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ANALYSIS OF ECOLOGICAL AND ANATOMICAL CHARACTERISTICS OF THE SPECIES *PLANTAGO LANCEOLATA* L. IN *EX-SITU* AND *IN-SITU* CONDITIONS

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The study analyzed the anatomical features of *Plantago lanceolata in situ* and *ex situ* conditions. Transverse sections of the samples were analyzed by optical means after placement in temporary and permanent preparations. Anatomical transverse sections were obtained from the leaf, rosette part and root and analyzed as a result of histological staining. As a result, it was established that various tissues are formed in these organs and in the plant as a whole and which adaptations and changes they have depending on the environment in which they spread. As a result of comparative anatomical studies on *Plantago lanceolata* samples, it was found that the entire tissue complex in the plant taken from in situ conditions is more conservative. In the sample grown in *ex situ* conditions, the cortex part of the root is more voluminous, the amount of phellem, phellogen and phelloderm cells in the periderm is less. On the contrary, in the *in situ* sample the central cylinder is better developed. It can be noted that in the *in situ* sample, the leaf mesophyll is relatively thin, the main parenchyma tissue is more densely located, and in the main central vessel, the number of small vascular bundles is higher, and the number of xylem tubes and sclerenchyma cells is relatively higher.

Keywords: axix cylinder, chlorenchyma, endodermis, parenchyma, pericycle

INTRODUCTION

It can note that there are plant groups from different taxa in the phytocenosis, and it is important to study not only their systematic but also their internal structures. In general, almost all of these plants are medicinally important. In this regard, it is necessary to study many of these plants [Ibadullayeva, 2010]. Experiments were conducted on the *Plantago lanceolata* species, which is widely used as a medicinal plant in the mountainous area of the Lesser Caucasus [Asgerov, 2006; Gurbanov, 2009]. Biologically active substances collected in the root of the plant are very important. A perennial herbaceous plant up to 50 cm high with a shortened rhizome and taproot. Linoleic acid, cholesterol, sitosterol, stigmasterol and campesterol are found in the roots. The aerial parts of the plant contain flavonoids, phenolcarboxylic acids and their derivatives.

The leaves contain carbohydrates and organic acids (fumaric, chlorogenic, neochlorogenic, vanillic, ferulic, protocatechuic, para-hydroxybenzoic, para-coumaric) [Sardarova, 2022]. The seeds contain mucilage and fatty oil. It is used to feed livestock - it is included in grass mixtures and provides valuable hay. In pastures it is eaten only by sheep, goats and geese In folk medicine, plantain leaf was used for chest diseases and as an external hemostatic and wound healing agent [Ibadullayeva and Kahramanova, 2016]. Taking into account the prospects of Plantago lanceolata, we found it relevant to conduct research on it. From this point of view, both herbarium specimens were prepared from plant specimens taken from different areas, and they were involved in anatomical analysis. For this purpose, a large number of anatomical sections were obtained from parts taken from both generative and vegetative organs of the plant Plantago lanceolata species was taken from both different areas and the anatomy of its stem, root, leaf, secondary root and rosette part was studied [Korovkin, 2007]. The following information about the work done during the research is reflected.

MATERIALS AND METHODS

The material of the study is *Plantago lanceolata* plants taken from the mountainous area of the Lesser Caucasus (the area around Maral Gol) and, comparatively, from the garden area of the city of Ganja (in-situ in the backyard). The plant was studied anatomically. Classical and modern botanical-floristic, ecological [Babayev, 2003], etc. methods, "Flora Azerbaijan" [1957], "Abstract of Flora of the Caucasus" [2006-2012] identifiers and websites were used [WFO]. Phenological observations were made on the plants taken to study the anatomical features of *Plantago lanceolata*. After the plant growing in natural conditions in the area reaches full morphological maturity, its stem, leaf, root and rhizome are taken [Sandoval, 2005]. A large number of cuttings from the vegetative organs of the species were prepared and analyzed in depth. Both temporary and permanent preparations were prepared by cutting the incisions by hand and with a microtome according to the method adopted in anatomical practice. Preparation of preparations was carried out according to generally accepted methods [Barykina et al., 2000]. Cuttings were made from fresh or fixed parts of plants. Alcohol or formalin was used to fix the plant. Sections are made with the help of a sharp razor. At this time, small objects are placed in the core of the kandalash body. Transverse sections were made from the leaf and cylindrical organs (root, stem) of the plant.

In order to achieve a more effective result, thin cuts were made by squeezing the object between two fingers of the left hand professionally. In the sections made with a microtome, the object is placed in paraffin blocks. Sections are added to the dyed water solution in petri dishes, thinner sections are transferred to a clean watch glass and an aqueous solution of the dye is added to it. After a few minutes (depending on the concentration of the dye), the sections were washed several times with water or 50% ethyl alcohol solution to remove the dye.

This process was monitored under a microscope. Afterwards, the washed sections were placed one by one on a glass slide in pre-prepared melted glycerine-gelatin drops. Canada balsam was also used to study cell contours. Anatomical preparations prepared using modern special modern digital and camera NLCD-307 B model, ZEES microscopes, Motic brand made in Germany, XSP 91-06-DN digital), as well as "MBU-6", MBU-1, MBU-3 microscopes has been studied [Barykina, 2007].

RESULTS AND DISCUSSION

Anatomical structure of the leaf of *Plantago lanceolata*: The leaf of *Plantago lanceolata* is anatomically dorsoventral in structure (Fig. 1). The leaf sample given below is taken from plants growing in different areas. Based on the microscopic analysis, we can note that the leaf mesophyll in the plant taken from (A) ex area is relatively different. Here, the number of transmission balls is large (7 pieces) [Tutayug, 1967]

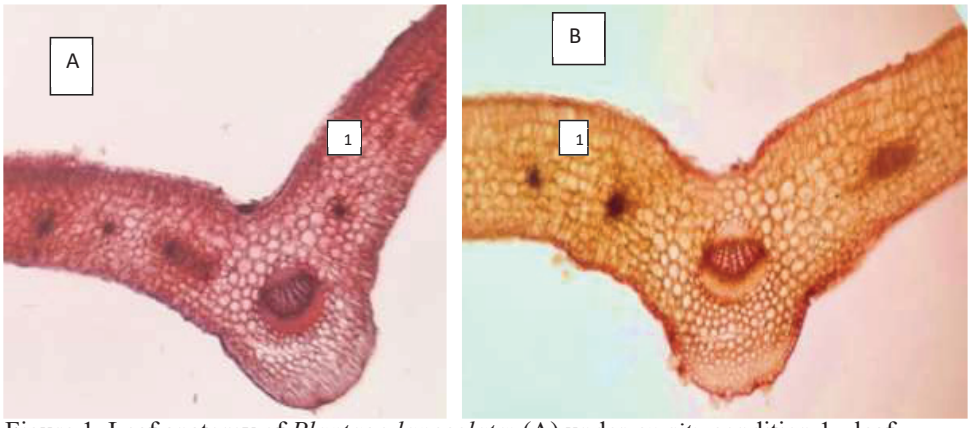

Figure 1. Leaf anatomy of *Plantago lanceolata*: (A) under *ex-situ* condition 1 - leaf mesophyll; (B) under *in-situ condition* 1 - leaf mesophyll.

number of mechanical cells in the main transmission ball is more. Leaf mesophyll is relatively thin. In the *in situ* plant, the number of small transmitter balls is low (3 pieces).

Microscopic research has been carried out and it has been determined that there are different structures in the cross-section of the leaf of *Plantago lanceolata* in *ex* and *in situ* conditions (Fig. 2). We can note that the following 2 examples are also observed from the image taken from the micropreparation with *ex* (A) and *in-situ* (B). Here, the structure of the central vein in the ex plant leaf and the central vein of the in-situ plant are relatively different.

It is also clear from the microscopic structure that the root consists of bark parenchyma and a central cylinder [Humbatov, 2017]. In the root of the plant growing in different areas, both the bark parenchyma and the central cylinder were formed in different structures in both *ex* (A) and *in situ* (B) samples.

Ex situ and *in situ* specimen of *Plantago lanceolata* anatomical structure of the rosette part: From the anatomical structure of the rosette in *ex* and *in situ* specimens of *Plantago lanceolata*, it is known that *in situ* (B) the main parenchyma is better developed in this part of the plant. Transmission system is more sparse and weak [Gasımov, 2010].

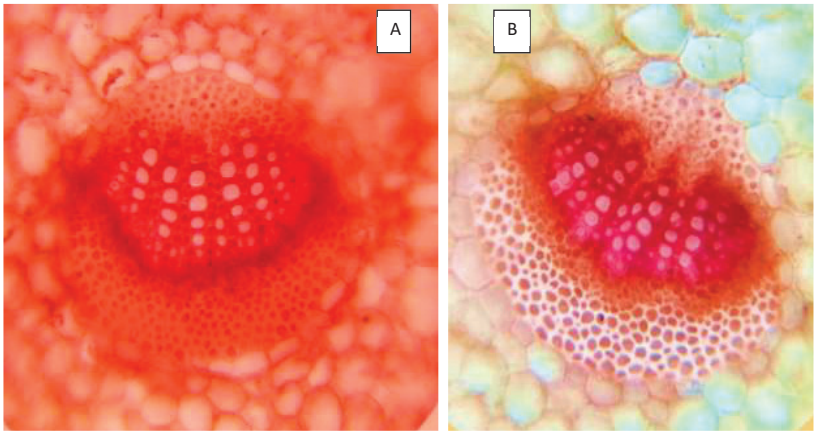

Figure 2. The main vascular system of a plant: (A) under *ex-situ* conditions; (B) under *in situ* conditions.

Anatomical structure of the root of *Plantago lanceolata*: The root of *Plantago lanceolata* has a secondary structure in cross-section (Fig. 3).

Ex situ and *in situ* specimen of *Plantago lanceolata* anatomical structure of the acces-

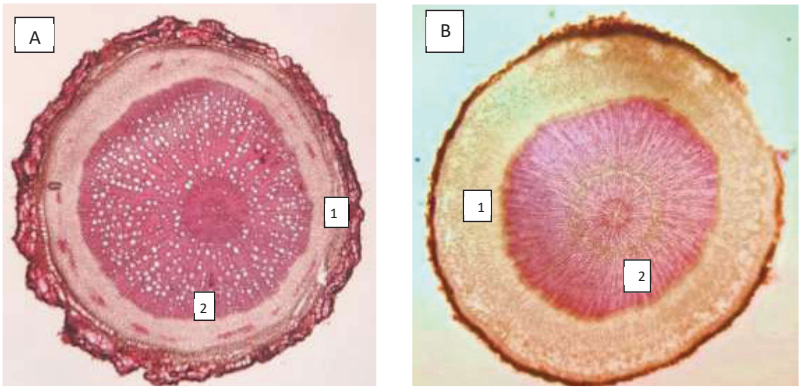

Figure 3. Anatomical structure of the root of *Plantago lanceolata* (A) *ex situ* conditions 1 - bark part, 2 - central cylinder; (B) *in situ* conditions 1 - shell part, 2 - central cylinder.

sory root: It can be seen from the anatomical structure of the appendage root in *ex situ* and *in situ* samples of *Plantago lanceolata*. *Ex situ* (A) the main parenchyma tissue in the plant consists of large cells of the prosenchyma type. The central cylinder is well developed in a representative in-situ (B). This is also associated with providing the plant with water at the required level. In the in situ plant, even the volume of the shell part is large when viewed from the central cylinder [Lotova, 2007].

The following conclusions can be drawn from the microscopic studies. So, for example, the periderm and bark parenchyma part of the root of *Plantago lanceolata* both in *ex* (A) and *in situ* (A) conditions have different structures (Fig. 4). In the example of plant. *Ex*, it is clear that the periderm layer is thick. There are many cells here. Also, the central vein part of the *Plantago lanceolata* leaf is relatively different in the microscopic image in both samples (A) and (B). Here we can note that the difference in the central vein in the leaf in both *ex* (A) and *in situ* (A) specimens of *Plantago lanceolata* is the better development of mechanical tissue in the *ex situ* plant. At the same time, their number is large and the wall of their cells is much thicker. This also shows structural differences. Rosette part (Fig. 5) of *Plantago lanceolata* has a relatively different structure in both *ex situ* (A) and *in situ* (B) conditions (Fig. 6). It is also clear from the microscopic picture that the transmis-

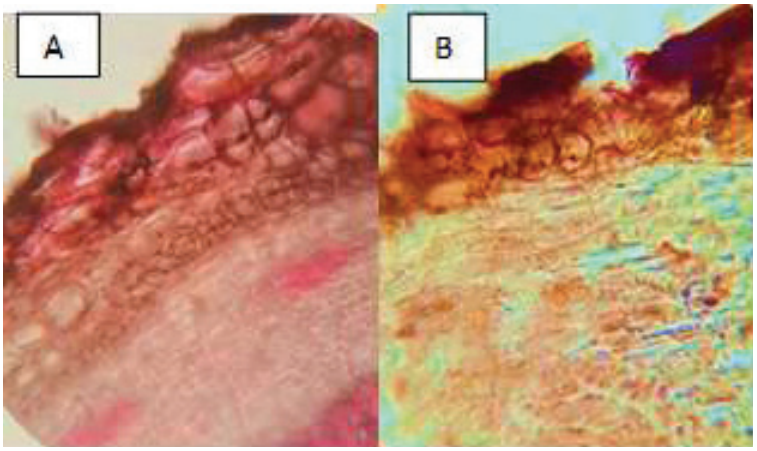

Figure 4. Anatomical structure of the periderm in the root of *Plantago lanceolata:* (A) under *ex situ* conditions; (B) under *in situ* conditions.

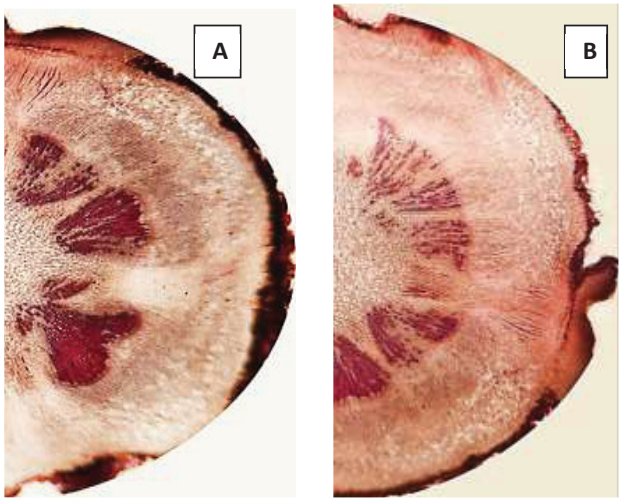

Figure 5. Anatomical structure of rosette tip of *Plantago lanceolata*: (A) *ex situ*; (B) *in situ*.

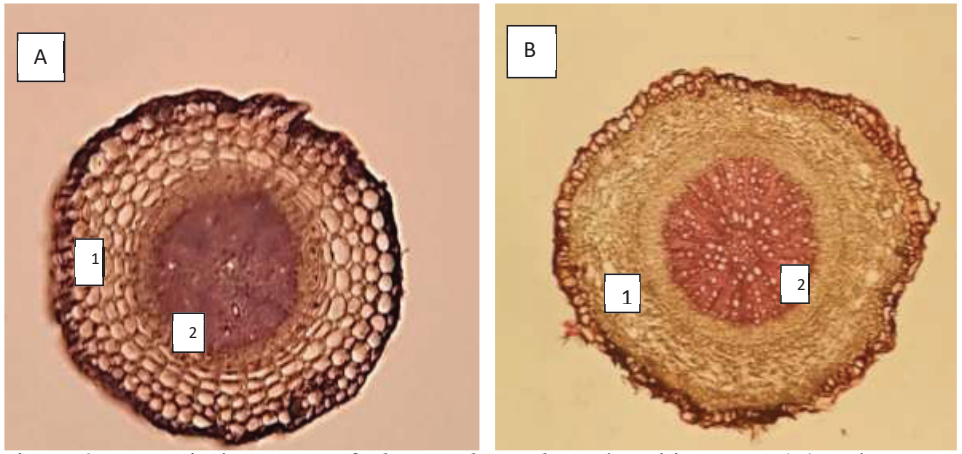

Figure 6. Anatomical structure of *Plantago lanceolata* adventitious root: (A) under *ex situ* conditions. 1 - bark parenchyma, 2 - central cylinder; (B) under *in situ* conditions. 1-shell parenchyma, 2 - central cylinder.

sion system is better formed in the plant growing in *ex* conditions. Also, the covering tissue surrounding the rosette part is relatively thick. Parenchyma cells are also large.

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Анализ эколого-анатомических характеристик вида *Plantago lanceolata* L. в условиях *ex-situ* и *in-situ*

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В ходе исследования были проанализированы анатомические особенности *Plantago lanceolata* в *in-situ* и *ex-situ* условиях. Поперечные сечения образцов анализировались оптическими средствами после помещения во временные и постоянные препараты. Анатомические поперечные срезы получали с листа, розеточной части и корня и анализировали в результате гистологического окрашивания. В результате было установлено, как в этих органах, так и в растении в целом образуются различные ткани и какие приспособления, и изменения они имеют в зависимости от среды, в которой они распространяются. В результате сравнительно-анатомических исследований на образцах *Plantago lanceolata* установлено, что весь тканевой комплекс у растения, взятого из условий *in situ*, более консервативен. У образца, выращенного в *ex situ* условиях, кортексовая часть корня более объемна, количество феллемы, феллогена и клеток феллодермы в перидерме меньше. Напротив, в образце *in situ* центральный цилиндр развит лучше. Можно отметить, что в образце *in situ* мезофилл листа относительно тонкий, основная ткань паренхимы расположена более плотно, а в главном центральном сосуде количество мелких проводящих пучков выше, а количество ксилемных трубок и клеток склеренхимы относительно выше.

Ключевые слова: центральный цилиндр, хлоренхима, эндодерма, паренхима, перицикл

Plantago lanceolata L. növünün *ex situ* və *in situ* şəraitində ekoloji-anatomik xüsusiyyətlərinin təhlili

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Tədqiqat zamanı *Plantago lanceolata* növünün *in situ* və *ex situ* şəraitdə anatomik xüsusiyyətləri analiz olunmuşdur. Nümunələrdən alınmış en kəsimləri müvəqqəti və daimi preparatlarda yerləşdirildikdən sonra optik vasitələrlə təhlil edilmişdir. Anatomik en kəsimlər yarpaqdan, rozet hissəsindən və kökdən götürülərək histoloji boyamalar nəticəsində analizlərə cəlb olunmuşdur. Nəticədə bu orqanlarda və ümumilikdə bitkidə müxtəlif toxumaların necə formalaşması və yayıldığı mühitə uyğun nə kimi uyğunlaşmalara və dəyişkənliklərə sahib olduğu müəyyən edilmişdir. *Plantago lanceolata* nümunələri üzərində aparılan müqayisəli anatomik tədqiqatlar nəticəsində aşkarlanmışdır ki, *in situ* şəraitdən götürülmüş nümunədə bütün toxuma kompleksi daha konservativ quruluşda-

dır. *Ex situ* səraitdə bitən nümunədə kökün korteks hissəsi daha həcmlidir, peridermdə fellem, fellogen və felloderm hüceyrələrinin sayı daha azdır. *İn situ* nümunə də isə əksinə mərkəzi silindr daha yaxşı inkişaf etmişdir. Qeyd edə bilərik ki, *in situ* nümunədə yarpaq mezofili nisbətən nazik, əsas parenxim toxuma daha kip yerləşmiş, kiçik ötürücü topanın sayı artıq, əsas mərkəzi damarda isə ksilem borularının və sklerenximanın hüceyrələri nisbətən artıq sayda müşahidə olunur.

Açar sözlər: mərkəzi silindr, xlorenxima, endodermis, parenxima, perisikl