ABSTRACT

The doctoral thesis addresses the issue of the dependence of quality parameters of flax fibers intended for clothing products, which could have a beneficial effect on human skin due to the content of active substances, on the climatic conditions prevailing during the flax vegetation period, especially extreme weather conditions causing drought. The aim of the doctoral thesis was to solve the scientific problem of identifying and determining the influence of drought stress occurring during plant growth on the quality and antioxidant activity of flax fiber. Key research to achieve the aim of the thesis included exploring differences in quality parameters of fibers depending on the soil moisture level in which flax was cultivated and flax variety, as well as studying the chemical structure of the fiber in terms of phenolic acid content and fiber crystalline structure.

The interdisciplinary nature of the work combines knowledge and methods appropriate for materials engineering and agricultural sciences, which allowed for the examination of the influence of external factors during plant growth on fiber, precisely defining the origin of the natural research material. Prior to this work, no research had been conducted to analyze the content of phenolic acids in flax fiber depending on drought stress during plant growth. The empirical nature of the doctoral thesis involved planning and conducting a three-year pot experiment in a plant growth facility, which enabled the acquisition of fiber as a research material for further analysis to verify hypotheses and understand the mechanism of how water deficit in the substrate during flax growth affects fiber quality. The work required a carefully designed experiment to identify dependent variables, such as quality parameters and phenolic acid content in the fiber, and independent variables, including flax variety and the assigned soil moisture level. Additionally, factors that could influence the parameters of the research material, such as air temperature and precipitation during flax straw retting, were analyzed.

The first chapter was devoted to the analysis of available literature to approximate and explain the existing theoretical knowledge regarding the issues addressed in the work. The chapter includes issues related to the characteristics of the flax species providing textile fiber and aspects of plant resistance to drought. The

presented literature data were used to plan the experiment. Next, the characteristic features of flax fibers were discussed along with a description of their chemical composition and health properties.

The second chapter presents the research objectives and hypotheses of the doctoral thesis.

The third chapter contains a description of the experimental part of the work, presenting in detail the conducted experiment along with the characterization of the selected fiber flax varieties (Artemida, Modran, Sara) and the research methodology based on standards or procedures.

The fourth chapter contains the analysis of the research results, which allowed for the verification of specific hypotheses and the main hypothesis of this work. Drought during the growth of flax plants significantly influences both the quality of fibers and the content of active substances. This is particularly important considering the complexity of nature and the difficulty in predicting plant reactions to weather changes.

The fifth and sixth chapters summarize the results of the conducted research within the thesis and formulate appropriate conclusions. The research results confirmed the validity of the main hypothesis stating that water deficit in the soil during the flax growth period affects the quality of flax fibers and the content of active substances in the fiber.

The seventh chapter presents the bibliography of sources used in the preparation of the doctoral thesis. Then, a list of tables, illustrations, and an appendix containing microscopic images of cross-sections and longitudinal views of fibers are included.

The doctoral thesis allowed for describing new insights into the properties of flax fibers by identifying and examining the influence of drought stress occurring during plant growth on the quality parameters and bioactivity of natural textile fibers.