

COMPARATIVE HISTOLOGICAL ANALYSIS OF SOME VEGETAL PRODUCTS OBTAINED FROM *PLANTAGO* L. GENUS

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Abstract

The paper provides important information for harnessing the *Plantago* genus, the *Plantago major* L. and *Plantago lanceolata* L. species, identified and harvested from the spontaneous flora of Bihor County. They were analysed comparatively the following vegetal products, from a morphological and anatomical point of view, originating from both species: *Plantaginis majoris radix*, *Plantaginis majoris folium*, *Plantaginis lanceolatae radix*, *Plantaginis lanceolatae folium*. All anatomical structures, present in these vegetal products, were elucidated correctly and throughoutly.

Key words: *Plantago major* L., *Plantago lanceolata* L., vegetal histology, Bihor County, spontaneous flora

INTRODUCTION

The *Plantago major* L., *Plantago media* L., *Plantago lanceolata* L.) Species belong to the Plantae kingdom, Magnoliophyta class, Plantaginales order, Plantaginaceae family; in popular terminology it is called plantain (Andrei et. al, 2009, Brundrett, 1991). Herbaceous, perennial species, of 10-40 cm, with leaves disposed in a rosette basal, and very common straight floriferous stems. The underground part it is a thick and short rhizome, with numerous fasciculated roots. (Bojor., 2003, Szabo, 2007)

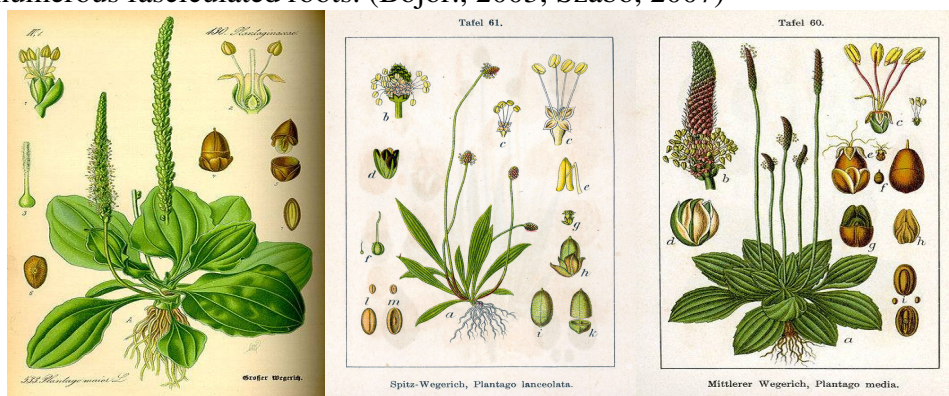


Fig. 1. *Plantago major* L. Fig. 2. *Plantago lanceolata* L. Fig. 3. *Plantago media* L.
(Source of images: https://es.wikipedia.org/wiki/Plantago_lanceolata - accessed 13.05.2015
<https://ierburiuitate.wordpress.com/2013/06/> - accessed 17.08.2016)

Plantago major L., **greater plantain**, it is also called lie, broadleaf plantain, garden fat grass, mother of the forest, sea grass (Fig.1). *Plantago lanceolata* L. **narrow plantain**, it is also called little tongue, milfoil, carts, grass for cutting (Fig.2). *Plantago media* L., **hairy plantain**, it is also called road grass, foal-tongue, sheep-tongue (Fig.3).

Plantago species grow on road sides, and in pastures. For medicinal purposes it was introduced only the *Plantago lanceolata* culture. It is often mentioned in many pharmaceutical formulas or forms, recommended for respiratory diseases. The medicinal vegetal product it is represented by leaves (Ciccarelli et al, 2009, Fahn, 1967, Hendawy, 2008).

Plantaginis species folium it represents the leaves of those three *Plantago* species, and *Plantaginis lanceolatae folium* represents the leaves of *Plantago lanceolata* L., harvested before and during flowering, without petioles. They do not have any smell, but have a sour – bitter taste (Pallag, 2015, Ianovici, 2010b, FR X.). The efficiency of preparations made of plantain are based on the action of glycosides and mucilages, which have a soothing and emollient effect. They are used for their laxative-, emollient-, expectorant effects, fluidifiant of bronchial secretions, anti-inflammatory-, anti-diarrheal-, diuretic- and cleansing-, healing-, astringent- and anti-itch-effects (Moscovici, et al, 2012; Banes et al, 2007).

Therapeutic indications: treatment of atherosclerosis, hyperacidity gastritis, hemorrhages, diarrhea, hypertension, gastric ulcer, coughs of various etiologies, bronchitis and asthma (Ciulei. et al, 1993, Istudor, 2001, Szabo, 2007).

MATERIAL AND METHOD

There were identified two species of *Plantago* genus, *Plantago major* L. and *Plantago lanceolata* L. in the spontaneous flora of Bihor County, and they were harvested from different unpolluted areas. Harvesting was performed during the flowering of those two species, in May – June 2015, in Oradea's area, afternoon, in dry weather.

The plants were handpicked, by breaking the vegetative organs into smaller pieces, in order to be able to analyze them easier under the microscope. Their identification was accomplished using determinates and botanical atlases. Any piece or part of the plant which had stains, or it was withered and damaged, has been removed. There were harvested only the healthy and clean plants. (Ciocîrlan V., 1990; Ardelean A., et al, 2012, Metcalfe, C.R. & Chalk, L., 1950, Sârbu I., 2013). The macroscopic exam was performed according to FR.X. There were determined the morphological characteristics of the harvested vegetal products, observed with the naked eye, or with a magnifying glass, as well as those

characteristics, which could have been determined by sensing taste and smell. The results of the macroscopic analysis on the vegetal material (radix, herba, folium, flos, fructus, and semen) were presented in Tables no. 1, 2, 3, 4. The macroscopic structure in the vegetative organs (root, stem, leaf, flower) was performed on cross-, longitudinal sections, and the preparations were obtained by skinning, cleared and colored with Genevez reagent (Şipos M., 2004, Tămaş M., 2007). The preparations were analyzed under the microscope *Optika B350*.

RESULTS AND DISCUSSION

There were obtained and characterized macroscopically, from botanical and pharmaceutical point of view, the following vegetal products: *Plantaginis radix*, *Plantaginis herba*, *Plantaginis folium*, *Plantaginis flos*, *Plantaginis fructus*, *Plantaginis semen*.

Table 1

The results of macroscopic analysis for *Plantago major L.*-vegetative organs

<i>Plantago major L.</i> , greater plantain					
Vegetative Organ	Aspect Form	Surface Fracture	Dimensions	Color	Smell Taste
roots	fasciculated and branched roots	uneven surface, fibrous structure	short, up to 2-5 cm	exterior-light brown, interior-yellowish	no smell
aerial stems	cylindrical unfoiled, knotless	even	long, up to 5 cm	dark green	characteristic taste and smell
leaves	whole oval, with a rounded, hairless, petiole base,	smooth-, whole edge, with arched ribs	wide up to 3-5 cm long up to 7 cm	bifacial, dark green on the upside and light green on the down side	characteristic smell

Table 2

The results of macroscopic analysis for *Plantago major L.*-reproductive organs

<i>Plantago major L.</i> , greater plantain					
Reproductive organ	Aspect Form	Surface Fracture	Dimensions	Color	Taste Smell
inflorescence	Long, dense Cylindrical inflorescences, (ears), with numerous, continuous flowers on the spindle	uneven surface	long ear, up to 5-10 cm,	the ear is dark green	The era has a characteristic, flavored odor
flowers	very small, hermaphrodite	smooth, soft	with flowers of type 4, persistent calyx of 3 – 4 sepals, radial symmetric, gamopetalous membranous corolla, androecium of 4 equal stamens, unilocular gynoecium	whitish	characteristic smell
fruits	long, ovoid capsules, pyxide	even surface	length of 2-4 mm	brownish color	characteristic smell
seeds	small seeds	even surface	6-30 seeds in a capsule	blackish	no smell

Table 3

The results of macroscopic analysis for *Plantago lanceolata L.*-vegetative organs

<i>Plantago lanceolata L.</i> narrow plantain					
Vegetative Organ	Aspect Form	Surface Fracture	Dimensions	Color	Smell Taste
roots	fasciculated and branched roots	uneven surface, fibrous fracture	short, up to 2-5 cm	exterior-light brown, interior-yellowish	no smell
aerial stems	grows only at flowering, 5 cylindrical edges, leafless, knotless	smooth	long, up to 20-30 cm	dark green	characteristic taste and smell
leaves	hairless, narrow or oblong, lanceolate, gradually narrowed towards the top, with hairy petiole	whole, smooth edge	wide up to 1-2 cm long up to 7-10 cm	bifacial, dark green on the up side, and light green on the down side	characteristic smell

Table 4

The results of macroscopic analysis for *Plantago lanceolata* L.- reproductive organs

<i>Plantago lanceolata</i> L. narrow plantain					
Reproductive organ	Aspect Form	Surface Fracture	Dimensions	Color	Taste Smell
inflorescence	Long, dense cylindrical inflorescences, (ears), with numerous, continuous flowers on the spindle	uneven surface	short ear of 2-5 cm, length, 5-8 cm diameter	the ear is dark green	The era has a characteristic flavored odor
flowers	very small, hermaphrodite	smooth soft	flowers of 3-4 mm, type 4, calyx with oval, hairy petals, hairless on the top, radial symmetric corolla, androecium of 4 stamens, whitish filaments, yellowish anthers, unilocular, filiform gynoecium,	yellowish, light brown, violet flowers,	characteristic smell
fruits	Capsules with cap, pyxide	even surface	Long from 4-5 mm	brownish color	characteristic smell
seeds	small seeds	even surface	2 long seeds, about 2 mm long	blackish	no smell

In the root's cross section can be observed, under the microscope, three areas, which from the outside to the inside are: *rhizodermis*, *bark* and *central cylinder*.

The bark is made up of *exodermis*, the bark itself and the *endodermis*. The first three layers of the bark, under the rhizodermis, make up the *exodermis*, which, in this case, being multilayered, it is called *cutis*. *Plantago major* L. presents a compact bark, with oval-round shaped cells, having thin and cellulose walls. *Plantago lanceolata* L. presents more intercellular spaces, stacked neatly, taking the appearance of some parenchyma.

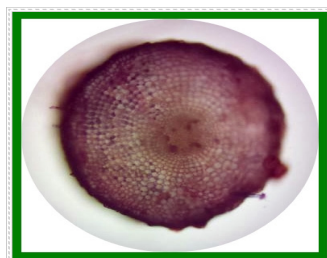


Fig. 4. Root's cross section in case of *Plantago major* L. (10x)

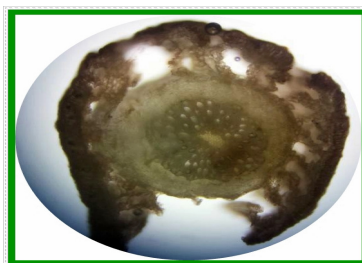


Fig. 5. Root's cross section in case of *Plantago lanceolata* L. (10x)

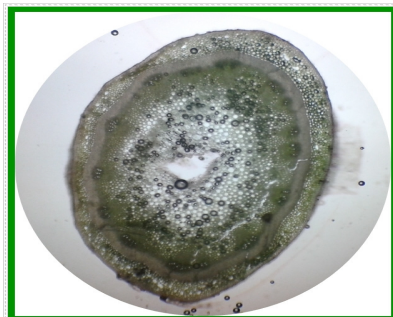


Fig. 6. Stem's cross section
in case of *Plantago major* L.(10x)

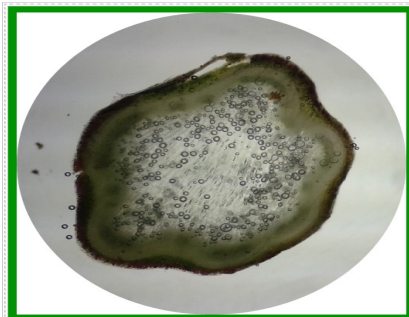


Fig. 7. Stem's cross section
in case of *Plantago lanceolata* L. (10x)

In cross section, both stems have a uniform and almost circular outline. The succession of tissues, from the outside to the inside, are: *epidermis, bark and central cylinder*. The *Plantago major* L. species present a central lacuna.

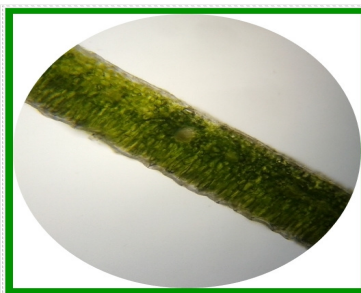


Fig. 8. Leaf's cross section
in case of *Plantago major* L.(10x)

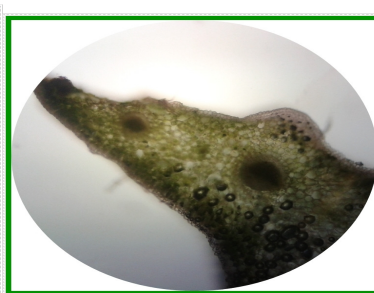


Fig. 9. Petiole's cross section
in case of *Plantago lanceolata* L. (10x)

Plantago major L. and *Plantago lanceolata* L. present leaves with bifacial structure, having the foliar limbo protected by the two epidermises: *superior epidermis and inferior epidermis*. The epidermis is a single layer of oval – elliptical cells, the outside cell wall being covered with a highly developed cuticle, which forms a continuous layer. Among the inferior epidermis cells are to be found the stomata. The leaf's mesophyll differs in a palisade parenchyma and a lacunar parenchyma.

In case of *Plantago lanceolata* L. species, in the mesophyll, from place to place in the palisade- and the lacunar tissue, are to be found calcium oxalate crystals, disposed in the form of some druze (or ursini). The petiole's cross section, observed with a 10x lens, presents the outline of letter V. At the lower part are to be found several protrusions, next to each leading fascicle.

There have been identified anatomical structures of the type of some secretory formations, not specified so far in the literature. The location of the secretory cells on the *Plantago lanceolata* L. leaf's epidermis was identified by performing some preparations by skinning. The presence of multicellular tector hairs was highlighted too, in case of this species.

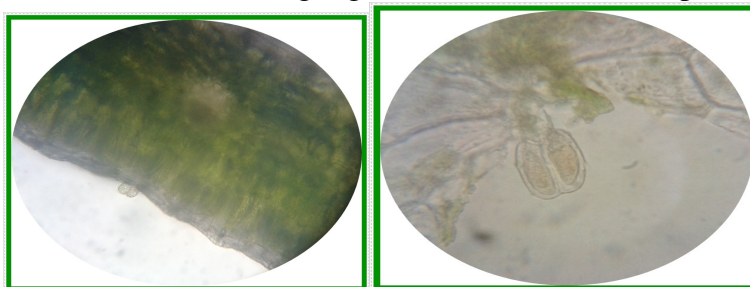


Fig. 10. Multicellular secretory formations, with bulging cuticle, in case of *Plantago lanceolata* L. species (10x, 40x)

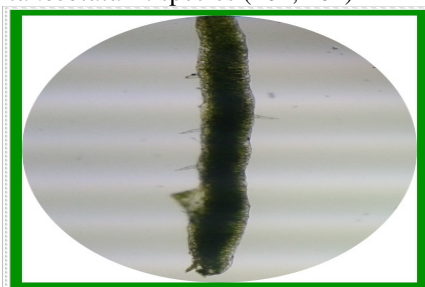


Fig. 11. Highlighting multicellular, filamentous tector hairs in case of *Plantago lanceolata* L. species (10x)

CONCLUSIONS

The paper provides important information for harnessing the *Plantago* genus, the *Plantago major* L. and *Plantago lanceolata* L. species, from the spontaneous flora of Bihor County

The analysis of *Plantago major* L. and *Plantago lanceolata* L. species, began with the collection of samples and their characterization from a macroscopic point of view, the botanical identity of each species, according to Romanian Pharmacopoeia 10th edition.

The microscopic study, on the level of vegetative organs, was performed on cross- and longitudinal sections, or by skinning and coloring with Genevez reagent.

There were determined by optical microscope the following anatomical structures, of the following organs: *Plantaginis majoris radix*, *Plantaginis lanceolatae radix*, *Plantaginis majoris folium*, *Plantaginis lanceolatae folium*.

There were identified the presence of calcium oxalate druzes, and some secretory formations in the *Plantaginis lanceolatae folium* vegetal product. The correct elucidation of anatomical structures becomes very precious for phytotherapy, for a more detailed knowledge of vegetal products, with therapeutic potential, and establishing some connections between the morphological features and the content in active principles.

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