

EVALUATION OF SOME PHYSIOLOGICAL FACTORS OF SPONTANEOUS AND CULTIVATED PLANTS FROM SOUTH-WEST OF OLTENIA (I)

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Abstract. The study was carried out in the Calafat and Maglavit localities between the 2017-2018 period, on 38 spontaneous and cultivated species, characteristic of the zonal soils (protisols, cernisols and hydrosols class) in the Danube meadow. Due to the biotope, plants use a series of adaptive strategies to respond to different types of abiotic stress (drought, salinity, radiation, high or low temperatures, floods) and biotic stress (pathogens, competition with other organisms) that alter the plant-environment equilibrium. In this context, two physiological processes, namely the Chlorophyll content index (CCI) and AVG, the average of mean chlorophyll concentration were determined. Variations of these processes were also found in the intensity of photosynthesis in *Sambucus ebulus*, *Rumex anguineus*, *Solanum nigrum*, *Thuja occidentalis*, *Mirabilis jalapa* (between 100 – 607 CCI), heat-tolerant plants with significant photosynthetically active radiation.

Keywords: plants, Chlorophyll content index - CCI, AVG, Oltenia.

Rezumat. Evaluarea unor factori fiziologici la plante spontane și de cultură din sud-vestul Olteniei (I). Studiul a fost realizat în perioada 2017-2018, în localitățile Calafat și Maglavit, pe 38 de specii spontane și cultivate, caracteristice solurilor zonale (clasa protisolurilor, cernisolurilor și hidrosolurilor) din Lunca Dunării. Datorită biotopului, plantele recurg la o serie de strategii adaptative privind răspunsul la diferitele tipuri de stres abiotic (secetă, salinitate, radiație, temperaturi înalte sau scăzute, inundație) și biotic (patogeni, competiția cu alte organisme), care modifică echilibrul plantă-mediu. În acest context au fost determinate două procese fiziologice și anume conținutul indexului clorofilian (CCI) Chlorophyll content index și AVG-ul, media mediei clorofiliene. S-au constatat variații ale acestor procese regăsite și în intensitatea fotosintezei la *Sambucus ebulus*, *Rumex anguineus*, *Solanum nigrum*, *Thuja occidentalis*, *Mirabilis jalapa* (între 100 – 607 CCI), plante rezistente la temperaturi ridicate și cu o radiație fotosintetic-activă semnificativă.

Cuvinte cheie: plante, indexul clorofilian - CCI, AVG, Oltenia.

INTRODUCTION

Plants are exposed throughout their life to numerous stress factors that cause changes in the normal physiological functioning of all species, especially of the cultivated ones (BEINȘAN et al., 2009). The terrestrial ecosystems situated in the south-west of Oltenia between the localities of Maglavit and Calafat are characterized by a flora specific to the Danube meadow.

From a phytogeographical and geobotanical point of view, the study area is included in the Central European Region, the Moesian Province (Banat-Oltenia), in the south-western silvo-steppe of the Romanian Plain (DRUGESCU, 1994; CIOBOIU C., 2005). Sedimentary formations, alluviums, accumulations of sands are present in this area, being given by particular characters, gleization, pseudogleization, salinization or alkalization, the appearance and degree of carbonates, which provide favourable conditions for the growth of spontaneous and cultivated plants (NĂSTASE & NĂSTASE, 2002).

The temperate-continental climate, with average annual temperatures around 11.7°C, with relatively low rainfall (480 mm/year), influence the Danube's silvo-steppe vegetation, represented by oak forests, steppe meadows formed of xerophilous plants and xeromezophiles (*Euphorbia agraria*, *Tribulus terrestris*, *Verbascum blattaria*, *Elymus repens*, *Plantago scabra*) (MARINICĂ & MARINICĂ, 2016; VLĂDUȚ et al., 2017).

Fragments of natural vegetation are rarely found in the study area due to the active manmade intervention and domestic animals (especially sheep) through grazing. Many surfaces of sandy lands have been cultivated (NĂSTASE, 2004).

MATERIAL AND METHOD

Observations were made during the 2017-2018 period in order to determine some physiological processes in spontaneous and cultivated plants from the terrestrial ecosystems in the Maglavit - Calafat area, Dolj county (Fig. 1). The main characteristics of soils were determined pedologically and agrochemically using the analytical methods in force. Chlorophyll content index and the AVG were measured using CM 1000 TM, which estimates the concentration of chlorophyll in leaves between 700-840 nm wavelength. It detects the change of chlorophyll content in the real-time growth process (ROJANSCHI et al., 1992; BERCA, 2000, ȘUMĂLAN & DOBREI, 2002; BURESCU & TOMA, 2005; BUCUR, 2009; HUSSAIN et al., 2010).

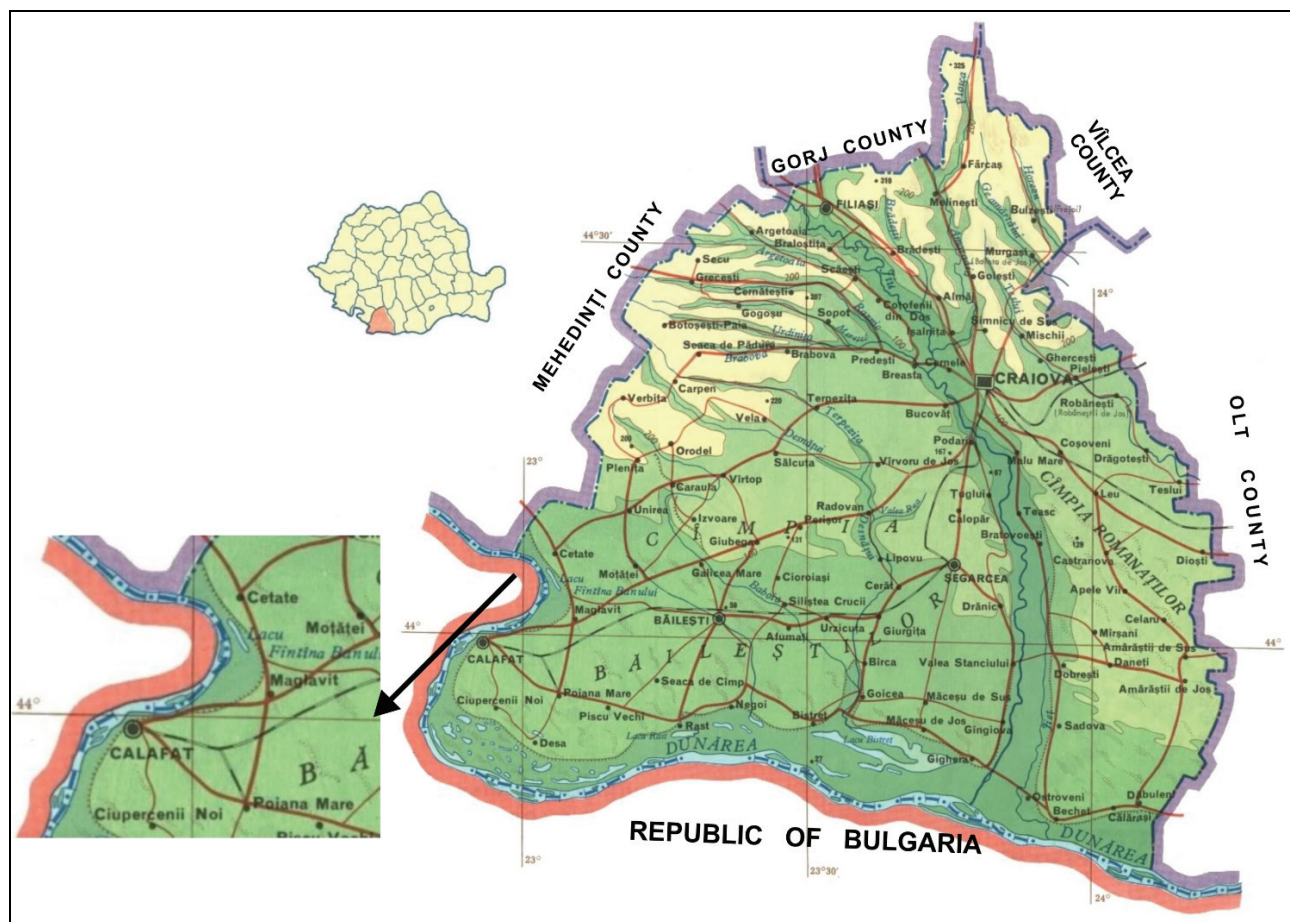


Figure 1. The localization of the study area in the south-west of Oltenia (Google Earth, accessed: March 5, 2019).

RESULTS AND DISCUSSIONS

The soils in the Maglavit - Calafat sector are characterized by sandy levigated chernozems, non-consolidated lands. There is a mosaic of soils on the lower terrace of the Danube meadow represented by sandy levigated chernozems and sands in different stages of solidification, alluvial solonetz soils, gleized chernozems and even marshy soils (NĂSTASE, 2004; GAVRILESCU, 2013).

Because of the varied pedoclimatic conditions, the flora of Oltenia includes over 2200 species of superior plants out of the 3868 species existing in Romania (CIOCĂRLAN, 2000). More than 750 species of vascular plants have been identified in the south-west of Oltenia, growing on the zonal soils in the Danube Meadow (NĂSTASE, 2004). Key factors in the evolution of the soils in the area are: the relief, rock solification, the depth of the ground water, the climate and microclimate. A great role in the formation and evolution of soils in this territory was played by the Danube. The dominant zonal soil in Calafat is cambic chernozem (CZ cb-K3-d5-LL42/UG(21)-Te-m/NB-A) which has a normal low modular aspect with level oscillations between 10-20 cm. The chemical characteristics are the pH between 6.4-7.6 upH, humus of 2.1%, total nitrogen of 0.120%, mobile phosphorus of 98 ppm, mobile potassium of 143 ppm and nitrogen index of 1.9.

As the soil reaction is poorly acidic, the total nitrogen content is low, the content in mobile phosphorus is very high, the mobile potassium content is moderate, the nitrogen index is low, the humus content is low.

The zonal soil prevailing in Maglavit is also cambic chernozem (CZ cb-G1-K3-d5-LL (42) / SG (31) -Te-m / NB-A) which has a normal low modular aspect with oscillation of level between 10-20 cm. The chemical characteristics are the pH between 6.3-8.2 upH, humus of 2.2%, total nitrogen of 0.121%, mobile phosphorus of 64 ppm, mobile potassium of 198 ppm, and nitrogen index of 1.9.

We note that in this area, the soil's reaction is poorly acidic - slightly alkaline, the total nitrogen content is low, the content of mobile phosphorus is very high, the mobile potassium content is moderate, the nitrogen index is low, the humus content is low.

In the study area, the influence of some physiological factors was evaluated on 38 spontaneous and cultivated species belonging to 30 families, characteristic of sandy soils in the Danube Meadow (Table 1).

Table 1. The taxonomic composition of the studied species from the Maglavit - Calafat sector.

Family	Species	Maglavit	Calafat
Cupressaceae	<i>Thuja orientalis</i> L. <i>Thuja occidentalis</i> L.		–
Berberidaceae	<i>Mahonia aquifolium</i> L.		–
Moraceae	<i>Ficus elastica</i> Roxb. ex Hornem.		–
Cannabaceae	<i>Celtis occidentalis</i> L.		–
Betulaceae	<i>Carpinus betulus</i> L.		–
Nyctaginaceae	<i>Mirabilis jalapa</i> L.	–	
Portulacaceae	<i>Portulaca oleracea</i> L.	–	
Caryophyllaceae	<i>Gypsophila muralis</i> L.	–	
Amaranthaceae	<i>Amaranthus retroflexus</i> L.	–	
Chenopodiaceae	<i>Bassia laniflora</i> (S. G. Gmel.) A. J. Scott	–	
Polygonaceae	<i>Rumex sanguineus</i> L.	–	
Rosaceae	<i>Chaenomeles japonica</i> (Thunb.) Lindl. ex Spach		–
Fabaceae	<i>Cercis siliquastrum</i> L. <i>Robinia pseudoacacia</i> L. <i>Gleditsia triacanthos</i> L.	– –	–
Hydrangeaceae	<i>Philadelphus coronarius</i> L.		–
Buxaceae	<i>Buxus sempervirens</i> L.		–
Euphorbiaceae	<i>Euphorbia agraria</i> M. Bieberstein	–	
Vitaceae	<i>Parthenocissus quinquefolia</i> (L.) Planch.		–
Zygophyllaceae	<i>Tribulus terrestris</i> L.	–	
Araliaceae	<i>Hedera helix</i> L.		–
Salicaceae	<i>Salix alba</i> L.	–	
Oleaceae	<i>Syringa vulgaris</i> Aiden C. Elharrar		–
Onagraceae	<i>Oenothera glazioviana</i> Micheli		–
Solanaceae	<i>Lycium barbarum</i> L. <i>Solanum nigrum</i> L.	– –	
Lamiaceae	<i>Marrubium peregrinum</i> (Horehound)	–	
Plantaginaceae	<i>Plantago lanceolata</i> L. <i>Plantago scabra</i> Moench	–	–
Scrophulariaceae	<i>Verbascum blattaria</i> L.	–	
Rubiaceae	<i>Galium aparine</i> L.	–	
Adoxaceae	<i>Sambucus ebulus</i> L.	–	
Asteraceae	<i>Matricaria perforata</i> Merat <i>Achillea millefolium</i> L. <i>Sonchus oleraceus</i> L. not Wall.	– –	–
Poaceae	<i>Sorghum halepense</i> (L.) Pers. <i>Elymus repens</i> (L.) Gould	– –	

Out of the 36 species identified in the terrestrial ecosystems in the Maglavit area, 8 species have a CCI ranging from 100 - *Gypsophila muralis* to 139 - *Euphorbia agraria*, species characteristic for the flora of sands; 18 species have a CCI ranging between 171 - *Gleditsia triacanthos* and 300 - *Verbascum blattaria* and the others between 400 - *Solanum nigrum* and 800 - *Tribulus terrestris*, species characteristic of sand dunes. Concerning the AVG (the average of mean of the chlorophyll index), significant values are found in all 36 species, with the highest values recorded by *Bassia laniflora* - 346, *Euphorbia agraria* - 363, *Marrubium peregrinum* - 451, *Salix alba* - 469, *Solanum nigrum* - 513, *Sambucus ebulus* - 800 (Fig. 2). Most species respond actively to dry conditions and temperature variations (over 40°C during summer and - 20°C during winter), specific to the Oltenia Plain (MARTA et al., 2011; ILIE et al., 2018).

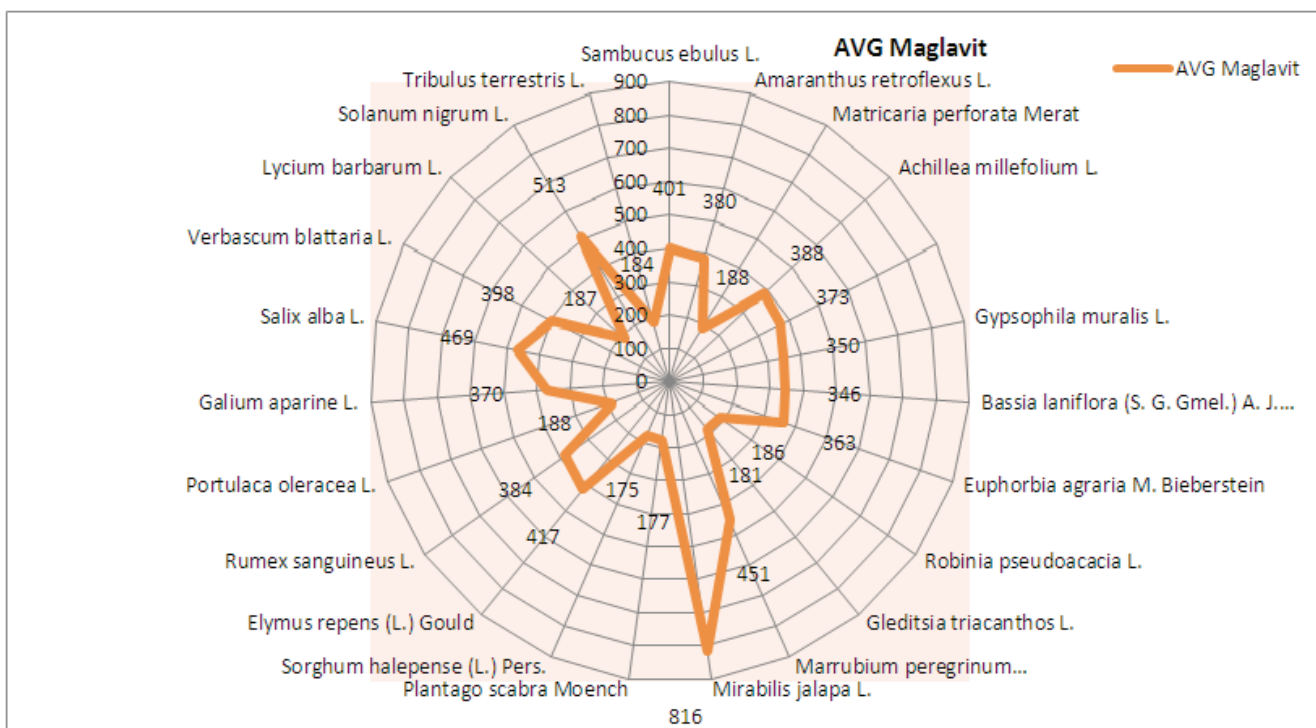
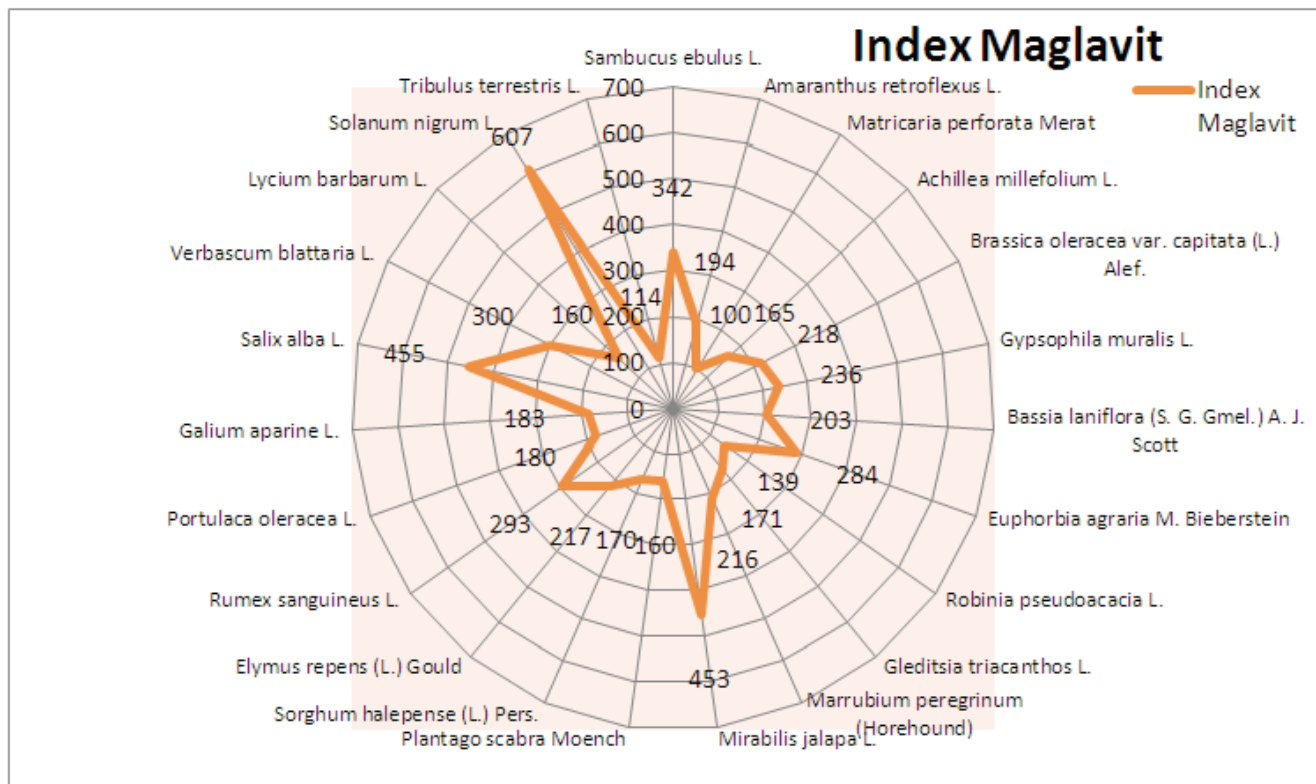


Figure 2. The values of the CCI and AVG in species of the Maglavit area.

Out of the 17 species identified in the area of Calafat, it is observed that 7 species are trees with a high CCI, ranging from 226 - *Carpinus betulus* to 300 - *Thuja occidentalis*; 6 species are shrubs with a CCI ranging between 206 - *Mahonia aquifolium* and 211 - *Syringa vulgaris*, and 2 species have the highest values - *Parthenocissus quinquefolia* (250) and *Hedera helix* (300). Concerning the AVG (the average of mean of the chlorophyll index), the average values range between 116 - *Sonchus oleraceus* and 198 - *Cercis siliquastrum* (Fig. 3) (NĂSTASE, 2004; GAVRILESCU, 2010).

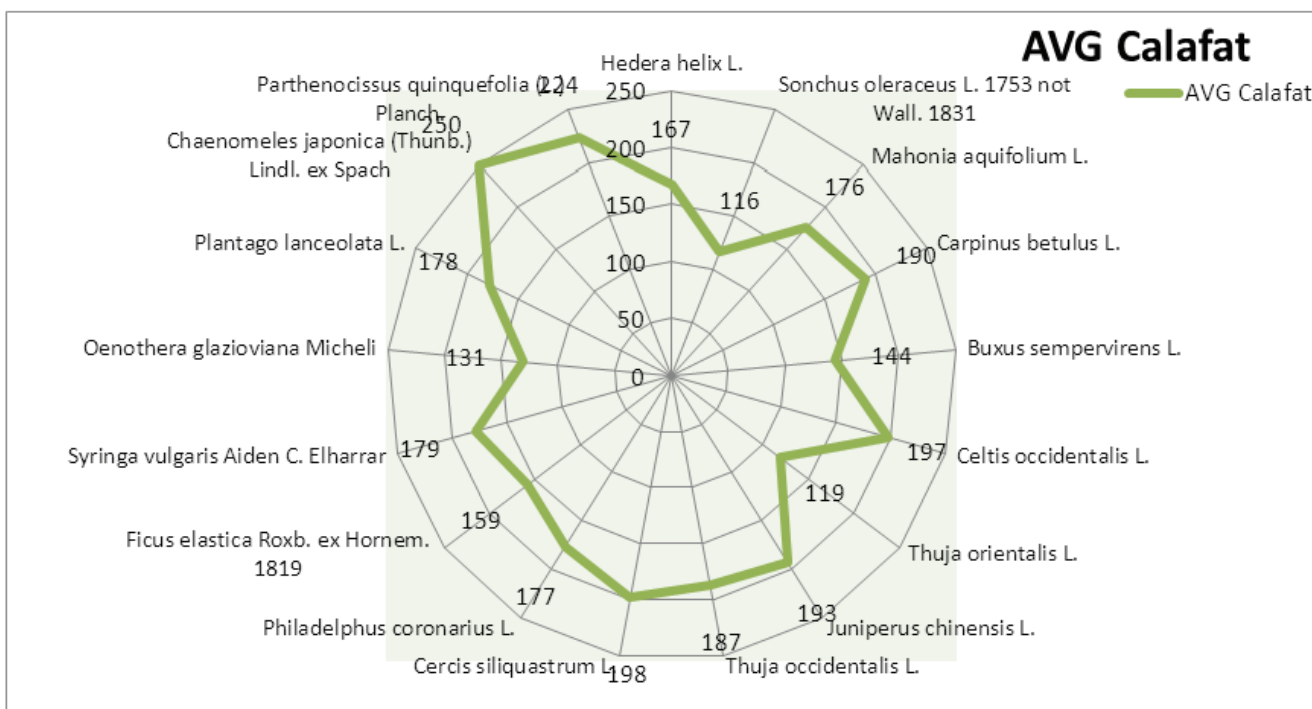
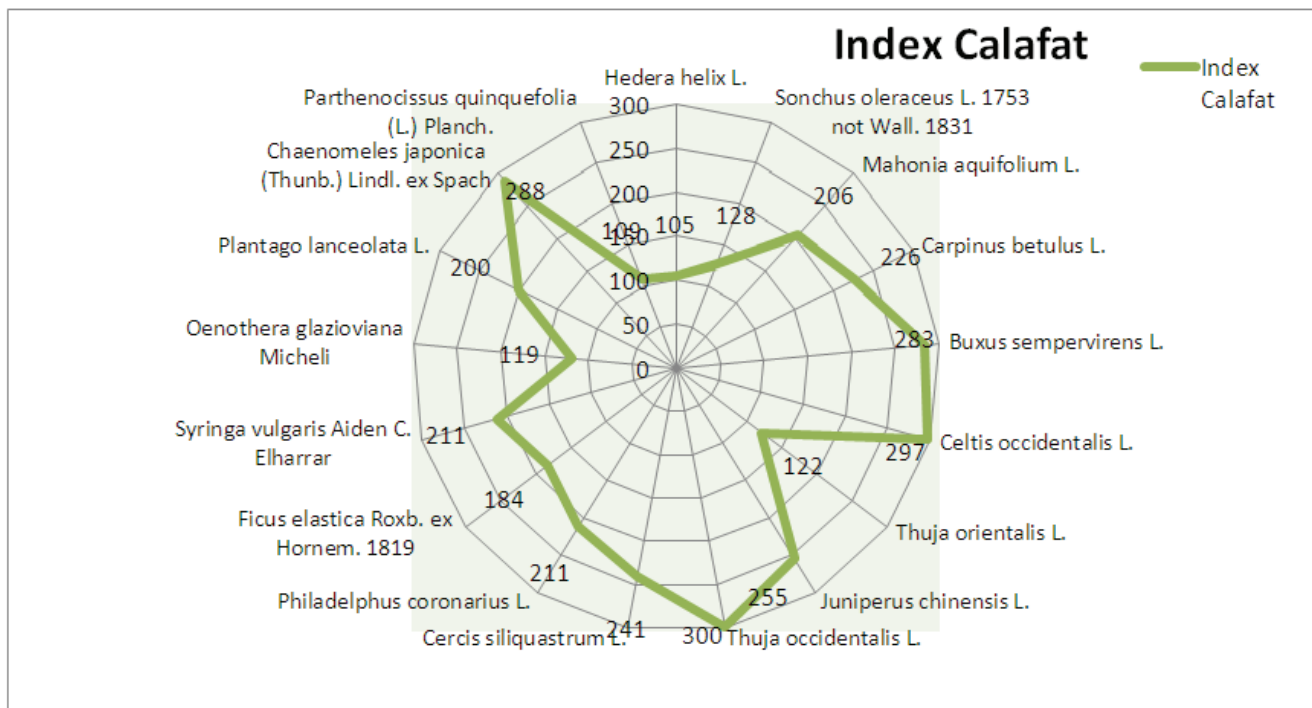


Figure 3. The values of the CCI and AVG in the species from Calafat.

CONCLUSIONS

The soils in the study area are characterized by sandy levigated chernozems and non-consolidated lands, to which there are added the alluvial solonetz, gleizated chernozems and even marshy soils from the Danube meadow. The soils are poorly supplied in macroelements, so that nitrogen and phosphorus fertilizers must be applied where necessary.

Out of the 750 species of vascular plants in the south-west of Oltenia, some physiological factors were assessed in 38 spontaneous and cultivated species belonging to 30 families, characteristic of the sandy soils in the Danube meadow. CCI ranged between 100 - *Gypsophila muralis* and 800 - *Tribulus terrestris*, in the Maglavit area, respectively 226 - *Carpinus betulus* and 300 - *Thuja occidentalis*, *Hedera helix* in the Calafat area. In terms of AVG, the values ranged between 346 - *Bassia laniflora* and 800 - *Sambucus ebulus* for the Maglavit area, and between 116 - *Sonchus oleraceus* and 198 - *Cercis siliquastrum* for Calafat. The evaluation of these physiological factors is closely related to the nitrogen demand, i.e. the rational use of fertilizers for adequate soil dosing in order to protect the environment (GAVRILESCU, 2013; ROȘESCU, 2018).

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