М.А. Гендельманның 110 жылдығына арналған «Сейфуллин оқулары – 19» халықаралық ғылыми - практикалық конференциясының материалдары = Материалы международной научно-практической конференции «Сейфуллинские чтения – 19», посвященной 110-летию М.А. Гендельмана». - 2023.- Т. I, Ч. IV. – Р. 272-276.

UDC№63.630.631.6

SEASONAL CHANGE OF SOME BIOACTIVE COMPONENTS OF *PINUS BRUTIA* TEN. CLONAL SEED ORCHARD IN ANTALYA DUZLERCAMI

YILMAZ E.*
Kastamonu University, Devrakani TOBB Vocational High School, Pharmcy Programme, Kastamonu, Turkiye
Kastamonu University, Institute of Science, Sustainable Forestry Doctorate Program, Kastamonu, Turkiye
AYAN S.
*Kastamonu University, Faculty of Forestry, Department of Silviculture, Kastamonu, Turkiye *Corresponding author: yilmazergin@kastamonu.edu.tr*

Abstract: Some bioactive components (chlorophyll *a*, chlorophyll *b*, total chlorophyll amount, carotenoid content and total phenolic substance content) in the needle leaves of 28 different clones of the Turkish pine (*Pinus brutia* Ten) clonal seed orchard in Antalya-Düzler Çamı seasonally (February and August) was analyzed. As a result of the biochemical analyzes; It was observed that the amount of chlorophyll and total phenolic substances changed in the active vegetation period and dormant phase. The amount of chlorophyll in February compared to August; It was determined that chlorophyll *a*, chlorophyll *b*, total chlorophyll amount and carotenoid amount increased. In addition, the fact that the total amount of phenolic substances gives higher results in February than in August shows that some phenolics have a function in protecting the plant against pests. Because it is known that some phenolics in plants play an important role in many issues, from protecting the plant against high light damage, from pathogen attacks to herbivorous insect damage.
Keywords: Turkish pine, biochemical analysis, needle, clone, vegetation

Introduction

Chlorophyll is one of the most important pigments that enable the photosynthesis event, in which plants use the light energy and obtain organic matter. Because plants absorb the energy from the sun and transform it into chemical energy with the chlorophyll pigment (Çetin, 2016). Plant phenolic compounds are the most common bioactive compounds found in plants. It is also known that phenolic compounds act as antioxidants (Decker, 1995; Rice-Evans et al., 1996). Plant

bioactive components are divided into primary and secondary metabolites. Primary metabolites are more involved in growth and development, while secondary metabolites function more in ecological roles for the plant, as defense compounds against herbivorous insects or pathogens (Bernards, 2010). With this research, it was aimed to reveal the periodic variation of the amount of chlorophyll and the total amount of phenolic substances, which play an important role in plant development and have a direct effect on photosynthesis.

Material and Method

As the study area, needle leaf samples of 28 clones were taken from the clonal seed orchard of Turkish pine (*Pinus brutia* Ten.) with national registration number 8 in Antalya province Düzlerçamı in February and August in 2021. The needle leaf samples taken were brought to Kastamonu University Central Research Laboratory as a cold chain. Needle leaf samples were stored at -20^0 C until the analysis stage.

Chlorophyll analysis:

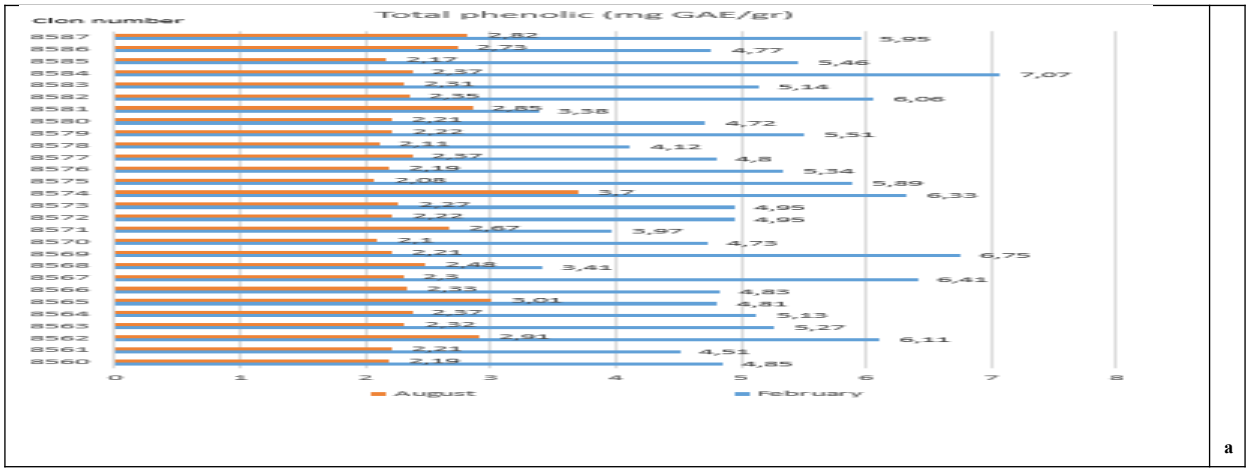
0.5 g of the needle leaf samples to be analyzed were weighed and the samples were homogenized with 80% acetone. Absorbance values were obtained at a wavelength of 663 nm for chlorophyll a, 645 nm for chlorophyll b, and 470 nm for carotenoid (Kabay, 2014). The total amount of chlorophyll was calculated with the help of Arnon's equation (Arnon, 1949), and the amount of carotenoids was calculated with the Jaspars formula (Witham et al., 1971).

Total Phenolic Substance Amount:

The total amount of phenolic substances was determined by the Folin-Ciocalteu method (Slinkard and Singleton, 1977). Gallic acid was used as a standard and the amount of phenolic substance was calculated from the standard graph using gallic acid.

Results

Periodic changes of chlorophyll *a*, chlorophyll *b*, total chlorophyll, carotenoid and total phenolic substance amounts of needle leaf samples taken from Turkish pine clonal seed orchard are given in Figures 1 a, b, c, d, and e.



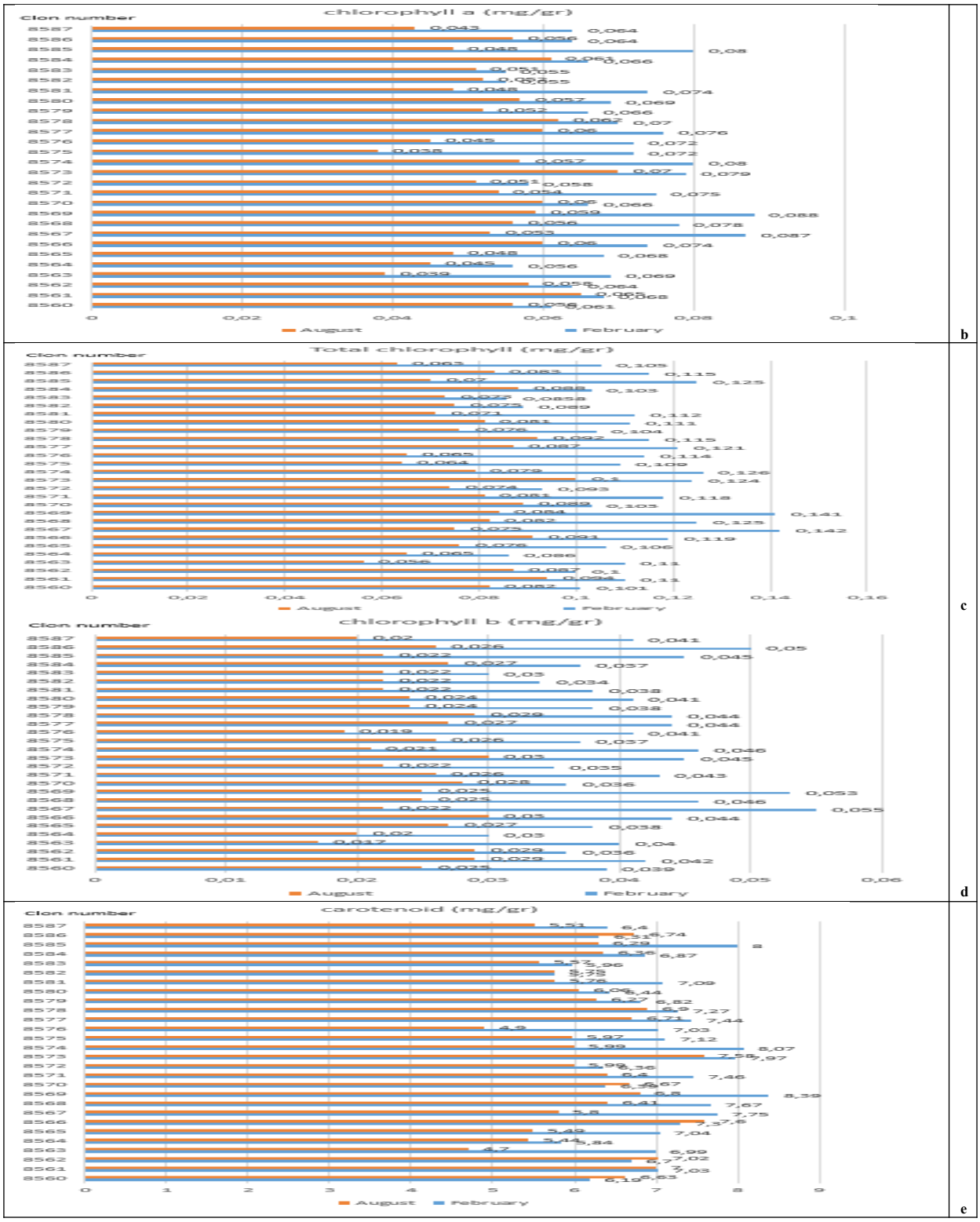


Figure 1. Seasonal variation of the total amount of phenolic substances (a), the amount of chlorophyll *a* (b), the amount of chlorophyll *b* (c), the total amount of chlorophyll (d), the amount of carotenoids (e)

Discussion and Conclusion

According to the data obtained; Seasonal changes are observed in chlorophyll a, chlorophyll b, and total chlorophyll values. It is observed that chlorophyll amounts are significantly higher in February than in August. It is thought that this situation is related to the high light and winter temperature drops due to water scarcity and summer droughts. It shows that the chlorophyll content in needle leaves can change seasonally within the same vegetation period. Sauceda et al. (2008) reported that the change in chlorophyll content is associated with water scarcity and temperature drops in high light and winter periods due to summer droughts. In addition, since the sampling times are February and August, there are also temperature differences between these months. Because Brett and Singer (1973) stated that high light and temperature may cause a decrease in chlorophyll content. In addition, when February and August are compared within themselves, it is thought that the higher temperature in Antalya in August may have affected the amount of chlorophyll. Again, the photosynthetic pigment content of high temperature and summer drought; It can cause a decrease in chlorophyll content and, in parallel, carotenoids (Yordanov et al., 2000). In this study, the amount of carotenoids decreased in August compared to February. It is known that phenolic compounds are bioactive components that have important roles in plants. These secondary metabolites, which also act as natural antioxidants, are closely related to antioxidant activity (Singleton and Rossi, 1965). It is known that phenolic compounds have many functions in plants. It is known that some phenolics in plants play an important role in many issues, from protecting the plant against high light damage, from pathogen attacks to herbivorous insect damage (Hedin and Waage, 1986; Lamb et al., 1989). These results confirm that in practice, the decreasing antioxidant level in the vegetation period makes the red pine more susceptible to pests.

List of used literature

1. Arnon, D.I. (1949). Copper enzymes in isolated chloroplasts. Polyphenol oxidase in *Beta vulgaris*. *Plant Physiology* 24: 1-15. doi: 10.1104/pp. 24.1.1
2. Bernards, M.A. (2010). Plant natural products: a primer. *Canadian Journal of Zoology 88*(7), 601-614.
3. Brett W.J., & Singer, A.C. (1973). Chlorophyll concentration in leaves of *Juniperus virginiana* L., measured over a 2-year period *The American Midland Naturalist* 90(1), 194-200.Çetin, M. (2016). Peyzaj Çalışmalarında Kullanılan Bazı Bitkilerde Klorofil Miktarının Değişimi. *Kastamonu University Journal of Forestry Faculty* 16(1) 239-245
4. Decker, E. A. The role of phenolic, conjugated linoleic acid, carnosine and pyrroloquinoline quinone as nonessential dietary antioxidants. Nutr. Rev. 1995, 53,49-58.

5. Hedin, P.A., & Waage, S.K. (1986). Roles of flavonoids in plant resistance to insects. *Progress İn Clinical and Biological Research 213*, 87-100.
6. Kabay, N. (2014). Abrasion resistance and fracture energy of concretes with basalt fiber. *Construction and Building Materials*, *50*, 95-101.
7. Lamb, C.J., Lawton, M.A., Dron, M., & Dixon, R.A. (1989). Signals and transduction mechanisms for activation of plant defenses against microbial attack. *Cell 56*(2), 215-224.
8. Qados, A. M. A. (2011). Effect of salt stress on plant growth and metabolism of bean plant *Vicia faba* (L.). *Journal of the Saudi Society of Agricultural Sciences* 10(1), 7-15.
9. Rice-Evans, C. A., Miller, N. J., & Paganga, G. (1996). Structure-antioxidant activity relationships of flavonoids and phenolic acids. *Free Radical Biology and Medicine* 20(7), 933-956.
10. Sauceda, J.U., Rodriguez, H.G., Lozano, R. R., Silva, I.C., Meza, M.G., Larga, L. (2008). Seasonal trends of chlorophylls a and b carotenoids in native trees and shrubs of northeastern Mexico. *Journal of Biological Sciences* 8(2), 258-267.
11. Singleton, V. L., & Rossi, J. A. (1965). Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *American journal of Enology and Viticulture*, *16*(3), 144-158.
12. Singleton, V.L., Rossi, J.A., (1965). Colorimetry of Total Phenolics with Phosphomolybdic-Phosphotungstic Acid Reagents. *American Journal of Enology and Viticulture*, 16, 144-158.
13. Slinkard, K., & Singleton, V. L. (1977). Total phenol analysis: automation and comparison with manual methods. *American Journal of Enology And Viticulture*, *28*(1), 49-55.
14. Witham, F. H., Blaydes, D. F., & Devlin, R. M. (1971). Experiments in Plant Physiology, Pp 55-56. Van Nostrand Reinhold Company, New York.
15. Yordanov, I., Velikova, V., Tsonev. T. (2000). Plant responses to drought, acclimation, and stress tolerance. *Photosynthetica* 38 (2), 171-186.