

# BIOCHEMICAL AND PHYSIOLOGIC STUDIES ON SALVIA (*SALVIA OFFICINALIS* L)

## STUDII FIZIOLOGICE ȘI BIOCHIMICE EFECTUATE LA SALVIA (*Salvia officinalis* L)

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**Abstract.** *In order to observe the concrete way in which the physiologic and biochemical processes vary in slavia plants, different peculiar and detailed studies were accomplished. Thus, different determinations (the content in chlorophyll and carotene pigments in leaves, in dry substance, water and mineral elements, soluble proteins and glucids) were accomplished in the leaves and shoots of different ages. The sampling of probes was realized in the following manner: the plants were in year II of cultivation in biologic culture. The studies were accomplished in plants form a local population of Salvia officinalis L with Italian origin, that is maintained in collection at VRDS Bacau.*

**Rezumat.** *Pentru a observa concret modul în care variază procesele fiziologice și biochimice din plantele de salvia s-a efectuat un studiu amănunțit asupra plantei. Astfel, au fost realizate o serie de determinări (conținut de clorofilă și pigmenți carotenoizi ai frunzelor, conținutul în substanță uscată, apă și elemente minerale, proteine și glucide solubile, ) la frunze și lăstarii de diferite vârste. Prelevarea probelor s-a realizat astfel: plantele la care au fost realizate aceste determinări se aflau în cultură biologică în anul II. Studiile au fost efectuate pe plante din populația locală de Salvia officinalis L de proveniență italiană ce se afla în colecție la SCDL BACĂU.*

## MATERIAL AND METHODS

- The content in water and total dried substance was determined by drying the plants in dry oven, for 24 hours, at a temperature of 105 °C.
- The titrable acidity was determined by titrating 25 ml of extract with Na OH 0.1 N and was expressed in % of malic acid.
- The carotene pigments were extracted in petrol ether and were spectrophotometrically determined, at a ripple length of 451 nm.
- The anthocianic pigments were extracted in methyl alcohol + 1 % HCl and were spectrophotometrically determined, at a ripple length 540 nm.
- The ascorbic acid was determined in the extract obtained in the oxalic acid 1 %, at a spectrometer in infrared with transformance Fourier.
- The content in soluble glucose was determined according with Fehling methods.
- The content in mineral elements was determined through tissues calcinations at a temperature of 560 °C and the mineral elements were determined at a spectrometer with plasma inductively coupled, IRIS INTREPRIED, in the solution obtained after dissolving the mineral substances.

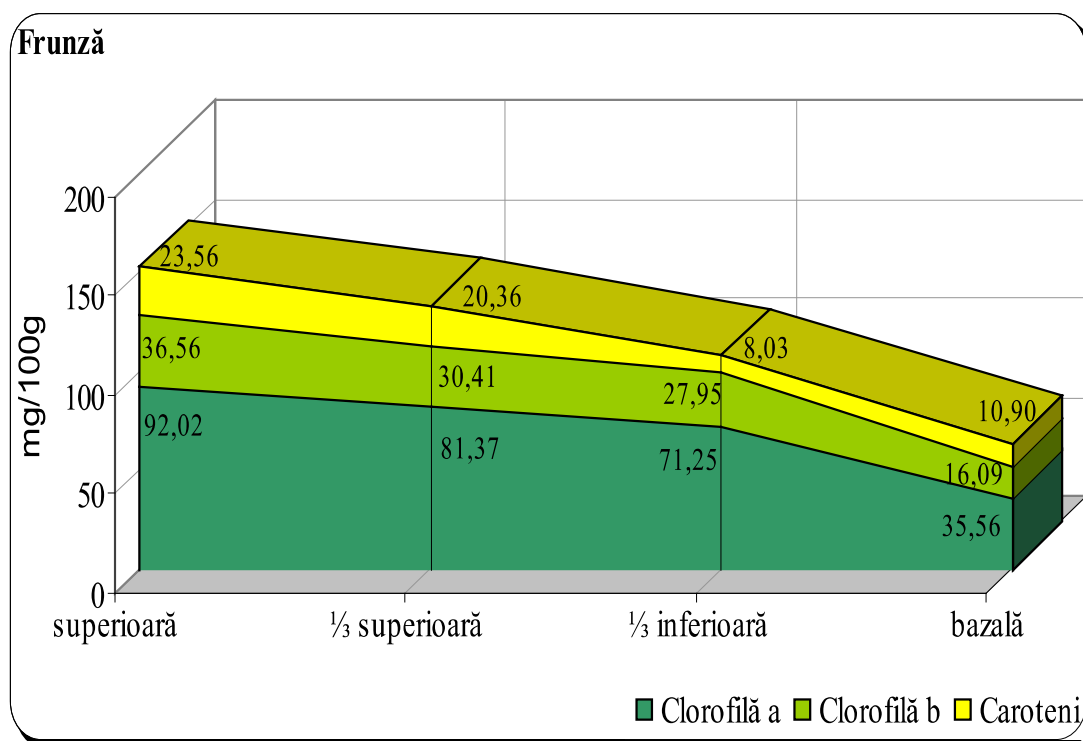
- The phonologic observations and the biometrical measurements were realized in the experimental parcels.

## RESULTS AND DISCUSSIONS

### The variation of chlorophyll contents from salvia leaves, depending on their position on plant

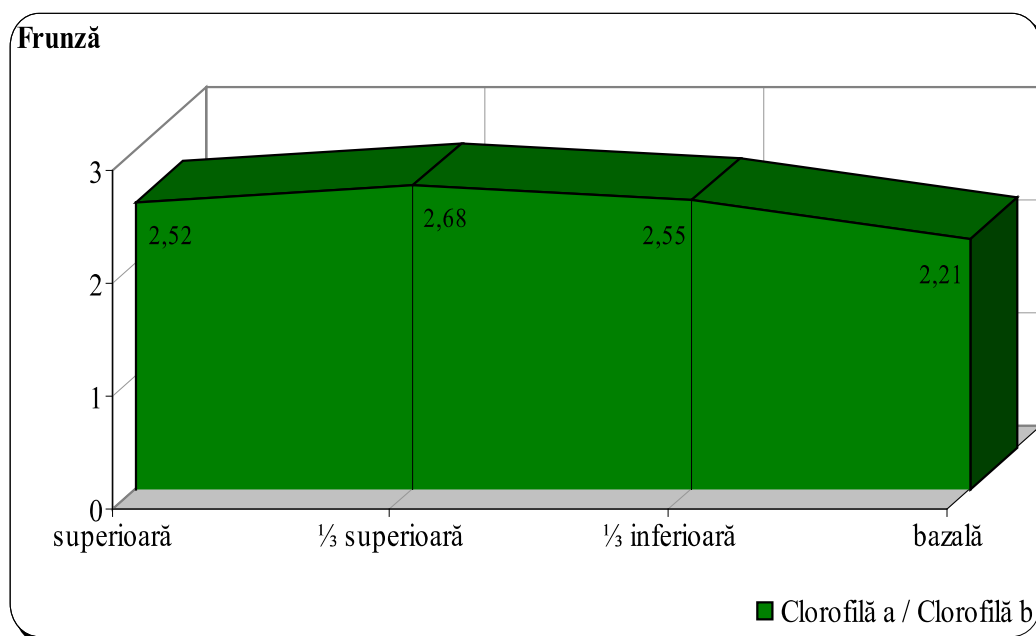
From the data presented in figure 1 result that the chlorophyll pigments quantitatively increased at the leaves situated in the lower part of plants towards the superior ones. So, the content in total chlorophyll varied between 51,65 mg/100g at basal leaves and 128,58 mg/100g at the apical ones, thus realizing an increase of 2,49 times bigger of chlorophyll content. The leaves from the inferior part of plants had a content in chlorophyll 99,19 mg/100g, and the leaves from the superior part a content of 111,79 mg/100g. The content in **chlorophyll a** vary between 35,56 mg/100g in leaves from basal part of plant and 92,02 mg/100g in the superior one, with an increase of 2,59 times. The content in **chlorophyll b** vary similarly, the smallest values were registered in basal leaves: 16,09 mg/100g, of 2,28 times smaller when comparing with the one determined in young leaves.

The variation of carotene pigments content was similar with the one determined in the case of chlorophyll. The content in carotene pigments register an increase at leaves from the basal part of plants (10,90 mg/100g) towards the apical ones (23,56 mg/100g) that represents an increase of 2,17 times.



**Figure 1** – The variation of content in total a, b chlorophyll and in carotene content at leaves of different ages.

The ratio between the content in chlorophyll a and chlorophyll b from salvia leaves (fig. 2) had the biggest value in case of leaves from superior third (2,68) and the smallest value at the basal ones (2,21). The superior leaves and the one from the inferior third had values almost equal 2,52 respectively 2,55.



**Figure 2** – The variation of ratio chlorophyll a/ chlorophyll b in leaves situated on different locations

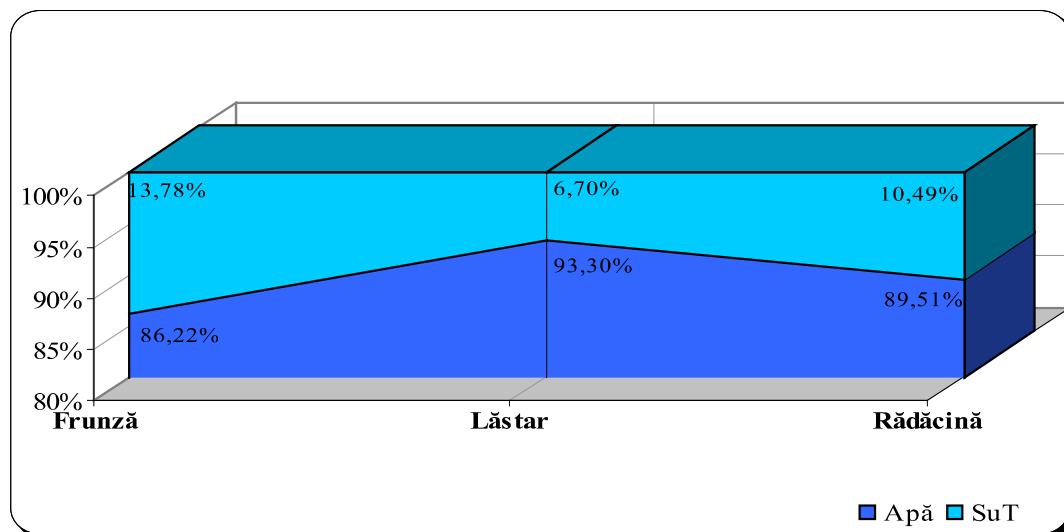
### **The variation of content in total dry substance, water and mineral substances from salvia plants.**

The researches proved that the shoots are the organs with the highest content in water 93,3%, 1,05 times bigger than in root and 1,09 times bigger in leaves.

**Table 1**  
**The variation of content in total dry substance, water and mineral from leaves and shoots located at different stories of plants and from roots of salvia (%)**

Specification	Total dry substance	Water	Mineral elements
Superior leaves	13,68	86,32	1,76
Leaves from the superior third	11,40	88,60	2,57
Leaves from the inferior third	12,35	87,65	2,77
Basal leaves	17,70	82,30	5,35
Superior shoot	6,77	93,23	1,33
Middle superior shoot	6,16	93,84	1,44
Middle inferior shoot	6,85	93,15	1,73
Basal shoot	7,02	92,98	2,02
Root	10,49	89,51	2,60

In what concern the total dry substance the highest content was determined in leaves (13,78 %) and roots (10,49 %), and the smallest content in shoots (6,70 %).

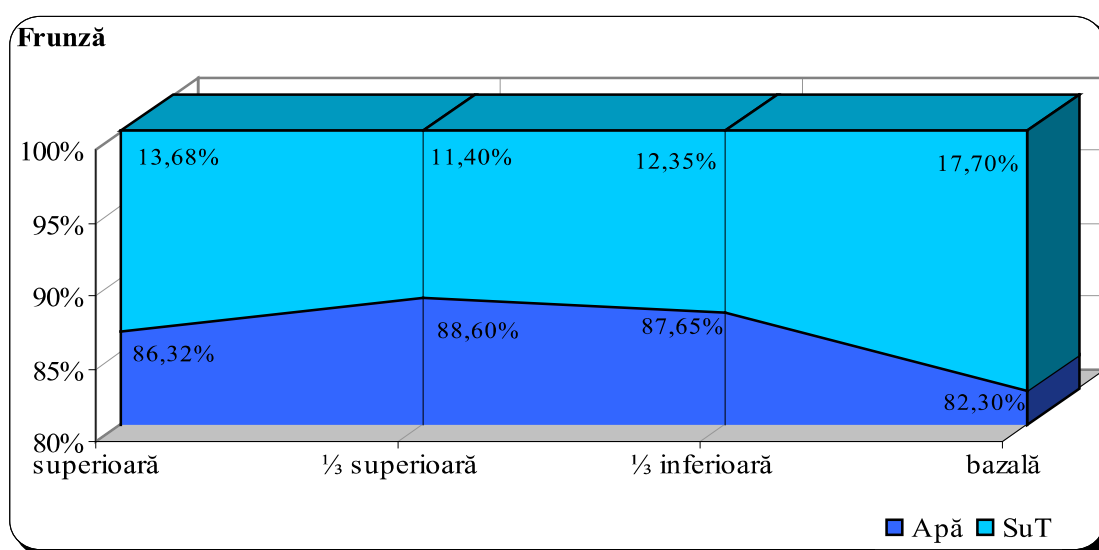


**Figure 3** – Comparation between the content in water and total dry substance from leaves, shoots and roots of salvia plants.

The analysis of total dry substance content from leaves of salvia, (figure 3) showed that it vary between 11,40% in the one from superior third and 17,70% at the basal one.

The trend of accumulation of total dry substance followed a descendent curve, from the basal leaves teal the one from the superior third, than it registered an increase toward the younger leaves, situated in top of plants.

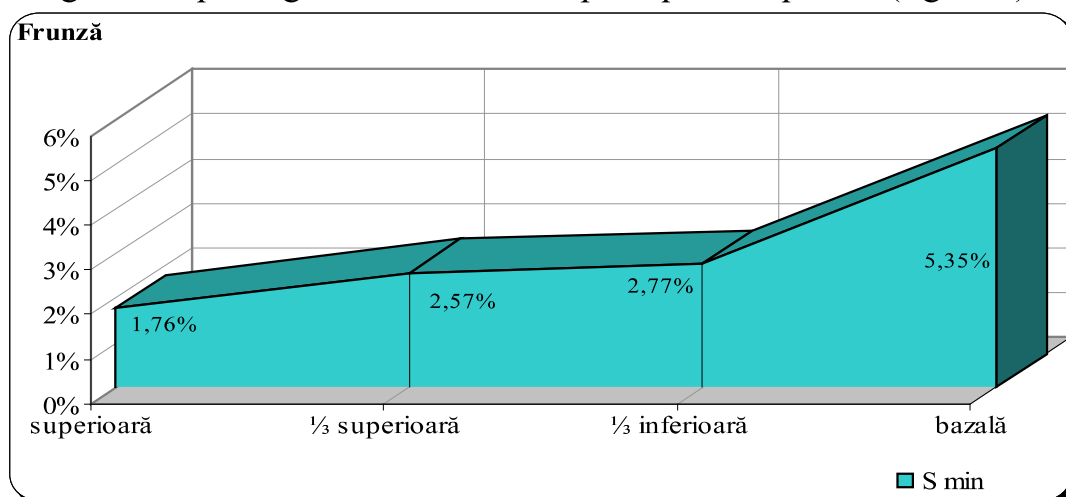
The content in water from salvia leaves was in reverse proportion with the one of total dry substance (figure 4).



**Figure 4** – The variation of content in water and total dry substance in leaves of salvia from different stories of plants.

Thus the content in water vary between 82,30% in case of basal leaves and 88,60% at the one from the superior third.

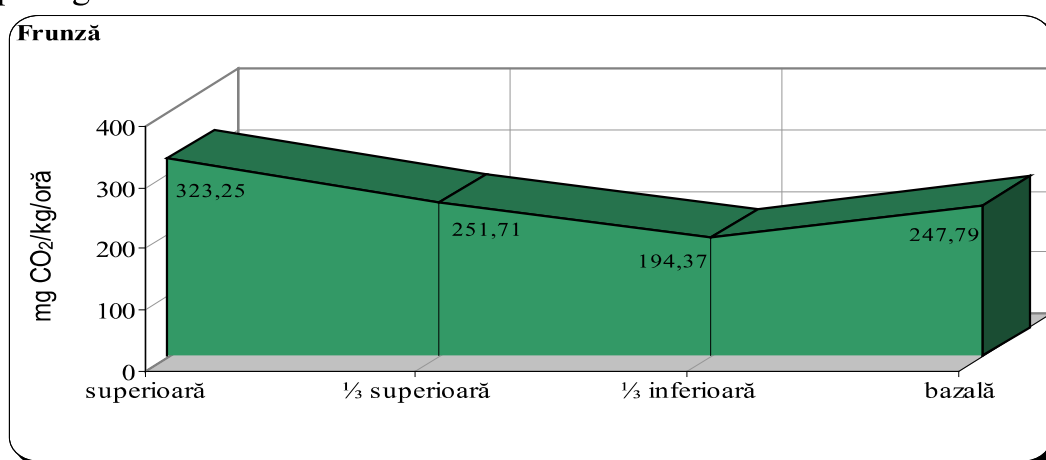
In the case of leaves, the variation of content in mineral substances presented semnificativ differences, depending on their maturation degree. Thus, the highest content in mineral substances was determined in basal leaves (5,35%), in which their proportion was 1.92 times bigger when comparing with the leaves from the inferior thirds, 2.08 times comparing with the superior thirds, and 3,04 times higher comparting with leaves from apical parts of plants (figure 5).



**Figure 5-** The variation of content in mineral substances in leaves of salvia depending on their position on plant.

Like in case of leaves, the highest accumulations of mineral substances were determined in older shoots situated in the basal part of plants. The variation of content mineral substances vary between 1,33 % at superior shoots and 2,02%.

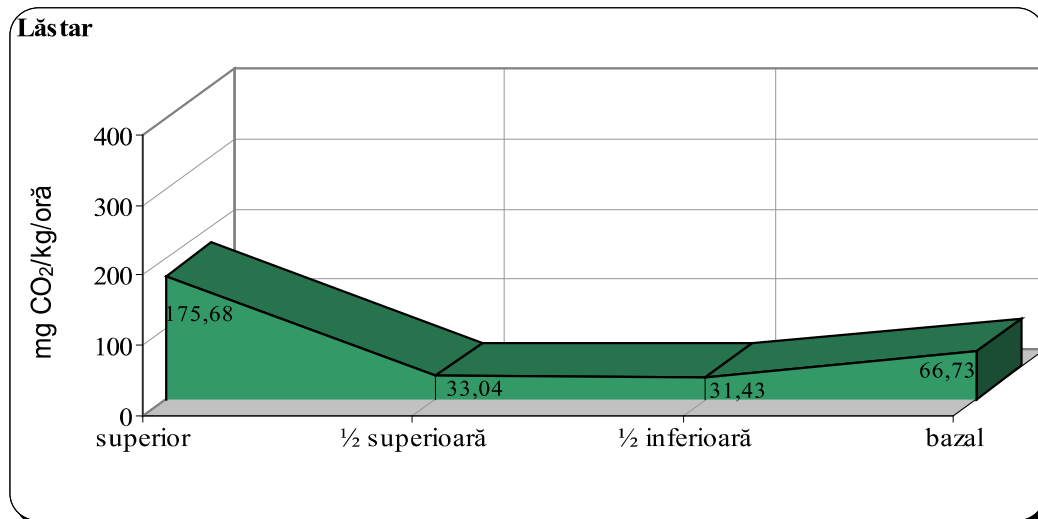
The intensity of respiration of these leaves was of 323,25 mg CO<sub>2</sub>/kg/hour, 1,28 times higher comparing with the leaves from the superior third, 1,30 times higher comparing with the basal leaves and 1,66 times higher comparing with the leaves from the inferior third.



**Figure 6 –** The variation of respiration in leaves of salvia

Similarily results were obtained also in case of intensity of respiration

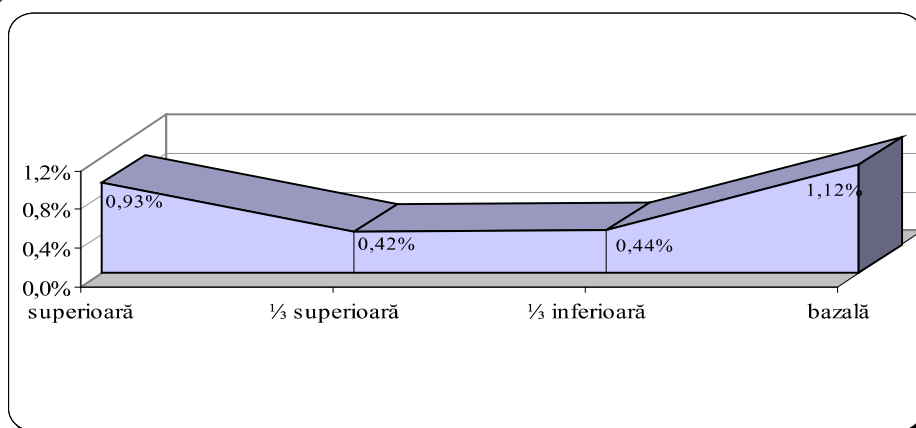
process of shoots (figure 7). The most intense respiration was observed at shoots from the superior parts of plants: 175,68 mgCO<sub>2</sub>/kg/hour. The intensity of this process decreased of 5,32 times at shoots from the superior third, 5,59 times at those from the inferior third and of 2,63 times when comparing with the one from basal area.



**Figure 7-** The variation of respiration process of salvia shoots from different stories of *Salvia officinalis* L.

#### The variation of content in soluble glucose in leaves of salvia depending on their position on plant

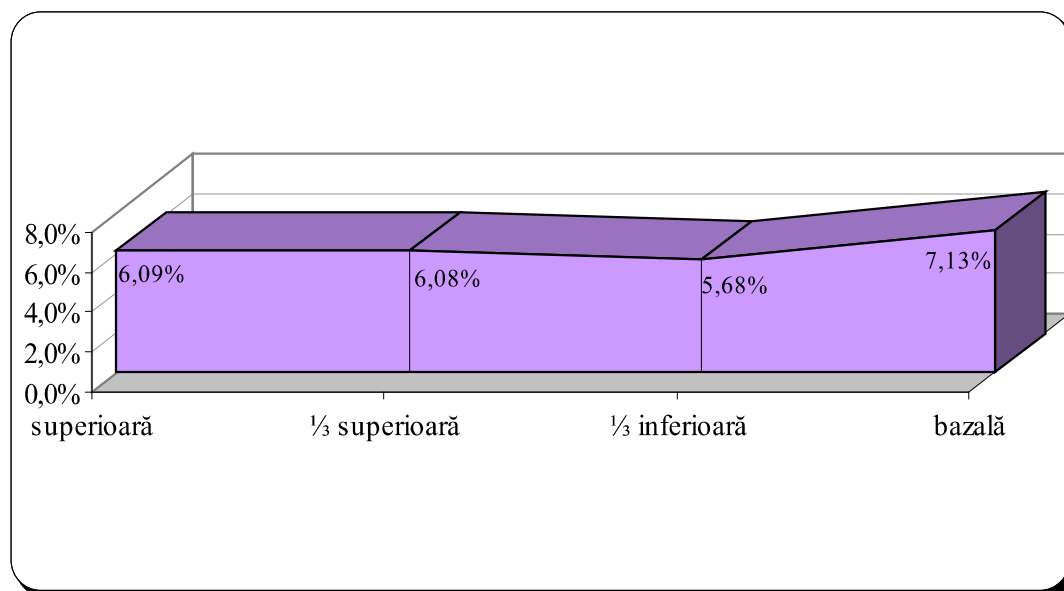
The content in soluble glucose from salvia leaves had the smallest values in leaves from the superior and inferior third of plants (0,42 respectively 0,44 %) and the highest value in basal leaves (1,12 %). The content in soluble glucoses from the apical leaves was 1,20 times smaller comparing with the one from basal leaves but still registered an increase of 2,21 times comparing with leaves from the superior third and 2,22 times comparing with the one from the inferior third (figure 8)



**Figure 8 –** The variation of soluble glucose content in leaves from different stories of *Salvia officinalis* L plants

### **The variation of content in soluble protein depending on the age of salvia leaves.**

The soluble proteins from leaves of salvia registered a variation relatively small in leaves from different stories of plants. These variations were comprised between 5,68 % in leaves from the inferior third and 7,13 % at the ones from basal part (figure 9.).



**Figure 9. – The variation of content in soluble proteins in leaves from different stories of *Salvia officinalis* L plants.**

The differences were even smaller, if we compare the content of soluble proteins from leaves in inferior, superior third and the apical ones. In this case, the content in soluble proteins vary between 5,68 % and 6,09 %.

## **CONCLUSIONS**

1. The ratio between the content in chlorophyll a and chlorophyll b from salvia leaves (figure 2) had the highest value in leaves from the superior third (2,68) and the smallest value at the basal one (2,21). The superior leaves and the one from the inferior third had almost equal values, 2,52 respectively 2,55.

2. The highest content in total dry substance was determined in leaves (13,78 %) and in roots (10,49 %), and the smallest content was determined in shoots (6,70 %).

3. The content in water from salvia leaves were in reverse proportion with the one in total dry substance

4. The highest content in mineral substance was determined in basal leaves (5,35 %), in which their proportion was 1.92 times bigger when comparing with the leaves from the inferior thirds, 2.08 times comparing with the superior thirds, and 3,04 times higher comparing with leaves from apical parts of plants.

5. The intensity of the respiration process of leaves was 3,32 times higher than the respiration of shoots and 1,16 times higher comparing with the roots.

6. The content in soluble glucose from apical leaves was 1,20 times smaller comparing with the one from basal leaves but still registered an increase of 2,21 times comparing with leaves from the superior third and 2,22 times comparing with the one from the inferior third .

7. The content in soluble proteins vary between 5,68 % and 6,09 %.

## REFERENCES

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