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Lipid peroxidation

e intensity of lipid peroxidation is one of the functional characteristics of plant cells [15]. e content of MDA, an indicator of peroxidation of lipids (Table 3), in the plantain leaves varied widely from 3.5-30 µmol/g dry weight. In the warm years (2007 and 2010), S1 plants had a higher MDA content in their leaves compared to S2 plants; in the cold, low-sunlight, and rainy year (2009), the level of MDA was equally low in leaves of both S1 and S2 plants. In the warmer season of 2007, an increase in MDA was observed in the a ernoon compared to morning hours. In the warm and dry 2010 season, lipid peroxidation was revealed only in the leaves of S2 plants. In the leaves of S1 plants, a high MDA level was maintained until late in the evening. e di erences in the content of MDA between S1 and S2 plants were larger in the warm season with sunny days.

Content of lipids

e morphometric parameters' change of leaves occurred when lipid composition was modi ed. e content of TL was 1.3−1.5 fold higher in dry and warm years (2007 and 2010) than in cool and rainy ones (2009) (Figures 2A and 2B). e greatest di erences in TL between plants at S1 and 2 occurred in 2007 (Figure 2).

e major components of TL (>75%) were polar GL and PL. Leaf concentrations of GL were higher in 2009 in comparison to other years. Also the concentration of GL was higher in shaded S2 plants during the

GL was observed when there was the most stable number of hours of sunshine, for instance in 2010.

The PL amounted to about 25% of total lipids. As seen in Figure 2, the year-related climatic conditions affected the PL content. In the cold and rainy 2009 year, PL concentration in leaves was lower than that in the other (drier and warmer) years (Figures 2E and 2F). During all years, the leaf content of PL in S2 plants was higher than that in S1 ones. The differences were larger in the dry and warm season of 2010. However, variations in daily flow of total PL content were less significant in comparison with GL.

The NL are referred to as storage lipids, and their content is comparable to that of PL (Figures 2G and 2H). In 2007 and 2010, the content of NL in S1 plants was higher than that in S2 plants. Plants of both groups accumulated the largest quantities of NL in their leaves in 2007, when the season was warm and amount of precipitation was sufficient. In the colder and rainy 2009 year, the leaves accumulated less NL.

Fatty acid composition

About 20 FA were identified in the leaves of *P. media*, with C_{16} and C_{18} acids comprising more than 90%. The leaves of the plantain plants had a relatively low FA content, containing some hydrocarbon chains shorter than 16 carbons (<5%) and less FA with hydrocarbon chains longer than 20 carbons (<2%). The main component of unsaturated FA (USFA) was linolenic acid ($C_{18:3}$; 33-58% of total FA) and predominant saturation FA (SFA) was palmitic acid ($C_{16:0}$; 18-26%). After integrating vital properties of cellular membranes, primarily uidity [11,28]. We found that high rate of light (S1) and sunny days (2007, 2010) lead to increased content of monoenoic FA. On the other hand, in a cold year (2009) noted the largest content of trienoic FA. As a result, ratios of the SFA and USFAs varied.

Using a mathematical method, we determined the degree of in uence of individual factors on the composition and content of lipids (Table 4). As the duration of sunshine increased, the content of total lipids increased (r=0.78). At the same time, an increase in temperature resulted in a decrease of their content (r=-0.7), especially for plants in high-sunshine habitats. Concentration of GL in leaves of shaded plants increased with increasing precipitation but decreased with increasing temperature and the duration of sunshine. e same e ect is exerted by rainfall on PL content. Weather factors had a statistically signi cant but opposite e ect on the contents of FA. Amount of SFA increased with increasing temperature and the duration of sunshine. Precipitation contributed to the accumulation of USFA.

Conclusions

us, the changes in lipid and FA composition have been studied in *P. ed a* leaves in response to light conditions in northeastern Russia (South Timan). e content of lipids in the leaves depended on weather and microclimate conditions. In general, our results suggest that the variability of lipid content, as well as morphological variability of leaves is functional features that de ne ecological plasticity of *P. ed a*. Apparently, due to their ecological plasticity, *P. ed a* plants can occupy di erent ecotopes, and, as a result, they have a wide geographic distribution.

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