EFFECT OF AIR TEMPERATURE ON LEAF PHOTOSYNTHESIS IN ELDER

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Abstract
Temperature with solar radiation intensity is the main external factor affecting photosynthesis process. Measurements were collected in the 2011 growing season. Photosynthesis and respiration measurements were made at Sambucus nigra leaves with a CO_2 analyzer. The aim was to develop a model of photosynthesis in relation to temperature (which is in close relationship with air humidity). Photosynthesis of Sambucus nigra leaves is sensitive to temperature with an optimum around 25-28^oC and rates declining by 18% with air temperature around 33-35^oC.

Keywords: Sambucus nigra L., elder, temperature, net photosynthetic rate.

1. INTRODUCTION

Temperature with solar radiation intensity is the main external factor affecting photosynthesis process. Net photosynthesis intensity increases with temperature up to 30^{o}C (Kliewer et al, 1972). The optimum temperature for this process will vary depending on the species within the following limits: 20-25^{o}C for citrus fruit, 30^{o}C for peach. Temperatures greater than 35^{o}C negatively affects the intensity of photosynthesis, causing the reduction of its.

Inhibition of photosynthetic CO_2 fixation under the influence of high temperatures has been studied by several researchers. They showed that some components of the photosynthetic apparatus and some associated metabolic processes are thermo labile. One of the metabolic processes that can be inhibited by high temperatures is the transport of photosynthesized substances. Temperature changes between 15 and 40^{o}C had two effects on photosynthesis and concurrent export. At all temperatures, suppressing photorespiration increased both photosynthesis and export, but above 35^{o}C, export processes were more directly inhibited independent of changes in photorespiration and photosynthesis (Jiao and Grodzinski,1996).

The ecological characteristics of *Sambucus nigra* L. are: the preferences for trophicity: eutrophic; the preferences for soil humidity: mesophylous; the preferences to light: heliophylous, heliosciophylous (Stratu et al, 2011).

2. MATERIAL AND METHOD

A portable photosynthesis system (Field CO2 Analysis Package with S151 CO2 analyzer) was used. The photosynthesis measurements were conducted at ambient relative humidity, air temperature and PPFD. Analysis of correlation was conducted using SPSS Program, at the 0.01 and 0.05 levels.

3. RESULTS AND DISCUSSIONS

With carbon dioxide analyzer (figure 1), we determined the intensity of photosynthesis and respiration in the leaves of *Sambucus nigra*. In Table 1 presents some results obtained by determining physiological parameters in 3 different days.

Determining the intensity of photosynthesis in leaves of elder, on different days, with different values of air temperature, relative humidity and the light intensity, maximum values were observed at temperatures of 25-28^{o}C (figure 2). With increasing temperature over 28^{o}C, there is a decrease in the intensity of photosynthesis. The response is also well in keeping with the generally understood effect of temperature on photosynthesis (Kliewer et al, 1972; Havaux, 1993).

The optimum temperature for this process will vary depending on the species within the following limits: 25-30^{o}C for Semillon grape leaves (Greer, 2012), and net photosynthetic rates declining by 30^{o}C with leaf temperatures around 40-45^{o}C. Photosystem II (PSII) is considered to be one of the most thermolabile aspects of photosynthesis (Havaux, 1993; Havaux and Tardy, 1996), but Havaux's study demonstrates the existence of adaptive processes which rapidly adjust the in *vivo* thermal stability of PSII in response to temperature increase. *In vivo* measurements of chlorophyll fluorescence and photosynthetic oxygen evolution in 25°C-grown potato leaves (cv. Haig) indicated that the threshold temperature T_c above which PSII denatures was indeed rather low–about 38°C– with temperatures higher than Tc causing a rapid and irreversible loss of PSII activity (Havaux, 1993). It was revealed that the small chloroplast heat-shock protein (Hsp) is involved in plant thermotolerance (Heckathorn et al, 1998). Moderately elevated temperatures inhibit light activation of Rubisco via a direct effect on Rubisco activase (Weis, 1981 a; 1981 b; Kobza and Edwards, 1987; Feller et al, 1998).

Table 1. Changes in gas exchange in elder

DAY	**PHYSIOLOGICAL PARAMETERS**
1	Net photosynthetic rate: 4.297 µmol CO_2 $m^{-2}s^{-1}$ Respiration rate: 1.983 µmol CO_2 $m^{-2}s^{-1}$ Air temperature: 23 ^{o}C Air relative humidity: 52% Light intensity: 10 000 lux
2	Net photosynthetic rate: 6,218 µmol CO_2 $m^{-2}s^{-1}$ Respiration rate: 2.837 µmol CO_2 $m^{-2}s^{-1}$ Air temperature: 25 ^{o}C Air relative humidity: 51% Light intensity: 50 000 lux
3	Net photosynthetic rate: 5.829 µmol CO_2 $m^{-2}s^{-1}$ Respiration rate: 2.188 µmol CO_2 $m^{-2}s^{-1}$ Air temperature: 24 ^{o}C Air relative humidity: 51% Light intensity: 22 000 lux

Figure 1. Field CO2 Analysis Package with S151 CO2 analyzer

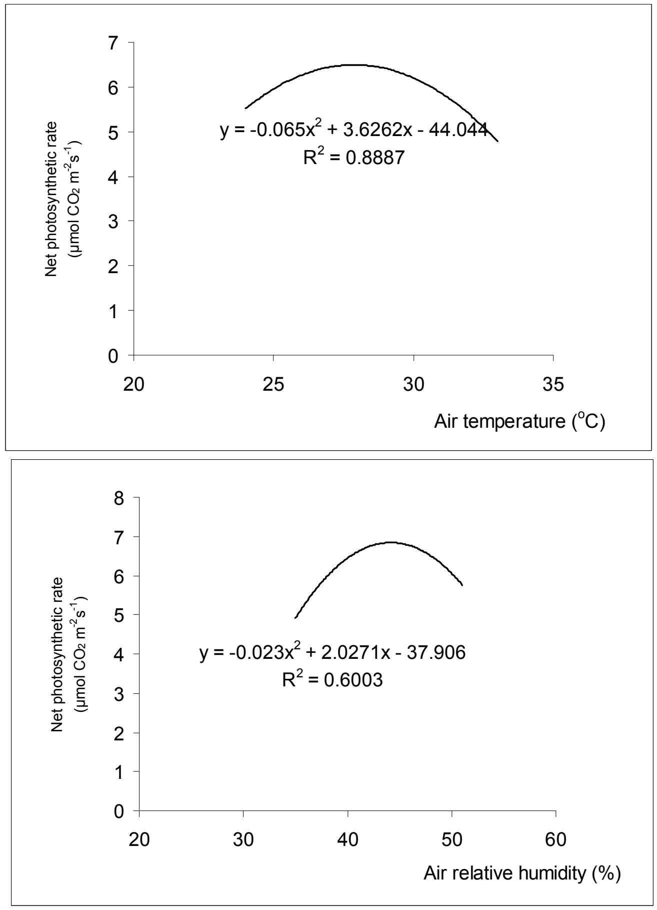

Figure 2. The effect on air temperature, correlated with air relative humidity, on net photosynthesis

Pearson correlation coefficients among air temperature (between 24 and 28°C) and photosynthesis rate was 0.890 (correlation is significant at the 0.01 level). Also, the correlation between air relative humidity (between 40 and 50%) and photosynthesis rate is significant for 0.05 level (pearson correlation coefficient was -0.585).

4. CONCLUSIONS

Photosynthesis of *Sambucus nigra* leaves is sensitive to temperature with an optimum around 25-28°C and rates declining by 18% with air temperature around 33-35°C. Between the intensity of photosynthesis and the air temperature (between 24 and 28°C) has established a positive significant correlation.

5. ACKNOWLEDGEMENTS

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