PHYTOCOENOLOGICAL, HISTO – ANATOMICAL AND BIOCHIMICAL ASPECTS IN *RHODIOLA ROSEA L.* SPECIES FROM ROMANIA

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Keywords : *Rhodiola rosea* L, morphology, structure, biochemistry

Abstract : In this paper the results of morphological, anatomical and biochemical investigation in *Rhodiola rosea* L. - as important medicinal plant species growing in Rodnei Mountains (Oriental Carpathians) - are presented

INTRODUCTION

Rhodiola rosea L., also known as "golden root" or "roseroot" belongs to the plant family *Crassulaceae*. Habitats of populations in Ceahlau Mountains are on calcareous support, on abrupt, moist and shady slopes, in a cool microclimate. In Rodnei Mountains, the populations of this species are growing on siliceous substratum, semi-fixated, around the glacial hollows.

Information referring to structure of *Crassulaceae* has been identified in the synthesis traits upon the dicotyledonous anatomy elaborated by H. Solereder, 1899; C.R. Metcalfe and L. Chalk, 1950; Napp – Zinn, 1973, 1974. The anatomical structure of *Crassulaceae* species has been investigated by different authors: (H. Sporer, 1915; K. Reiche, 1921; A. Berger, 1930 (according to Metcalfe and Chalk, 1950 and B.M. Borisovskaja, 1960).

Morphological features of *Rhodiola rosea* species from Romania

The plant is growing as small shrubs. The rhizome is thick, fleshy, with fragrance like roses, with buds generating new aerial stalks. The stalks are erect, cylindrical, simply, thick, leaved, sometimes - less red coloured in upper extremity. Leaves are alternatively disposed, narrow oval or lance - shaped, sessile, wedge - shaped towards basis, sharply toothed in the superior – half, planed, fleshy, hair-loss. The inflorescence is a dense corymb. Flowers are on the type 4, seeds are brown, long to 1.5 mm.

Characteristics of *Rhodiola rosea* population's from Romania

The leaves of *Rhodiola rosea* growing in Romania are frequently wedge - lance shaped, wedge – elliptic - lance shaped or reversed – oval - wedge shaped.

Phytocoenologic analysis of the species

Rhodiola rosea, in the Ceahlau Mountains, enters in the composition of the phytocoenoses integrated in the vegetal association *Saxifrago moschatae- Drabetum kotschyi* Puşcariu et al. 1956. This vegetal association appears, also, in the Bucegi Mountains. The characteristic species is *Draba kotschyi* (Alpine - Carpathians element), and edificatory species are *Saxifraga oppositifolia* and S. m*oschata.* In this association there are an important number of shade - plants, meso – hygrophilous, like: *Lloydia serotina*, *Achillea schurii*, *Arabis alpina*, *Saxifraga aizoides*, *Silene pusilla.*

In the Rodnei Mountains (Ineu, Pietrosu), *Rhodiola rosea* enters in composition of the phytocoenoses belong to vegetal association - *Saxifrago carpaticae - Oxirietum digynae* Pawl. et. Al 1928. Phytocoenosis of this association are presented also in Făgăraş Mountains (Scara, Caltun, Capra). The characteristic species is *Saxifraga carpatica*, near by Carpathians – Balkan species which are specific to the alliance *Veronicion baumgartenii* and of the order *Androsacetalia alpinae* (*Oxyria digyna*, *Achillea schurii*, *Saxifraga adscendens*). Carpathians – Balkan elements confer to this association a particular aspect comparing to phytocoenoses of the association *Oxyrietum digynae* Br.-Bl. 1926 from Central Europe.

MATERIAL AND METHODS

The study materials originated from the Rodnei Mountains, being collected in the summer of 2006.

Plants have been fixed and preserved in 70% ethanol and subsequently analysed according with the currently used plant anatomy methods: microtome sectioning, staining in iodine green and carmalum, mounting in Canada balsam, analysing under a Novex (Holland) microscope.

For soluble proteins (albumins) dosing, we used the Lowry method (Lowry et al., 1951), which is the most common colorimetric assays performed in biochemistry and molecular biology. This procedure is particularly sensitive and it relies on two different reactions. The first is the formation of a copper ion complex with amide bonds, forming reduced copper in alkaline solutions (“Biuret” chromophore). The second is the reduction of Folin-Ciocalteu reagent (phosphomolybdate and phosphotungstate) by tyrosine and tryptophan residues. The reduced Folin-Ciocalteu reagent is blue and thus detectable with a spectrophotometer (Jenway UV-VIS) in the range of 500-750 nm. The Biuret reaction

itself is not all that sensitive , but using the Folin-Ciocalteu reagent to detect reduced copper makes the assay nearly 100 times more sensitive than the Biuret reaction alone.

RESULTS AND DISCUSSIONS

Anatomical investigation

- Structure of rhizome in cross section

The protective tissue is represented by 6-8 layers of cork and just 1-2 layers of phelloderm. The cortical parenchyma is thick, from 12 – 20 layers of cells oval or less tangential elongated. The cells from the first 3 - 5 layers have the walls thicker than the cells from the inner cortex.

The central cylinder has secondary structure. The conductive tissues are disposed on a ring, being separated by narrow parenchyma rays. Conductive elements of phloem and xylem are relatively less represented, being radial spread in a mass of conductive parenchyma. In the centre of the organ there is extensive parenchyma pith.

- Structure aerial stalks

The cross section has an oval contour. The epidermis is unilayered, having cells with outer walls covered by a thin cuticle. The cortex is thick, a homogenous parenchyma from 12 – 14 layers of cells. The first one or the firsts 2 -3 layers of cells have the inner and outer wall thicker than lateral ones.

Conductive tissues are disposal on a ring. The phloem is formed of conductive elements of small dimensions. The secondary xylem is formed from conductive vessels having the thick, lignified walls. The primary xylem has less conductive elements with the walls less lignified, being irregularly disposed.

The pith, in the centre of the vegetative organ, is in a very large proportion - disorganised.

The upper and lower epidermises are composed from irregular shaped cells having numerous simple pits in the walls. The leaf lamina is amphystomatique, having stomata of anizocitous type

Biochemical investigation

The medium values of the soluble proteins from the samples analyzed were transformed in masses concentration (g soluble proteins / 100 g vegetal tissue).

As a result of the analyze of the *Rhodiola rosea* samples at 500 nm and the ulterior identification of the soluble proteins (albumins) concentration there were obtained the following medium values (corresponding to those 3 consecutive investigations) of quantities (g soluble proteins / 100 grams vegetal tissues) at the 3 vegetal organs level (stalk, leaves and fruit) compared to the control ones (Table 1).

Table 1. The variation of soluble proteins (albumins) at *Rhodiola rosea* L. (specific genotype / "Rodnei" Mountains, Oriental Carpathians, Moldavia region, Romania)

Research material / Vegetative organs of *Rhodiola rosea*	Soluble proteins (albumins) concentration values g soluble proteins / 100 g vegetal tissue			
	investigation 1	investigation 2	investigation 3	medium value
Stalk	0.146	0,144	0,148	0,146
Leaves	0,198	0,193	0,203	0,198
Fruit	0,232	0,238	0,232	0,234

CONCLUSIONS

Our morphological, histo-anatomical researches confirm the statement that *Rhodiola rosea*, can be included in **scopolii** subspecies.

The results of biochemical investigations have shown differences between soluble proteins (albumins) concentration in an increased pattern: stalk (0,146 g -), leaves (0,198 g -) and fruit (0,234 g - soluble proteins / 100 g vegetal tissue)

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