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COMPARISON OF DEVELOPMENT OF CHLOROPHYLL IN THE LEAVES OF *GINKGO BILOBA* L. USING DESTRUCTIVE AND NON-DESTRUCTIVE ANALYSIS

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The research defines the time depended differentiation of chlorophyll in the leaves of *Ginkgo biloba* L. seedlings using destructive and non-destructive methods. Water regime was induced for plants at the stage of growth of shoots at the beginning of June. Moisture of the substratum was 70% of saturation of the soil, and was regulated three times a week. Water regime was maintained for seven measurements. Sampling for analysis of chlorophyll content in leaves was carried out at three week intervals. First sampling was conducted immediately after the establishment of experiments in mid-June. The last collection was conducted in mid-September. By using different methods for measuring the chlorophyll in the leaves was found that changes in chlorophyll content can be identically recorded by destructive as well as non-destructive methods. The advantage of using non-destructive methods is less of subjects needed for the analysis and elimination of errors caused by the individual characteristics of plants.

Keywords: chlorophyll content index, leaf, *Ginkgo biloba* L. seedlings

Introduction

Ginkgo biloba L. is one of the phylogenetically oldest tree species which comes from Southeast Asia. Its homeland is the in province of Sichuan in China, but also grow in other countries of East Asia and since 1730 is growing in Europe (http://ohioline.osu.edu/sc157/sc157_13.html). It is characterized by slower growth, is relatively resistant to immission load and de-icing salts. It is generally considered one of the most adaptable species in our climate (http://ohioline.osu.edu/sc157/sc157_13.html). For this reason is ginkgo subjected to review its response to various stress factors, particularly the response to water scarcity (Raček et al., 2009a). One of the potential secondary indicators of the reaction on dryness are changes in chlorophyll, which was confirmed in the experiments with seedlings of *Pyrus pyraster* Burgsd L. and *Sorbus domestica* L. Paganová (2008) and Paganová (2009), and at the seedlings of *Acer davidii* ssp. *Grosseri* Pax de Jong (Raček, 2009b). For herbaceous species were recorded similar results by Jureková et al. (2003) when examining *Lycopersicum esculentum* Mill.

To confirm the changes in chlorophyll content is necessary for defining of the optimal development of chlorophyll content during ontogenesis of leaves and for detection of factors which influence synthesis. For that reason, was the goal of study to define and compare the time depended differentiation of chlorophyll content in the leaves of *Ginkgo biloba* L. seedlings by using destructive and non-destructive methods.

Materials and methods

Plant material was produced from seeds from parent plants growing in the park of Topoľčianky. It were one-year old seedlings grown in plastic one-litter containers in a substrate TS 3 Standard (pH 5.5 to 6.0 + fertilizer 1 kg m^{-3}) enriched by clay fraction (0–25 mm/m clay 20 kg m^{-3}). At the beginning of June in the phenological stage of rapid shoot growth irrigation regime was induced. The level of soil substratum saturation was 70%. Substratum was irrigated three times a week. Irrigation regime was maintained for eighty five days. The sampling was made seven times per growing season. The first collection took place immediately after the induction of irrigation regime. The last sampling took place at the beginning of September after eighty five days of differentiated irrigation regime. Five seedlings were analysed for one analysis. Analysis of chlorophyll content in leaves was carried out according Šesták and Čatský (1966). For each analysis were used all leaves of the plant. Parallel was on the collected leaves measured chlorophyll content by chlorophylmeter Opti Science CMC-200th. Chlorophyll content was expressed by means of the CCI (Chlorophyll Content Index). Results were analyzed for one growing season.

Results and discussion

The results obtained by destructive analysis were compared with those obtained by measuring with chlorophyllmeter Opti Science CMC-200th. The comparison

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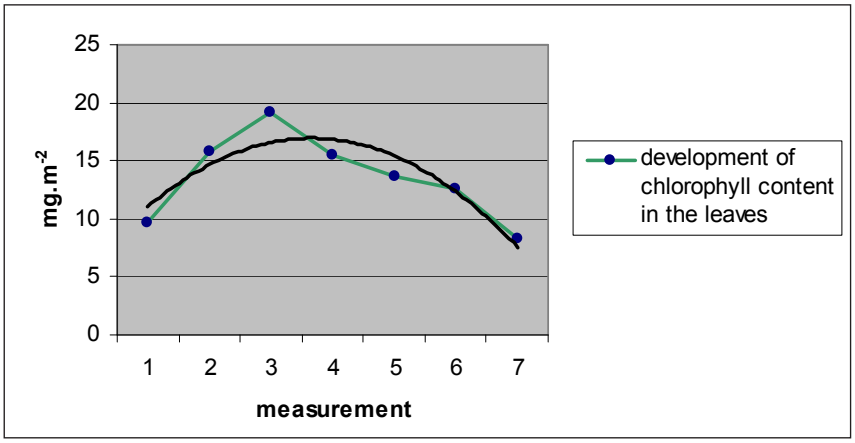

Figure 1 Time depended development of chlorophyll content in the leaves of *Ginkgo biloba* L. in mg m^{-2}

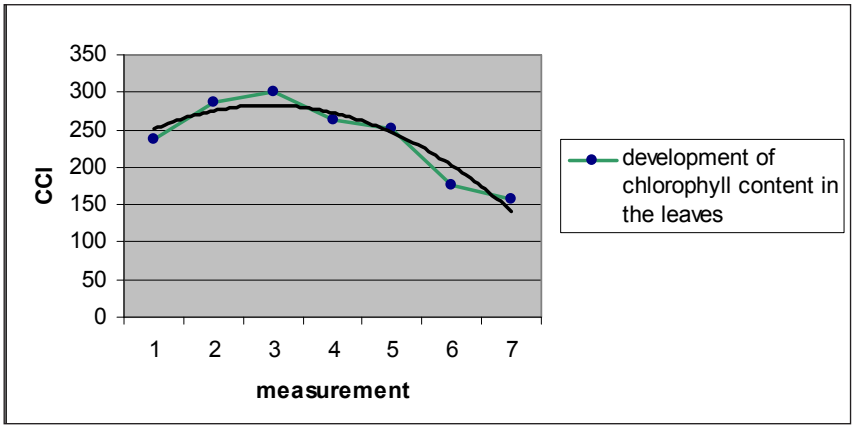

Figure 2 Time depended development of chlorophyll content in the leaves of *Ginkgo biloba* L. in CCI2

between the corrected curves (Figure 1 and Figure 2) confirmed the identical time differentiation of chlorophyll in the leaves of *Ginkgo biloba* L. seedlings during late spring and summer. When measured by chlorophyllmeter in comparison with destructive methods had a less pronounced deviation distance expressed by a polynomial curve of the measured values (Figure 1 and Figure 2). Chlorophyll content varied, depending on the course of the vegetation. Chlorophyll content peaked in mid-July. In the coming days and weeks there has been measured a decrease of chlorophyll content. Decrease in chlorophyll content was gradual and even up to the last measurement, which took place in mid-September. By using different methods for measuring the chlorophyll in the leaves was found that changes in chlorophyll content can be recorded relatively identically by both destructive and non-destructive methods. The advantage of using non-destructive methods is less of subjects needed for the analysis and elimination of errors caused by the individual characteristics of plants.

Conclusions

The results obtained suggest that the chlorophyll content in leaves of one-year seedlings of *Ginkgo* L. culminates around mid-July. In subsequent weeks was recorded a gradual decline in its content. Measurement also confirmed that the use of destructive methods by Šesták and Čatský (1966) and non-destructive measurements using chlorophyllmeter Opti Science CMC-200th leads to identical results. By using chlorophyllmeter is in comparison with destructive methods possible to moderate measurement errors caused by the individual characteristics of plants.

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