

Variability of Total Essential Oils Content in Leaves of Bay Laurel (*Laurus nobilis* L.) in 12 Distinct Populations of Croatian Adriatic Area In Relation With Geographic Position of Locations, Leaf Lamina Surface and Genetic Variability

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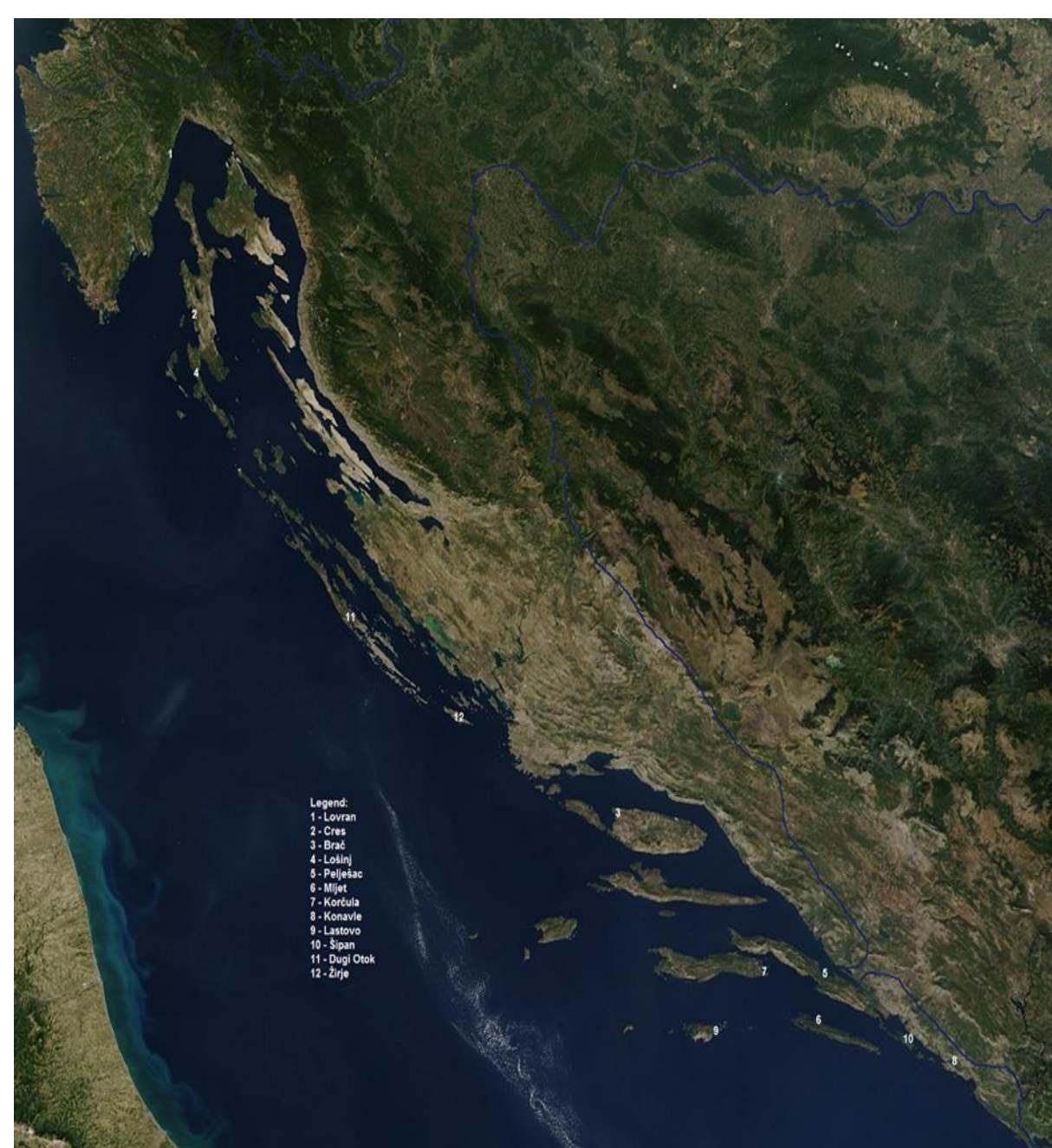
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Introduction

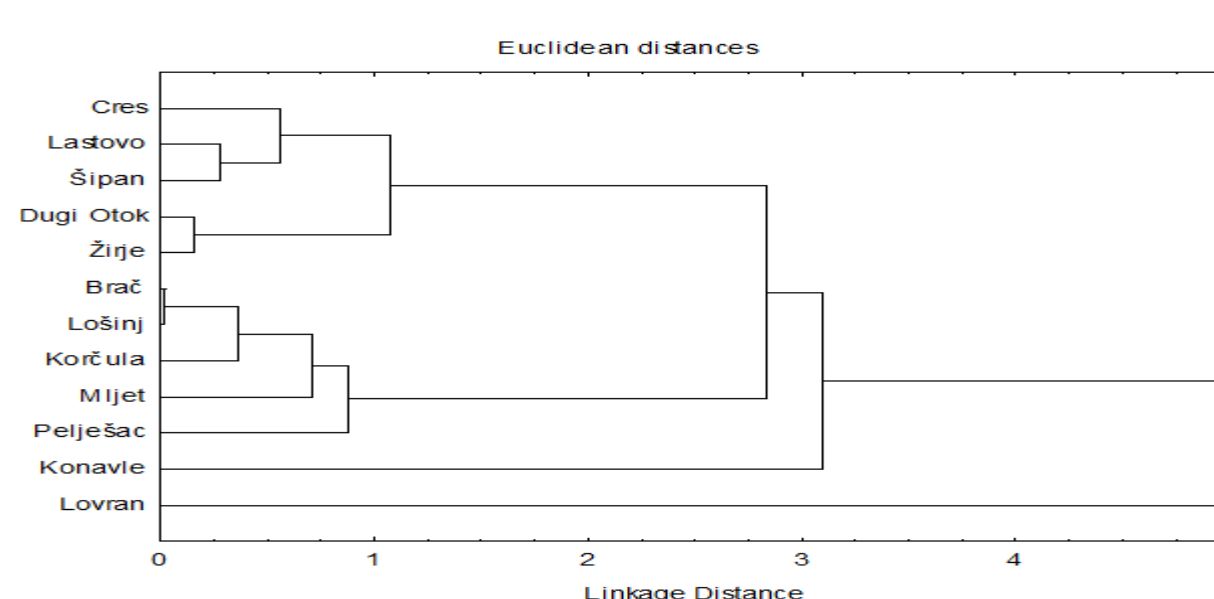
The leaves of *L. nobilis* contain essential oils and the usage of laurel leaves is well known in Mediterranean cuisine. Also, the essential oils, extracted from the leaves of laurel, show significant antifungal and antimicrobial effects on some foodborne pathogens. However, the leaves of *L. nobilis* have components of essential oil, phenolic compounds, and sesquiterpenic lactones as the principal active substances and shows significant antioxidant activity. The qualitative composition and quantitative content of these groups of essential oils compounds in laurel leaves depends of ecological conditions, geographical position, climatic factors, soil conditions etc.



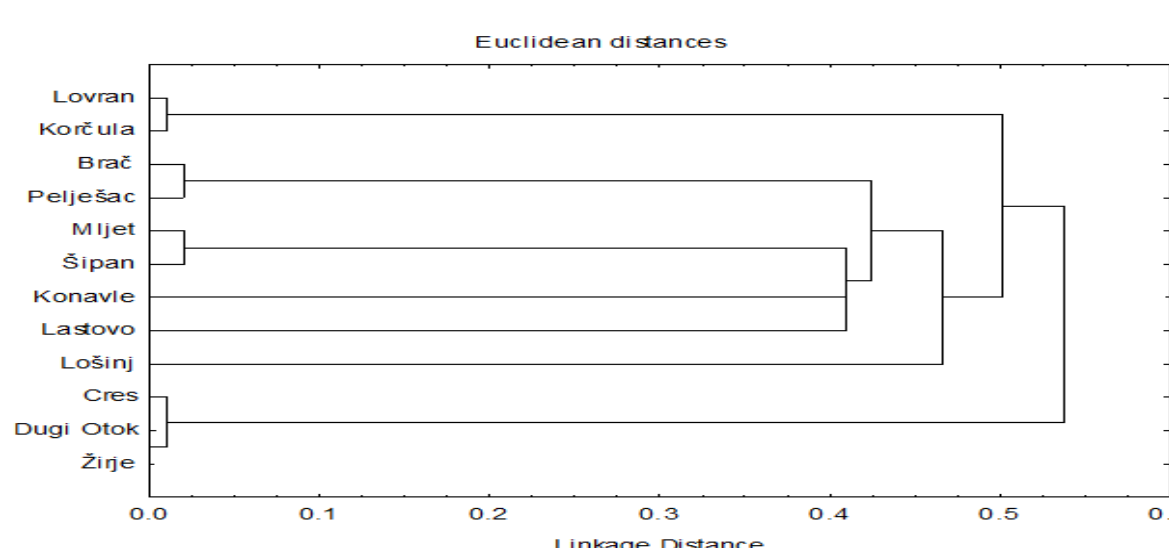
Locations of 12 distinct populations of *L. nobilis* (map is adapted from source: <https://sites.google.com/a/middleschoolkcd.org/croatia/home/physical-geography/maps>)

RESEARCH

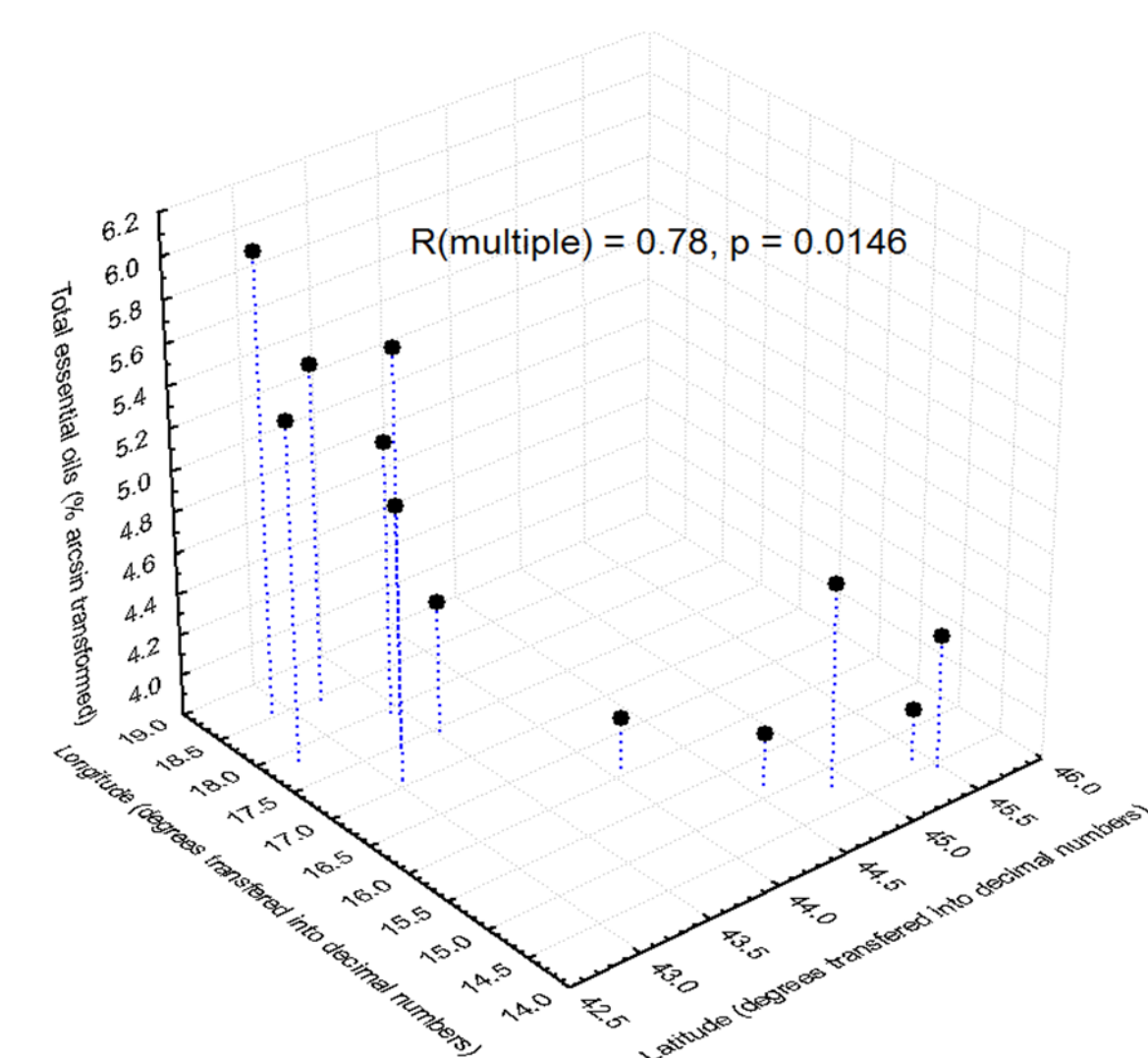
The aim of this research was to find possible differences in variability of total essential oils content in laurel leaves, collected in 12 distinct populations of Croatian Adriatic area, in relation with geographic position of locations, differences in leaf lamina surface and genetic variability between distinct laurel populations. Morphometric analyses of leaves. Hydro distillation of essential oils from dried leaves. DNA isolation and AFLP analyses. Statistical analysis Friedman's ANOVA and Kendall's Coefficient of Concordance. Correlations between laurel leaf surface and content of total essential oils, and also geographic position of each location and content of total essential oils, were examined by Spearman's Rank Order Correlation, Cluster analyses by unweighted pair group method with arithmetic mean, Mantel test.



Cluster analysis of 12 distinct populations of *L. nobilis* for trait of leaf lamina surface



Cluster analysis of 12 distinct populations of *L. nobilis* for trait of total essential oils content



Multiple correlations between latitude and longitude of 12 distinct locations and content of total essential oils in *L. nobilis* leaves

Results

Opposite of our previous expectations, the average surface of bay laurel leaves has no influence on accumulation of essential oils in 12 distinct populations (r_s (average surface of leaves vs. total oil content) = 0.125; $p > 0.05$). The highest rank of leaf surface is detected in *L. nobilis* population of Lovran, which is the northernmost population and then follows the population of Konavle, which is the southernmost population of *L. nobilis*. Then follows the population of south Adriatic island of Korčula. Also, the population of middle Adriatic island of Brač share the same rank considering the leaf lamina surface with the population of north Adriatic island of Lošinj (average ranks 8.75 and 8.25, respectively, with diff. between average leaf surface of only 0.01 cm²). The lowest leaf lamina surface has been noticed on the population of Cres north Adriatic island, which is the nearest location of the population of Lovran. The results of Friedman's ANOVA, for trait of leaf lamina surface, correspond with the results of UPGMA analysis for the same trait. Consequently, the correlations between leaf lamina surface and latitude and longitude of the location of investigated population were not obtained (r_s (latitude vs. leaf lamina surface) = -0.083; r_s (longitude vs. leaf lamina surface) = 0.055; $p > 0.05$, respectively). Spearman's Rank Order Correlation between longitude and total essential oils content in laurel leaves of the same populations were strongly positive and also highly significant ($r_s = 0.77$; $p < 0.01$). The results of Spearman's Correlations are also confirmed by the Multiple Correlation Analysis. Determined multiple correlation coefficient between longitude and latitude, treated as two independent variables, and total content of essential oils was very high and significant. The results of Mantel test between results of AFLP analysis and content of total oils in leaves of *L. nobilis* of these 12 distinct populations, shows low positive correlation ($r = 0.39$; $p < 0.05$), but there were no correlation obtained between results of AFLP analysis and leaf lamina surface, latitude and longitude of locations, by Mantel test ($r = -0.06$; 0.09; 0.17; $p > 0.05$, respectively).

CONCLUSION

According to results of this study, it seems that geographical position of the locations of 12 distinct populations has a stronger influence on accumulation of total essential oils in leaves of *L. nobilis*, rather than its leaf lamina surface. Namely, achieved results shows that content of total essential oils generally increase from the northern to southern populations and also from west to the east. However, considering the low positive correlation between results of AFLP analysis and content of total oils in leaves of *L. nobilis* of these 12 distinct populations, it is not possible to exclude the influence genetic factors and variability between populations on differences in accumulation of essential oils between them.

Acknowledgements

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