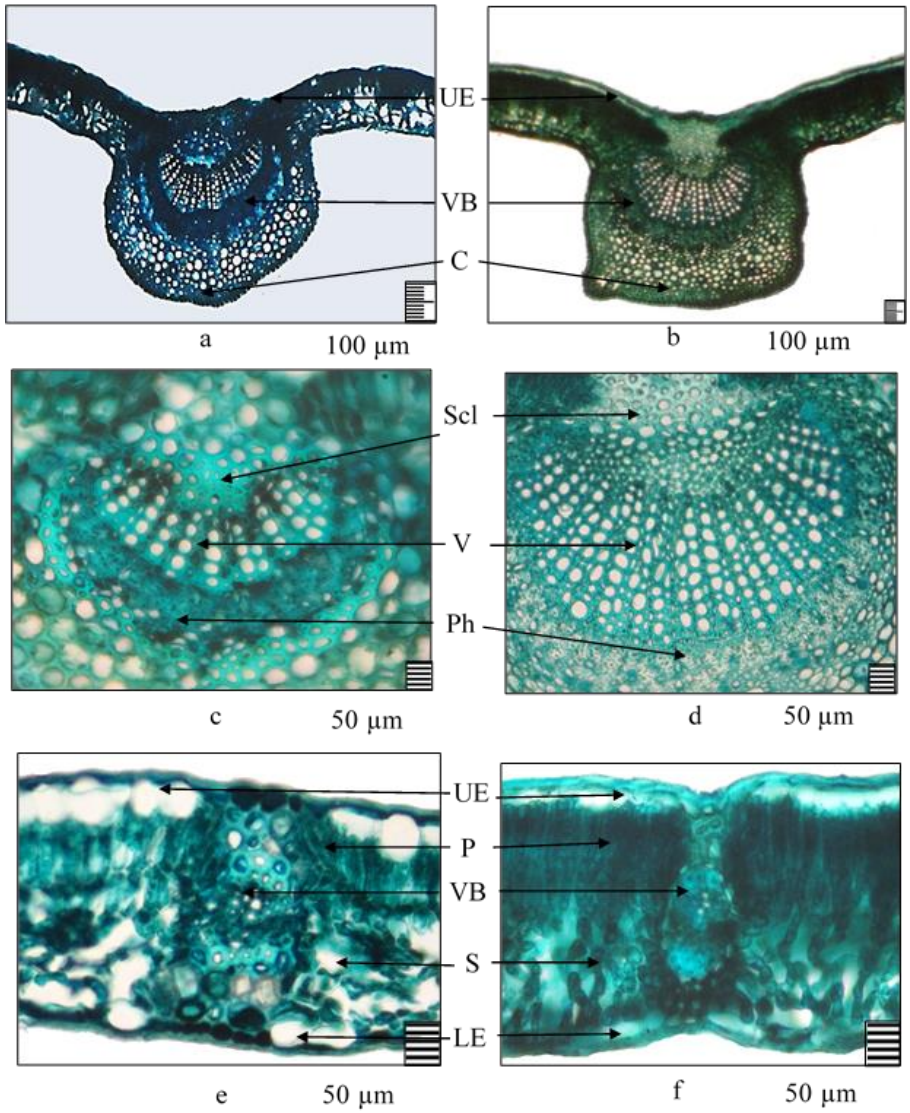


Figure 1. The structure of the leaf species of *Crataegus korolkowii* from different environmental conditional (Angren, Ustyurt) : a, c, e – Angren; b, d, f – Ustyurt. a, b – the main vein; c, d – median bundle; e, f – mesophyll.
Legenda: C – cuticle, LE - lower epidermis, P – palisade parenchyma, Ph – phloem, S – spongy parenchyma, Scl – sclerenchyma, UE - upper epidermis, V - vessel, VB - vascular bundles.

The anatomical structure of the stem is also similar. Under the single row epidermis, the petiole is a multi-layered parenchyma, its peripheral layers are differentiated into a lamellar collenchyma. Behind the collenchyme is a loose thin-walled parenchyma. In the middle part of the stem, mezopteole, there is one conducting beam of arcuate form, not closed from the adaxial side. The central vascular bundle is sclerified, formed from primary and secondary xylem and phloem. The structure of the stem is mainly characterized by signs of a quantitative order (Figure 2, Table 1).

Based on the data obtained on the anatomical structure of leaf plates and petioles of representatives of *C. korolkowii,* growing in different environmental conditions, a number of general structural features can be noted: single-layered epidermis, mesophyll of the dorsyventral type, stomata anomocytic, rarely cyclocyte type, located on the abaxial side of the leaf, the presence of drusen calcium oxalate in the spongy mesophyll.

However, the biometric indicators of anatomical structures revealed differences that make it possible to associate these structural features with certain environmental conditions. In plants growing on Ustyurt under conditions of periodic lack of moisture, the following xeromorphic signs were revealed: leaf thickening, thickening of the outer walls of the epidermis, a large percentage of palisation coefficient, densely closed cells of the columnar mesophyll. Plants

growing in Angren, with sufficient soil moisture is dominated by features of the mesomorphic: surfaced stomata and the dominance of their number on the abaxial side, loose spongy parenchyma, well developed intercellular spaces.

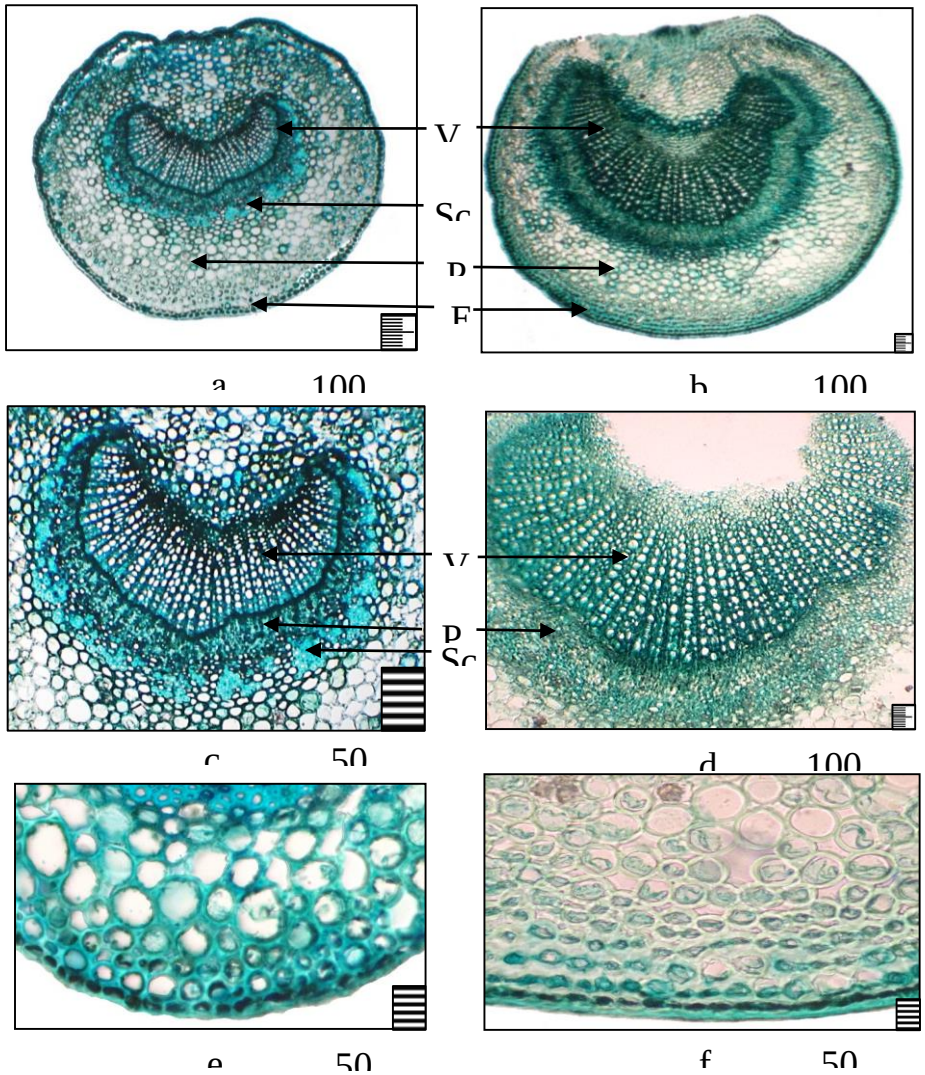


Figure 2. The structure of the petiole species of *Crataegus korolkowii* from different environmental conditions (Angren, Ustyurt): a, c, e – Angren; b, d, f – Ustyurt. a, b – general view; c, d – vascular bundle; e, f – fragment.
Legenda: E – epidermis, P – palisade parenchyma, Ph – phloem, Scl – sclerenchyma, V - vessel, VB - vascular bundles.

By origin, representatives of the studied genus - mesophytes. However, plants growing under the severe conditions of Ustyurt can be characterized as xerophytes on the basis of the anatomical data obtained. The natural conditions of Ustyurt (Eastern Chink) are characterized by a pronounced seasonality of climate and a high probability of soil and atmospheric drought in spring and summer, which requires a high adaptive capacity of plants.

## CONCLUSIONS

Thus, various methods of adaptation can equally successfully provide the plant with the possibility of existence in certain environmental conditions. The highest level of adaptation of the plant, as a rule, is achieved by combining various adaptations. In the same species of plants growing in different environmental conditions, the general plan of the structure of the leaf is preserved, only quantitative indicators change. Under conditions of higher illumination and moisture deficiency in plants, there is a tendency to enhance xeromorphic signs. Despite the high temperatures, lack

of moisture and soil properties, *C. korolkowii* adapted very well to these conditions. Consequently, the adaptations to environmental conditions acquired during the evolution are the most viable.

## REFERENCES

[1] Barykina, R.P., Chubatova N.V. (2005) Large workshop in botany. Ecological anatomy of flowering plants. Moscow: Association of scientific publications, 77.
[2] Boboreko E.Z. (1974) *Crataegus* - Minsk: Science and Technology, 224.
[3] Zaitsev G.N. (1991) Mathematics in experimental botany. Moscow: Nauka, 296.
[4] Letukhova V.Yu., Potapenko I.L. (2013) New data on the number of hawthorn (*Crataegus*) in the Karadag Nature Reserve. Ecosystems, their optimization and protection. Simferopol, 125-133.
[5] Ostashevsky A. Ya. (2011) Features of the biology of the development of species of the genus *Crataegus* L. in the flora of Central Asia introduced in Ukraine. Kiev: Phytosociocentre, 136.
[6] Sarkisyan M.V. (2011) Ecological-geographical Analysis of Representatives of the *Crateagus* genus of the South Caucasus // Takhtajania - Yerevan, 168-172.