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Original Article

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VARIATIONS OF CHLOROPHYLL CONTENT AT *ABIES ALBA* AND *NEPETA PANNONICA* SPECIES ACCORDING TO PHENOPHASE AND HARVESTING AREA

S. BUHĂIANU[1],*, Doina Carmen JITĂREANU[1]

*E-mail: sergiu_buhaianu@yahoo.com

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ABSTRACT. Chlorophylls from plants are photosynthetic pigments. Their quantity offers valuable informations about photosynthetic activity, growing and developing of plants. Photosynthetic pigments decrease quantitatively during senescence process or in stress conditions. The present study has been realized in laboratory conditions with material harvested from spontaneous flora. The purpose of this research was the investigation of variations of chlorophyll content from samples of biological material collected from *Nepeta pannonica* L. and *Abies alba* Mill. plants, from Câmpulung Moldovenesc and Cacica areas, Suceava county, Romania. The targeted phenophases were growth and flowering. There were realized acetonic extracts from samples for spectrophotometric determinations. Obtained data were processed to estabilish chlorophyll a and b content. There were observed that at *Abies alba* species, from both locations, the chlorophyll a content grew during flowering phenophase, while the chlorophyll b content had little variations. At *Nepeta pannonica* species, the chlorophyll a and b content decreased visibly during the flowering, due to stress. Leaves of plants from this species presented a intense green color in the growing phenophase, while during flowering phenophase they had a purple or yellow coloration. Obtained results revealed a different dynamics of chlorophyll content at studied species.

Keywords: photosynthesis, plants, pigments, flowering.

INTRODUCTION

Photosythetic pigments are known for their importance in the photosynthesis process, which determine plant growing and development (Ashraf and Harris, 2013; Li *et al.,* 2011). Chlorophylls are the main photoreceptors, absorbing the light energy from sun in the form of

[1] The University of Agricultural Sciences and Veterinary Medicine Iaşi, Romania

electromagnetic radiation to synthesize carbohydrates and O_2 from water and CO_2 (Mall *et al.*, 1973; Mishra *et al.*, 2013). In the vegetable world, there are found two types of chlorophyll, respectively chlorophyll a and b (Khaleghi *et al.*, 2012). From the structural point of view, chlorophyll has a porphyrinic nucleus. It holds a Mg^{2+} atom in the center, which gives the green color and fluorescence to chlorophyll. The nucleus has two – COOH acid functions. The chloro-phyll a has in its structure chlorophy-llic acid a, while chlorophyll b has chlorophyllic acid b.

Also, chlorophyll molecule has two poles. The first pole is hydrophilic, being constituted by porphyrin nucleus. The second pole is hydrophobic and it is represented by phytol (Jităreanu and Toma, 2007). The photosythetic activity and processes from plants, like growing and development, can be studied considering the chlorophyll amount. It reflects the physiological state of plant and it can be connected with progress of some biochemical processes (Sims and Gamon, 2002; Steele *et al.*, 2008).

The chlorophyll amount can grow or descrease according to season and external factors, like precipitations, temperature and light (Jităreanu and Toma, 2007).

MATERIALS AND METHODS

The research material was represented by samples harvested from annual growths from *Abies alba* and *Nepeta pannonica* species. The colecting of material was realized during the year 2018, in the growing and flowering phenophases. The sampling areas are placed in different locations, with different orographic characteristics. They are located in the areas of Cacica and Câmpulung Moldovenesc areas, Suceava county. The harvesting location from Cacica is situated at an altitude of about 350 m. From Câmpulung area, plants were harvested from an altitude about 750 m. From *Abies alba* species were colected annual growths from the first level of branches in the growing and flowering phenophases. Samples from *Nepeta pannonica* species were taken under leaves form from the third foliar node, in both phenophases.

In order to determine the amount of chlorophyll in leaves, two steps were taken. In the first stage samples of vegetal material were collected. In the second step, acetone extracts were made from them, obtaining solutions of 1% photosynthetic pigments.

The extracts were subjected to measurements on a SHIMANDZU UV-1800 spectrophotometer. The absorbance of the solution was read at wavelengths of 665 and 649 nm. The amount of chlorophyll was calculated in µm using the following formula (Afeefa *et al.,* 2017):

Chlorophyll ‘a’ (µg/ml) = 11.63 × A665 - 2.39 × A649

Chlorophyll ‘b’ (µg/ml) = 20.11 × A649) - 5.18 × A665

Total Chlorophyll (µg/ml) = 6.45 × A665 + 17.72 × A649.

RESULTS AND DISCUSSION

Numerical value of species obtained from study is presented in *Fig. 1*. and *Fig. 2.*

The determined chlorophyll content indicates the intensity of photosynthesis. A high chlorophyll content is equivalent to a high intensity of photosynthesis. At the *Abies alba* species, there were observed a noticeable increase of chlorophyll content with the maturation of annual growths, being noticeably higher in the flowering phenophase than in the growing phenophase (*Fig. 1*).

Chlorophyll b has a different dynamics. At Cacica, it increased quantitatively during flowering, while in Câmpulung there weren't observed visible differences (*Fig. 2*).

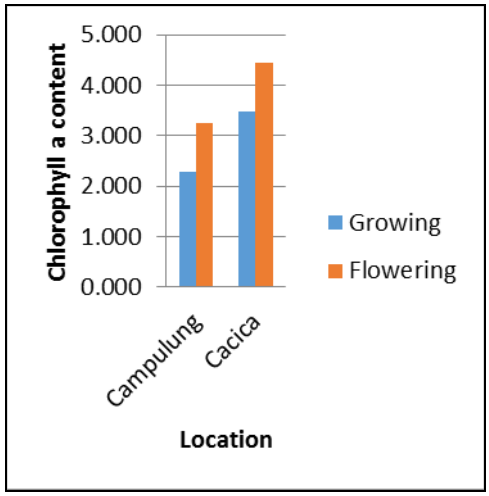

Figure 1 – Variations of chlorophyll a content at *Abies alba*

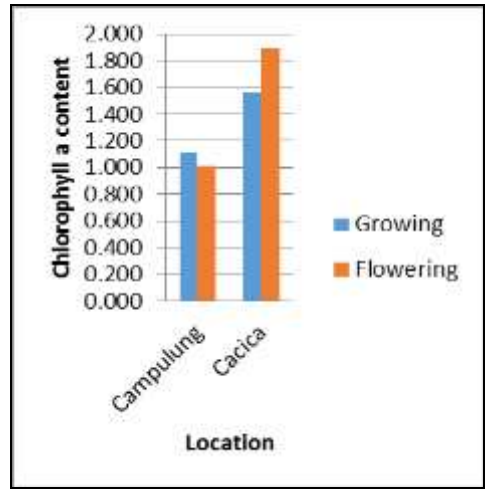

Figure 2 – Variations of chlorophyll b content at *Abies alba*

However, the total chlorophyll content in both areas has seen a significant increase with the transition from the growth of the phenophase to the flowering (*Fig. 3*).

At the *Nepeta pannonica* species, because of lack of light and leaf senescence, the chlorophyll content is much lower during flowering than during growth. The competition of other spontaneous flora plants has direct implications for the chlorophyll content of *Nepeta pannonica* leaves, so that, with the passage of the growth phenophase, they have a less intense green coloration.

In Câmpulung and Cacica, the species behaved according to visual findings. Thus, less chlorophyll was identified during flowering than during growth (*Fig. 4*).

Chlorophyll b had a proportional decrease with chlorophyll a. In the same manner, it decreased quantitatively in the flowering phenophase for plants harvested in both areas.

The decrease is more visible in the Cacica area than in the Câmpulung area. In this area, during flowering, chlorophyll b content was found to be twice as low as during growth (*Fig. 5*).

Also, the total content of chlorophyll decreased as well. The largest differences were recorded in the Cacica area (*Fig. 6*).

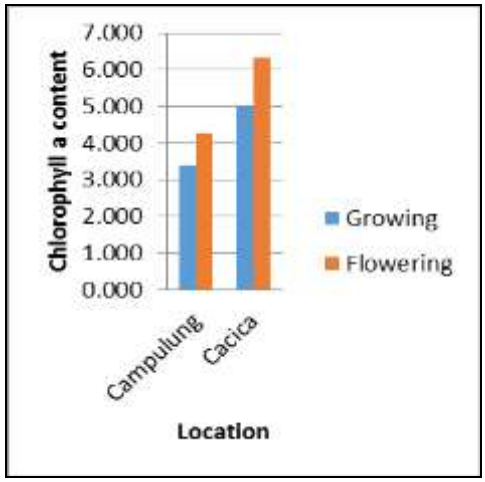

Figure 3 – Variations of total chlorophyll content at *Abies alba*

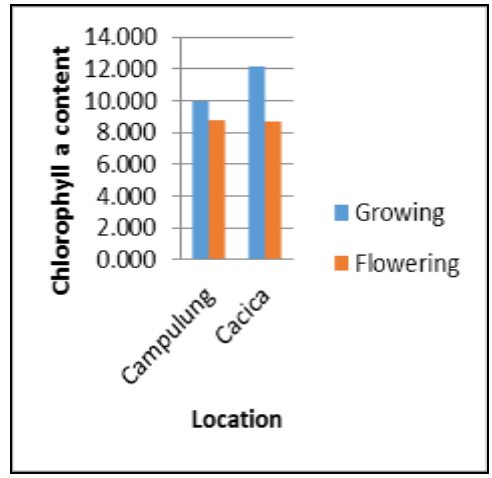

Figure 4 – Variations of chlorophyll a content at *Nepeta pannonica*

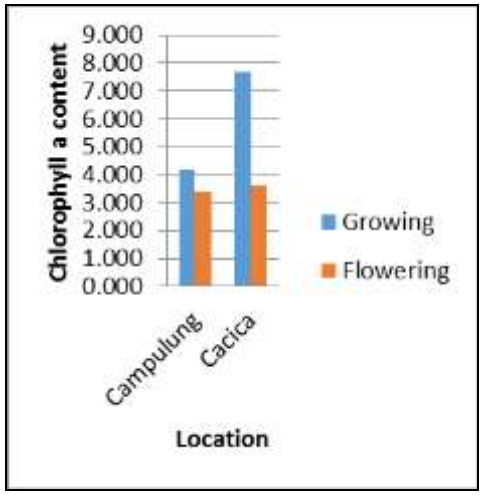

Figure 5 – Variations of chlorophyll b content at *Nepeta pannonica*

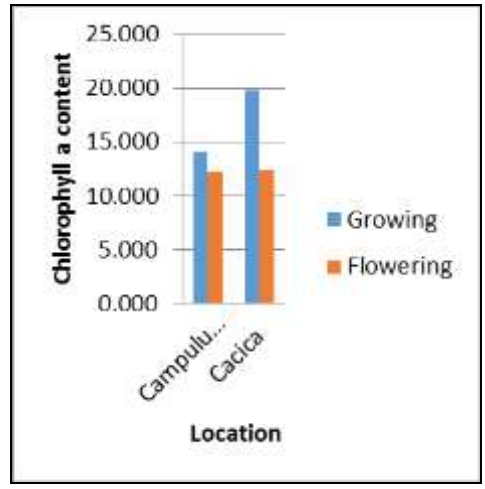

Figure 6 – Variations of total chlorophyll content at *Nepeta pannonica*

CONCLUSIONS

During growth phenophase, the total chlorophyll content was inversely proportional to altitude. The total chlorophyll content increased in the *Abies alba* species in the flowering phenophase, in the two areas. At *Nepeta pannonica*, the chlorophyll content can not be linked to altitude. Samples collected from *Nepeta pannonica* plants, in flowering phenophase, indicated a remarkable decrease in the amount of chlorophyll a and b. The two species behave differently according to the phenophase and the harvesting area.

Strong influence on chlorophyll content has the stress, the senescence and the lack of light, caused by competing plants, which are clearly visible in case of *Nepeta pannonica* species.

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