ECOPHYSIOLOGICAL ASPECTS OF SOME HERBACEOUS SPECIES FROM CODRII PASCANILOR FOREST

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Abstract

The purpose of this paper is to underline some ecophysiological characteristics of some herbaceous species specific to the forest Codrii Pascanilor in pedoclimatic conditions. Ten species belonging to seven botanic families were taken into account (*Ranunculaceae, Lamiaceae, Campanulaceae, Asteraceae, Violaceae, Scrophulariaceae, Orchidaceae* We analysed the following physiological parameters: the content of water and dry substance, the concentration of the cellular juice and the content of chlorophylls pigments. The species analysed present a high water contents in leaves and flowers: 81.06 g % - 88.24 g % at vernal species and 85.65 g % - 92.2 g % at summer ones; exception are the species *Viola reichenbanchiana* and *Veronica chamaedrys*, which have the water content in leaves below 80 %. The concentration of the cellular juice in leaves and flowers present moderate-low values (5,2 % saccharose - 14,8 % saccharose). The content of chlorophylls pigments presents moderate/high values, except for the species *Plathantera bifolia.* The ratio chlorophyll a/ b has values comprised between 2.55 and 3.36, which indicates an own rhythm of biosynthesis of the two types of chlorophylls in each species.

Key words: deciduous forest, the herbaceous species, physiological indicators

The species analysed by the present study are part of the floristic composition of the herbaceous layer from the deciduous forests. According to Pisică Donose (1983), the herbaceous layer of the forests represents a secondary constituent in forming the vegetal biomass; its study presents a special scientific and practical importance.

In our country, ecophysiological researches over herbaceous species from forest ecosystems were realized by Păucă – Comănescu M., Tăcină A. (1979); Păucă – Comănescu M., et al., (1980); Pisică Donose A.(1983); Tăcină A., Păucă – Comănescu M. (1992); Murariu A. et al., (2000; 2002; 2006). Among the physiological indicators used in the researches made by the above - mentioned researchers we can mention: the content of water and dry substance; the concentration of the cellular juice; the content of chlorophylls pigments; the mineral and organic substances.The study of these indicators offers data referring to the „answer modalities" of species to specific environment conditions.

The purpose of this paper is to underline some ecophysiological characteristics of some herbaceous species specific to the forest Codrii Pascanilor in pedoclimatic conditions. Biochemical (Backmann M et al., 1994; Tomaczyk M., Gudej J., (2002; 2003), phytochemical (Tomaczyk M., et al., 2002; Gille E., et al., 2005; Marcenco A., 2008; Hemcinschi Lungu A., 2010; Harput U. Ş., et al., 2011;) and physiological/ecophisiological researches (Păucă - Comănescu M., Tăcină A., 1978; 1979; Păucă- Comănescu M. et al.,1980; Masarovičcová E., Eliás P., 1980; Goryshina T. K., et al., 1983, Tăcină A., Păucă - Comănescu M., 1992; Golovko T. K., Dymova. O. V, 1999; Murariu A. et al., 2000; Golovko T. K., et. al., 2004; Dymova. O. V., et al., 2010) were made over some of the species to be analysed.

Three of the studied species have medicinal potential: *Ranunculus ficaria* - expectorant, antihaemorrhagic, antihemoroidal effects, (Temelie M., 2006; Tiţă I., 2008), anti-inflammatory; astringent effects (Tomczyk M., Gudej J., 2003); *Ajuga reptans* - anti - inflammatory, cicatrizing, anti - diarrheic effects (Tiţă I., 2008; Temelie M., 2005), antioxidant effect (Gille E., et al., 2005) şi Platanthera bilofia - anti - diarrheic effect (Temelie M., 2005).

MATERIAL AND METHOD

Codrii Paşcanilor forest is located in the Basin of Siret River, between Moţca and Gâşteşti localities (250-300 m altitude). It is a holm and beech hill forest. The wooden region is in a state of high-forest or small high-forest; the tree have between 10 (15) to 55 (65) cm in diameter. The

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consistency varies between 0.7 and 0.9 and the height of the arborescent layer is of 15 (16) to 22 – 25 meters.

Among the species that form the arborescent layer we can mention *Quercus petraea*, *Fagus sylvatica, Queurcus dalechampii, Tilia tomentosa, T. cordata, Fraxinus excelsior, Acer campestre, A. platanoides, Carpinus betulus, Cerasus avium* The arborescent layer is made of *Crataegus monogyna, Cornus sanguinea, Cornus mas, Evonymus verrucosus, Evonymus europaeus, Ligustrum vulgare, Viburnum opulus, Viburnum lantana, Corylus avellana, etc.* Among the species that made the herbaceous layer we can mention *Pulmonaria officinalis, Anemone nemorosa, Galium odoratum, Stellaria holostea, Dentaria bulbifera, Glechoma hirsuta, Viola reichenbachiana, Poa nemoralis, Lamium galoebdolon, Ajuga reptans, Ranunculus auricomus, Salvia glutinosa, Scophularia nodosa, Melica uniflora, Mercurialis perennis, Mycelis muralis, Carex pilosa, Melampyrum bihariense,* etc.

Due to its geographical position as well as the relief characteristics, the region where the forest can be found is characterised by a pronounced continental climate, being part of the high hills climate land. The forest microclimate benefits from moderate rainfalls varying between 500-600 mm/year. The repartition of the rainfall quantities over the year is not uniform, the biggest quantity being registered during the vegetation season.

Ten species belonging to seven botanic families were taken into account (*Ranunculaceae, Lamiaceae, Campanulaceae, Asteraceae, Violaceae, Scrophulariaceae, Orchidaceae (tab.1).* The biological material (represented by flowers and leaves) was sampled from exemplars in the blooming phenophase, during the vernal - aestival period (April – June) of 2009.

Referring to the ecological requirements, most of the species to be studied are mesophytes / mesophytes and heliophilous (heliosciophytes) *(tab.1).*

Table 1

The ecological characteristics (according to Doniţă et al.,1977)

Botanical Name	Plant Family	The preferences for soil trophicity	The preferences for soil humidity	The preferences to lihgt
Anemone nemorosa L.	Ranuculaceae	eutrophic	mesophylous	heliophylous, helio-sciophylous
Ranunculus auricomus L.	Ranuculaceae	mesotrophic	meso-higrophylous	heliophylous, helio-sciophylous
Ranunculus ficaria L.	Ranuculaceae	eutrophic	mesophylous - meso-higrophylous	heliophylous, helio-sciophylous
Viola reichenbachiana Jordan ex Boreau	Violaceae	amphytolerant	mesophylous	helio-sciophylous; sciophylous
Ajuga reptans L.	Lamiaceae	mesotrophic	mesophylous - meso-higrophylous	heliophylous, helio-sciophylous
Veronica chamaedrys L.	Scophulariaceae	mesotrophic	mesoxero phylous	heliophylous, helio-sciophylous
Lamium galeobdodon L.	Lamiaceae	eutrophic	mesophylous - meso-higrophylous	sciophylous
Campanula patula L.	Campanulaceae	mesotrophic	mesophylous - meso-higrophylous	heliophylous
Hieracium lachenalii C. C. Gmelin	Asteraceae	oligotrophic	/mesoxero phylous - mesophylous	helio-sciophylous; sciophylous
Platanthera bifolia (L.) L. C. M. Richard	Orchidaceae	mesotrophic	mesophylous	heliophylous, helio-sciophylous

We analysed the following physiological parameters: the content of water and dry substance, the concentration of the cellular juice and the content of chlorophylls pigments. The water content and the dry matter were gravimetrically determined by maintaining the biological material to be analysed to a temperature of 105 degree Celsius until reaching a constant weight. The cellular juice concentration was determined by refractometric method. The chlorophyllian pigments were extracted from the leaves using a 85% acetone solution solvent.

The concentration for the"*a"* and "*b"* chlorophyllian pigments was determined by the spectrophotometric method; the extinction indicators were measured for a wavelength between: 663 nm – for the „a" chlorophyll; and 645 nm for the „b" chlorophyll.

RESULTS AND DISCUSSIONS

The water content is an important indicator of the hydric regime, the water being necessary for carrying out all the physiological processes. The highest variations of the water content are seen in leaves because the leave realises the biggest contact surface with the atmosphere.

In the leaves, the water content presents values between 74.25g % and 92.2 g %. The highest values of the water content were registered to the *Platanthera bifolia* (92.2 g %,), followed in a decreasing order by *Ranunculus ficaria* (88.24 g %), *Hieracium lachenalii* (86.73 g %) and. *Ranunculus auricomu*s (86.61 g %) *(fig.1)* In case of *Viola reichenbanchiana* and *Veronica chamaedrys* the water content is under the value of 80% (79.83 g % and respectively 74.25 g %).

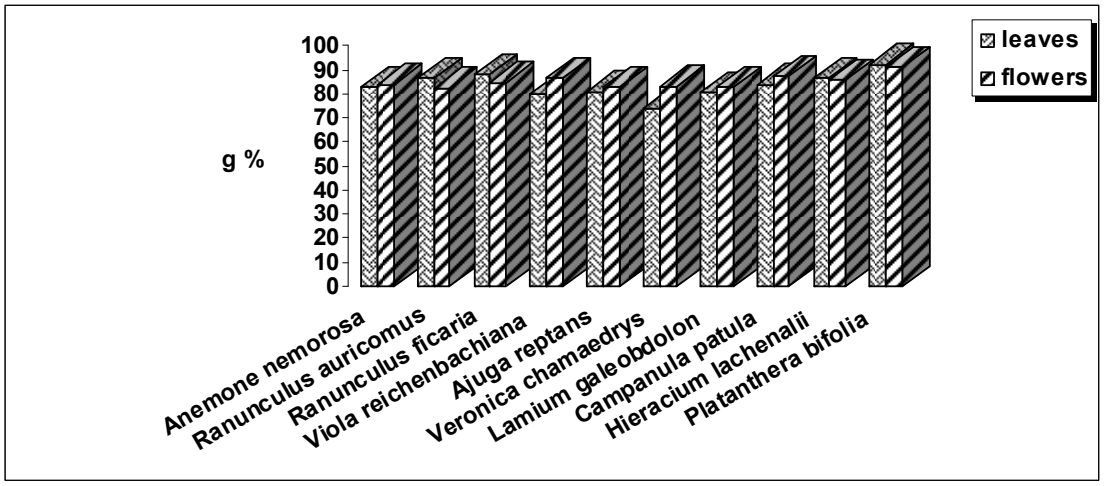

Figure 1 **The water content**

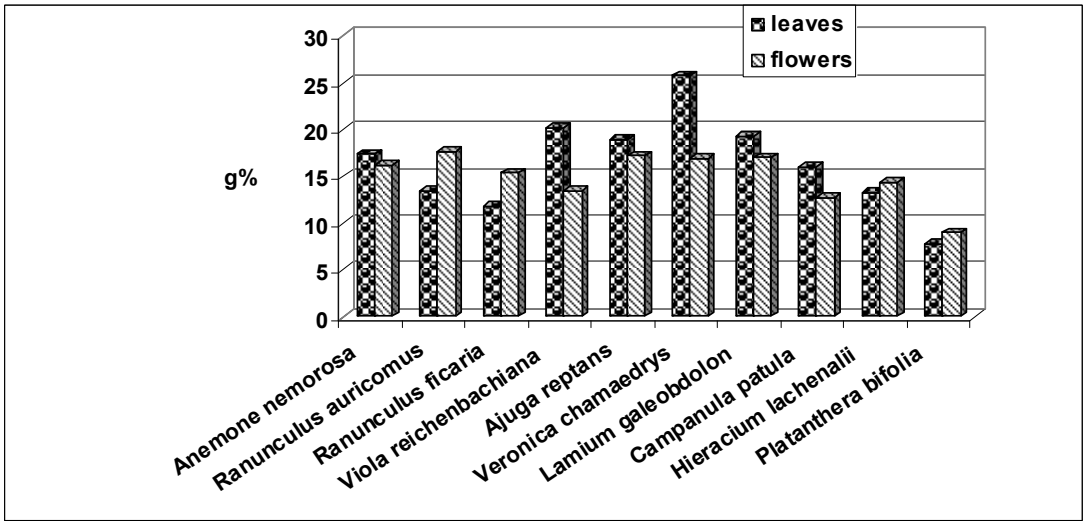

Figure 2 **The dry substance content**

The water presents values between 82.37 g % and 91.01 g % in flowers. The highest values of the water content are registered in *Platanthera* species followed in a decreasing order by *Campanula patula* (87.31 g %) and *Viola reichenbachiana* (86.57 g %). For the rest of the species to be studied, the water content in flowers present close values (82.37- 85.65g %).

The dry matter contains mineral elements and the organic substances from the analysed organs and reflects the biomass accumulation. In our case, the dry matter content registers values between 7.80 and 25.75 g % in leaves, and between 8.99 and 17.63 g % in flowers.(fig.2).

The concentration of cellular juice in leaves varies from low values (5.2- 8.3 % saccharose)(at *Platanthera bifolia*, *Campanula patula, Anemone nemorosa*) to moderate values (12,9-14,8 % saccharose)(at *Lamium galeobdolon, Veronica chamaedrys* and *Ajuga reptans)(fig.3).*

The concentration of cellular juice in flowers was determined at 6 of the species taken into account for the present study. There were registered values comprised between 6.4 – 11.8 %

saccharose. There is revealed the fact that at 3 of the analyzed species (*Ajuga reptans*, *Veronica chamaedrys, Lamium galeobdolon),* the concentration of the cellular juice in flowers had lower values than the ones in leaves. It is observed in most analyzed cases that there was a negative correlation between water content and the concentration of cellular juice (in leaves and in flowers): the species which have a higher water content indicate a lower concentration of the cellular juice and those with a lower water content indicate a higher concentration of the cellular juice. The concentration of the cellular juice has an important role in the settlement of the osmotic pressure of the vegetal cell (Tăcină A., Păucă - Comănescu M., 1992), being in an indirect way an indicator of the water condition (Păucă - Comănescu M., Tăcină A., 1978).

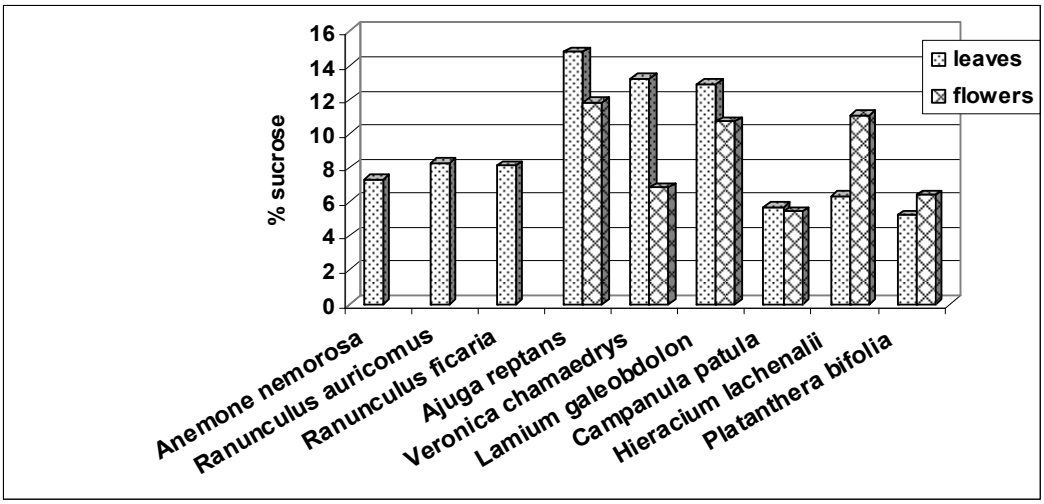

Figure 3 **The concentration of cellular juice**

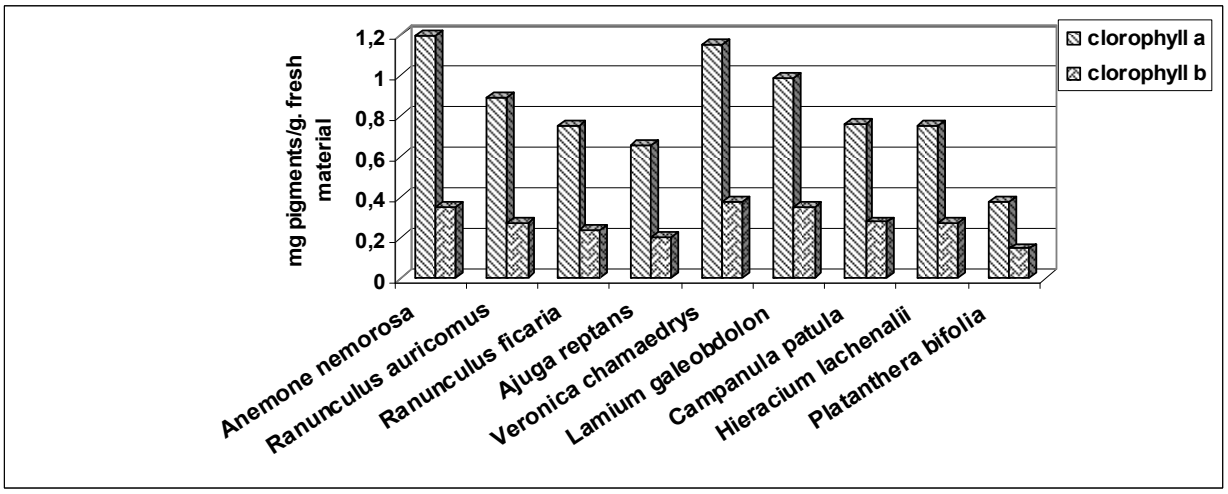

Figure 4 **The contents of chlorophyllian pigments**

The contents of chlorophyllian pigments registered a varied range of values comprised between 0.3755 - 1.1958 mg /g fresh material for chlorophyll a and between 0.1472 - 0.3743 mg /g fresh material – for chlorophyll b (*fig.4*).

Although in terms of preferences of light most of the species taken into the study are heliophilous (helio-sciaphilous), there were found specific variations in chlorophyll pigments content.

The highest values of the contents of chlorophyll a and b are registered at *Anemone nemorosa* (1.1958 mg /g fresh material for chlorophyll a; 0.354 mg /g fresh material for chlorophyll b) and *Veronica chamaedrys* (1.1525 mg /g fresh material for chlorophyll a; 0.3743 mg /g fresh material for chlorophyll b) (*fig.4*). *Platanthera bifolia* is situated at the opposite pole and registered the lowest values with regard to the contents of chlorophyllian pigments (0.3755 mg /g fresh material forchlorophyll a; 0,1472 mg /g fresh material for chlorophyll b).

The proportion chlorophyll a / b has values comprised between 2.55- 3.36, fact which indicates an own rhythm of biosynthesis of the two types of chlorophylls at each species *(fig.5).*

At vernal species, the ratio chlorophyll a/b is higher than 3. According to Eliás P., and Masarovičová E., (1980), the proportion chlorophyll a / b is a characteristic of leafs, being the expression of the interspecific differences and adaptability of plants to the condition of luminosity.

The authors quoted by Masarovičová E., and Eliáš P., (1980) show that one of the indicators of the photosynthetic capacity of plants is the quantity of chlorophyll. Other data in the specialty literature (Burzo et al., 1999) indicate the fact that there is no relation between the intensity of the photosynthesis and the contents of assimilator pigments.

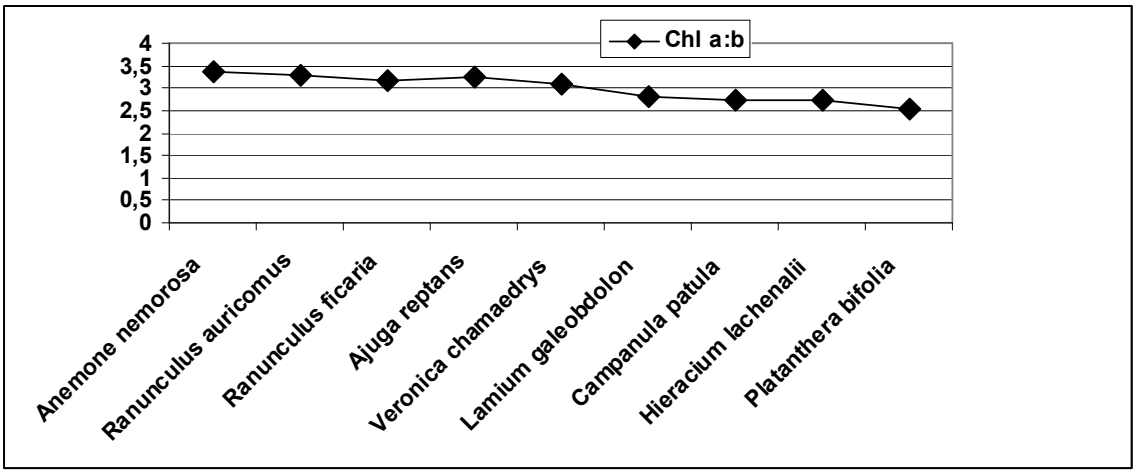

Figure 5 **The proportion chlorophyll a / b**

CONCLUSIONS

The obtained results reveal specific variations of the analyzed indicators for all the investigated species, the determined values presenting comparable ranges for each indicator apart.

Among the analyzed species, the species *Plathantera bifolia* remarks itself through the highest degree of hydration of tissues from leaves and flowers, decreased concentration of the cellular juice, low contents of chlorophyllian pigments.

The physiologic features have a variability between certain limits determined by the genetic characteristics of the species and by the micro-climatic conditions in the resorts these species vegetate. Therefore, in the conditions of some forest ecosystem in Banat şi Muntenia, Păucă – Comănescu et al. (1980) determine to *Anemone nemorosa* a concentration of the cellular juice from the leafs with values of 9 and 12.1% saccharose; for the proportion cla: b there were obtained values of 3.60 and respectively 3.34. In our case, at *Anemone nemorosa,* the concentration of the cellular juice was of 7.3 and the proportion cllophyll a : b had the value of 3.36. Murariu A., et al. (2000) determine for *Lamium galeobdolon* gathered from the forest ecosystems in the hills of Tutova a water content with values comprised between 82.52% and 87.07%. In the assessments made by us, the water content in leaves at *Lamium galeobdolon* registered the value of 80.72 g%.

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