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SEVERAL HISTO-ANATOMICAL ASPECTS ON THE RHIZOME STRUCTURE IN *RHODIOLA ROSEA* L.

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Key words: *Rhodiola rosea, golden root, rhizome*

INTRODUCTION

R. rosea L. is known since antiquity by the name of *rodia riza*.

The Greek physician Dioscoride (in 77 B.C.) recommended it for its curative purpose in his paper „*De Materia Medica*".

LINNÉ renamed it *Rhodiola rosea*, due to its rose scent emanated by its roots, as we previously mentioned.

Both the rhizomes, and the herba are edible, therefore it was introduced into people's nutrition, as it is the case of the Inuit in Groenland, the eskimo people in North America and the natives of Alaska.

It appears that *R. rosea* is one of the 20 most frequently used plants in Alaska and Siberia. Alm (2004), quoting from Pontoppidan (1752) and Gunnerus (1766), related that the roots were a remedy against scurvy in Norway.

The same author reported that, along the Western Coast of Norway, the R. rosea decoction was used to wash the human hair in a certain period of time (in the folk tradition, it stops hair fall), to stimulate hair growth, or in the treatment of various hair problems (such as dandruff).

The same decoction was given to horned animals to treat some specific diseases and also intestinal parasites. In a certain age, in Norway, *R. rosea* was cultivated on roofs in order to protect the house from fire, a system rarely used nowadays, and the cultivated plant is the turf.

It is remarkable that both the rhizomes, and the herba are edible in some aother regions as well, such as Groenland, Siberia, Norway, and at a certain age back in time they were used for human feed (ALM, 2004).

In 2007, COSTICĂ M. et al. published a scientific contribution entitled 'Phytocoenological, histo-anatomical and biochimical aspects in *Rhodiola rosea* L. species from Romania', that comprises some histo-anatomical aspects in this species, as well.

MATERIAL AND METHODS

The vegetal material used in the anatomical tests in *Rhodiola rosea* L. originated in the Ceahlău mountains and it was represented by plants in various stages of development. In order to evince the histo-anatomical structure, cross sections were effected through the rhizome/tuber, using the botanical scalpel, elder pith and hand microtome. The used methods are the classic ones, according to the references.

The lab protocol used in the making of the microscopic slides followed the successive stages: the harvested plants were fixed and preserved in alcohol 70%, subsequently cross sections were effected through each vegetative organ. The cell content is removed from the plant tissues (the plant sections are immerged into some drops of sodium hypochlorite, and maintained for various periods of time depending on the vegetative organ where they were sampled from (underground organs – 20 minutes; aerial stem - 15 minutes; leaf lamina - 10 minutes).

The emptied sections are washed in acetic water, and then rinsed in tap water (twice). The surface sections through the leaf lamina and aerial stem will not be submitted to cell content removal. The sections were stained using one of the following reagents depending on the vegetative organ where they were sampled from: ruthenium red, iodine green, Carr solution, or acetic orcein. The surface sections through the leaf lamina and aerial stem were stained either with iodine green or ruthenium red.

The stained sections were transferred onto glass slides in a few drops of glicero-gelatin (sligthly pre-heated at the flame of an alcohol lamp) and covered with coverglass. The cross sections were subsequently analyzed using a photonic microscope (Olympus CX31) at the objectives 4X, 10X, 40X, and 100X, then photographed by means of a digital camera (Olympus C 5060).

RESULTS AND DISCUSSIONS

The underground stem (the rhizome)

At an early phase we aimed to analyze (from the histo-anatomical viewpoint) the rhizomes of the *Rhodiola rosea* plants grown in their native environment (Ceahlău mountains) compared to the rhizomes of some plants of the same species grown *in vitro* and subsequently acclimatised in their native environment. The lab analysis proved a similar histo-anatomical structure for the two types of plants.

As the cross sections reveal, the rhyzome has a circular or irregular shape (fig.1, 2).The rhizome displays a secondary structure, formed by means of the lateral meristems: the cambium and the felogen.

The protective tissue is represented by 6-9 layers of cork, exfoliated toward the outer side, therefore the epidermis exfoliated on the most part of the rhizome's periphery. The cortical parenchyma comprises about 6-7 layers of oval or slightly tangentially elongated cells (fig. 3, 4). The central cylinder displays a typical secondary structure, the conductive vessels form radial lanes inside a mass of fundamental parenchyma, separated by large pith rays (fig.6).

The centre of the rhizome withholds the parenchymatic-celulosic pith, comprising cells of various sizes, with thin walls and large aeriferous speces in between. Many solid ergastic inclusions may be observed in this area, represented by starch grains. This is the resrve starch deposited by plants, mainly in their underground organs, as it is the case of the studied species. The starch grains have an eliptical shape, with a central hill in *Rhodiola rosea* L. (fig.5).

CONCLUSIONS

Rhodiola rosea L., known as *the golden root*, *the rose root*, due to its freshly sectioned rhizomes' rose scent, was studied since the ancient times. It is an extremely valuable species from the phytopharmaceutical viewpoint.

At an early phase we aimed to analyze (from the histo-anatomical viewpoint) the rhizomes of the *Rhodiola rosea* plants grown in their native environment (Ceahlău mountains) compared to the rhizomes of some plants of the same species grown *in vitro* and subsequently acclimatised in their native environment. Many solid ergastic inclusions may be observed in the rhizome, represented by starch grains.

ABSTRACT

Rhodiola rosea L., known as *the golden root* or *the rose root* due to the rose scent of its freshly sectioned rhizomes, or *the arctic root*, is a dioic perennial herbaceous species with a thick rhizome, belonging to the *Crassulaceae* family. It was thoroughly studied from the pharmaceutical viewpoint, though the histo-anatomical studies are extremely scarce. As a consequence, this species was not described within the botanical treaties on the anatomy of the dicotyledons, or in other recent scientific papers.

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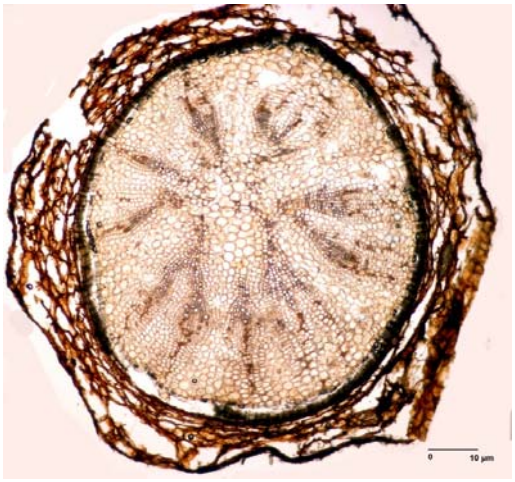

Fig. 1. Cross section through the rhizome inferior third in *Rhodiola rosea* L. – plants in their native environment – general aspect

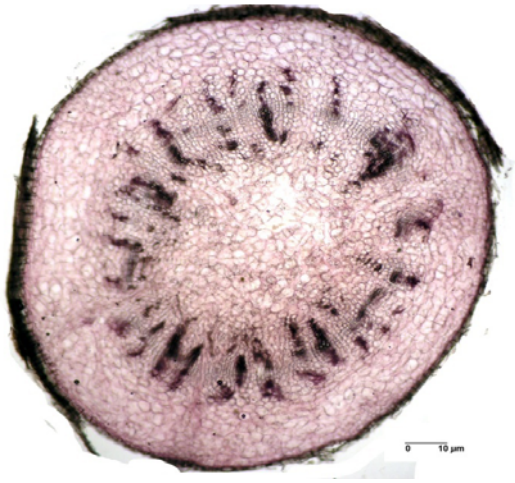

Fig. 2. Cross section through the rhizome superior third in *Rhodiola rosea* L. – plants in their native environment – general aspect

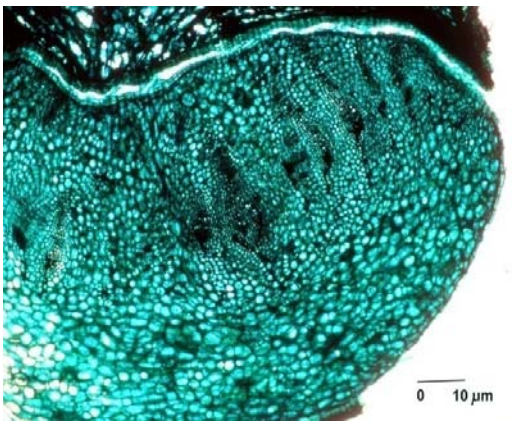

Fig. 3. Cross section through the rhizome middle third in *Rhodiola rosea* L. – plants in their native environment – general aspect

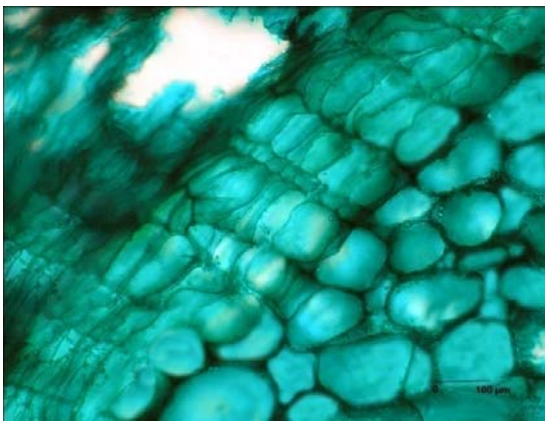

Fig. 4. Cross section through the rhizome middle third in *Rhodiola rosea* L. – plants in their native environment – detail

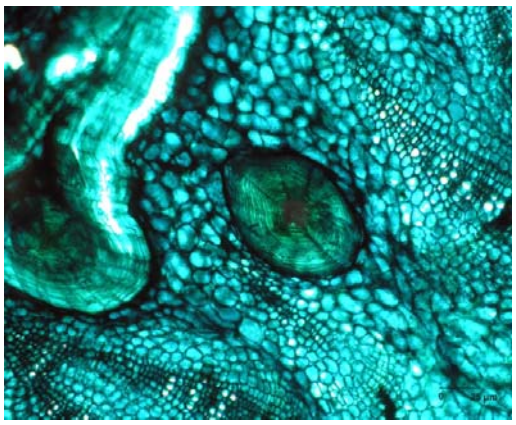

Fig. 5. Cross section through the rhizome middle third in *Rhodiola rosea* L. – plants in their native environment – detail of a starch grain

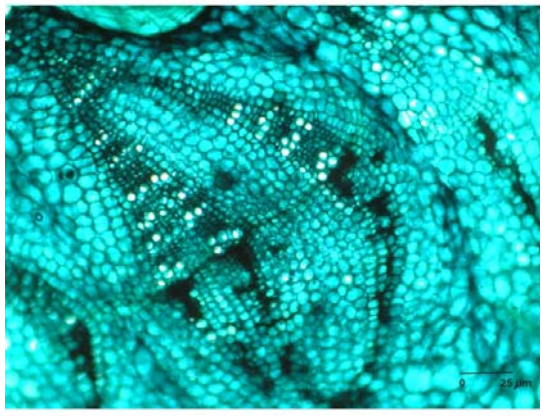

Fig. 6. Cross section through the rhizome middle third in *Rhodiola rosea* L. – plants in their native environment – detail of the conductive system