

Streszczenie w języku angielskim pracy doktorskiej pt.:

KSZTAŁTOWANIE SIĘ EPIFITYCZNEJ I EPIKSYLICZNEJ BIOTY POROSTÓW
ŚWIERKA POSPOLITEGO POD WPŁYWEM NATURALNYCH ZABURZEŃ
W DRZEWOSTANACH GORCZAŃSKIEGO PARKU NARODOWEGO

THE DEVELOPMENT OF EPIPHYTIC AND EPIXYLIC LICHEN BIOTA OF NORWAY
SPRUCE AFFECTED BY NATURAL DISTURBANCES IN THE STANDS OF GORCE
NATIONAL PARK

Autor: Magdalena Tanona

The presented doctoral dissertation was aimed at determining the changes in lichen communities inhabiting bark of living trees and the wood of Norway spruce (*Picea abies* L.), in response to two main types of natural disturbances affecting the stands of the Gorce National Park in the Polish Western Carpathians, i.e., spruce bark beetle outbreaks (*Ips typographus* L.) and windthrows. At the same time, the impact of air pollutants reaching the Gorce Mountains on the biota of spruce epiphytic lichens was assessed in a long-term perspective by critically analyzing the commonly used method based on the Index of Atmospheric Purity (IAP).

The field research was preceded by a compilation of the results of recent, mainly European studies on lichens inhabiting rotting spruce wood, on the basis of which the first of a series of articles included in this dissertation was published. With its help, the impact of the spruce bark beetle gradation and severe wind was shown on the shaping of appropriate natural habitats inhabited by epixylic lichens, and thus on ensuring the survival and maintenance of high diversity within this group of organisms. Thus, the work refers to a modern approach to environmental stewardship, paying attention to the importance of proper management of dead wood in areas of protected and governed forests.

The results of examination of the accumulation of air pollutants in the thalli of the *Hypogymnia physodes* bioindicator on permanent monitoring plots indicate that atmospheric pollutants in Gorce are a factor of little importance for the occurrence of spruce lichen biota. The assessment used a comparative method based on a graphical interpolation of the

concentrations of selected elements, as well as the Spearman's rank correlation between three variables: i) the amount of pollutant deposition, ii) the Index of Atmospheric Purity (IAP) according to LeBlanc and De Sloover (1970), iii) ecological indicator values characterising species requirements for light (L), substrate reaction (R) and nutrients (N) according to Wirth (2010). It was found that in the study area, the IAP values reflected the general ecological conditions of the habitat to a greater extent than the concentrations of toxic elements flowing in with air masses.

The ecological analyses assessed the impact of the studied types of natural disturbances in forests on epiphytic lichens growing on the bark of surviving spruce trees inside a mosaic of small gaps and large post-disaster areas. Research on epiphytes on the bark of 186 spruce trees, surviving since 1993 on 33 monitoring plots located in various parts of the Park, showed that over 25 years, i.e., in the period 1993-2018, the total number of lichen species observed, such as the average number of species per research plot increased significantly. At the same time, the coverage of tree trunks with dominant species decreased, also the share of macrolichen species decreased. The forest plant community had a decisive influence on the direction of changes in the species composition of epiphytic lichen communities. Large-scale dieback of spruce forest in the upper mountain zone increased the share of light-requiring species on the studied trunks. In lower mountain mixed forests, the dynamics of small gaps is more important. The shading effect due to the rapid take up of the freed space by the crowns of beech and fir trees remaining in the stand was revealed in this community in the increase in the share of shade tolerant lichen species.

In subsequent articles, attention was drawn to the role of natural disturbances in the structure of protected Carpathian forests, caused by the invasion of the spruce bark beetle and stormy winds, for the diversity of epixylic lichen communities on the wood of Norway spruce. Climate warming, stimulating an increase in the frequency of occurrence and a more violent course of insect outbreaks, as well as atmospheric storms combined with severe winds, contribute to the intensification of dynamic spatial changes in mountain forests built by spruce throughout its range. The results were obtained based on the knowledge of the history of spruce dieback in the long term, recorded on permanent plots for the study of the dynamics of stands, established in 1992. With a view to improving the management of rotting wood resources in forests, the impact of, inter alia, the time of depreciation of dead spruce trunks and logs and the spatial scale of the stand decomposition, as well as selected site and topographic factors, i.e., forest plant community, altitude and slope exposure to the formation of epixylic lichen

biota. The aim of this part of the research was also to assess the impact of the above-mentioned environmental factors on the diversity (expressed by the Shannon H index) and abundance (expressed as a percentage cover of a wood patch with thalli) of recorded lichen communities, and then to determine the most favourable conditions for their development. The time of wood depreciation (age) was the most important of the tested factors, significantly and positively influencing the variety and abundance of lichens on both standing trunks and lying logs. The spatial scale of the decay of the stand, examined in three categories for standing deadwood (single, group and large-scale) and two categories for lying wood (group and large-scale), turned out to be significant for both types of substrates, each time a greater abundance of lichens was favoured by large-scale disturbances. The standing and lying wood was more abundantly covered with lichens on the "western" slopes (NW, W, SW) than on the "eastern" slopes (NE, E, SE). The same exposure effect also applied to Shannon's H diversity index. The "northern" slopes (NW, N, NE) were slightly more favorable than the "southern" slopes (SW, S, SE) for the abundance of lichens on standing wood, while on logs the opposite is true – greater coverage was recorded at the southern exposures. Increasing altitude had a positive effect on the abundance of lichens only on standing dead trunks, while the type of forest plant community was not significant in any of the matched statistical models.

In the research on lichens inhabiting dead spruce trunks, both standing and lying, an innovative method of assessing the degree of wood depreciation was implemented. It was based on measuring the hardness of the substrate under the thallus of the observed lichen specimens using a Shore durometer. In this way, the following was established: 1) the preferences of the identified species, separately on lying and standing wood, in relation to the objectively defined degree of its decay; 2) the potential course of lichen succession on both substrates related to the subsequent stages of wood depreciation. Similar results, based on long term stand data, enabling the assessment of the significance of natural disturbances for the preservation of lichen communities over the entire quarter of a century, have not been obtained before in Europe, hence our results appear as new data on the ecology of lichens and forest ecology in the Carpathian range of Norway spruce. They can be useful in understanding biodiversity's response to increasing disturbances in forests caused by the mass appearance of the spruce bark beetle and the increased frequency of weather anomalies accompanied by severe wind. These results show that the protection of the consequences of such spontaneous processes in forests allows the formation of a typical epixylic biota of spruce lichens, as well as preserving

numerous epiphytic lichens that are able to survive for a long time on post-disaster surfaces thanks to the possibility of facultative colonization of rotting wood.

.....

Data złożenia pracy

.....

Podpis autora