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The changes of wood structure in deformed Scots pine trees

ANETA MICHALSKA[1], MARCIN KLISZ[2]

[1]Departament of Forest Botany, Warsaw University of Life Sciences, Nowoursynowska 159 St. 02-776, Poland
[2]Forest Research Institute, Department of Silviculture and Genetics, 3 Braci Leśnej Street, Sekocin Stary, 05-090 Raszyn, Poland

Abstract: *The changes of wood structure in deformed Scots pine trees*. In the Lubsko Forest District, a group of deformed pines (*Pinus sylvestris* L.) on 3,37 hectares area of the forest stand was found. The trees are 83 years old and there are supposed to deformed by activity of man. This paper covers the stem wood structure of deformed pines. The wood samples were collected from four deformed trees from different parts of stem. Tree-ring analysis of the deformed part of stem revealed that tree rings from compression wood was greater than that of opposite wood side. The compression wood started from after year 1945 until 2007. The reaction wood occurred on lower or upper part of the stem depending upon position within deformed part of the stem.

Keywords: Pinus sylvestris, Lubsko, deformed pines, compression wood, coniferous wood

INTRODUCTION

In the Lubsko Forest District area (3,37ha) 83 years old deformed pine (*Pinus sylvestris* L.) stand by the local people called "dancing trees". The butt-end of the trunk show a crooked bend. Continue to grow longer straight up like a normal tree. Crooked trees do not grow alone, nor are scattered throughout the complex. Giving form to extract a compact surface, highlighted in the plan of forest management as a separate subunit [2].
In Poland there were known cases of forest tree breeding crooked for useful, for example, to build a large vat, for the construction of fishing boats, farm equipment and furniture [3]. Previous research in the field explain the genesis of the described deformation carried out at the Lower Silesian Coniferous Forests (western Poland), indicating that the curvature resulting from mechanical damage to the main shoot, which took over the role of lateral branches. The probable cause of deformation of the shots is believed to be in war and the stationing of troops in the Lower Silesian Coniferous Forests in 1945, forcing over Neisse Army by the II Polish Army [4]. Is not excluded that a deformation in the pines in Lubsko formed in a similar or the same way.
The purpose of this study was to examine the structure of wood in the deformed tree trunks of varying shapes in the Lubsko District, where previously there was no specific research in this area.

MATERIAL AND METHODS

The study was performed in the Brody, Lubsko District of the 358d division. The samples were collected from four 83 years old pine trees (*Pinus sylvestris*), which then differed deformed shape. Trees were selected on the basis of morphology. Before harvest at each
of the trees set the direction of the north, and set the direction of bending trees. After felling, using measuring tape, the measurements were made fixing the amount of whole tree and crown. Were also carried out measurements of breast height diameter (1,3m) of all trees with

circumeter. The next step was collected five centimeters wood samples from eight part of trunk (Fig.1).

Fig. 1.Tree number 1. Places of wood samples were collected from trunk (photo by M. Majewski)

Each of the wood samples generated on the bottom side is indicated in the description contains the number of trees, the letter indicating the amount of which height was taken, and the line designating the direction of north. Then each of the 32 samples were prepared to stem analysis. The upper side has been polished. Counting the tree rings and their width measurements were carried out at the Laboratory of the Sub-Department of Dendrometry and Forest Productivity in Warsaw University of Life Sciences. Is performed using the program's incremental SGM “Biotronic”.

STEM ANALYSIS

After stem analysis of all four trees, obtained data were compiled using the Excel, which included a presentation of the figures in the form of graphs. The results of this study have been published previously [10].

ANATOMICAL STRUCTURE

Pieces of wood cross-sections of Scots pine, were smoothed with fine sandpaper. The next step was cooking the samples in water with glycerol for a period of about 3 hours (every 25-30 minutes cooking was interrupted quenching in cold water). This treatment was aimed at venting wood, as well as protection against invasion by fungi and germs. These preparations were divided into smaller pieces and placed in a mixture of water, glycerol and 96% alcohol. Then slices were cutting by blade installed in microtome. The result was to obtain sections with a thickness of about 30 micrometers from the cross section [9]. These slices are made of tree ring formed every 10 years (i.e. 2005, 1995, 1985, ..., to 1925).

Sections were placed on slides in a drop of glycerin, and the whole covered with a cover glass. Preparations were made of observations, descriptions, and selected fragments were photographed. Analyses were made using a fluorescence microscope Olympus BX61, coupled with a digital camera. Participation in the annual late-wood rings was determined using the "Cell P" software. Using the tools of the program, measured the general length

of the annual ring and four with of compression wood of occurring in examined ring. After calculating the average length of compression wood, determined the percentage of the annual ring.

RESULTS

In coniferous occurs reaction wood, asymmetrically arranged, which is referred to as compression wood. It is easy to recognize, in fact characterized by a darker staining (reddish), especially when wet. During puberty or at the last stage of maturation tends to longitudinal expansion, whereas normal wood behaves differently and has essentially then tend to shrink. Because of its asymmetric position counteracts the forces changing the normal position of the stem and restores proper distribution of the species to shoot, if it becomes impaired [6, 7, 11, 12].

The sloping main trunk is formed on the bottom and causes the bending of the trunk up and to restore its normal vertical orientation. In the side branches, which by its own weight fall downwards, is formed on the bottom of it and compensates for fall. Compression wood tracheids differs from normal wood. The walls are thicker than the tracheids of earlywood and latewood, but where the compression wood, earlywood replaced, the walls are not as thick as in normal latewood. Compression wood tracheids on the cross-section are more or less circular. Therefore, there are between intercellular spaces are filled highly hydrated mucus. After drying remain filled with air [1, 5, 8, 12].

CONCLUSIONS

Stem analysis showed that annual rings in the section containing compression wood are wider than opposite wood side. In the initial period of development of deformed trees, defined

in the text as a tree of semi-circular, the width of annual rings on the side of compression and opposite wood side from the height of the bottom of trunk show a similar course. Width further increases the compression wood side show an upward trend, while in normal wood are clearly smaller. Annual increments of wood with diameter at 1,3m height at the beginning of life on both sides of trunk are similar. Further width of annual rings of wood on the side of compression are clearly higher than the opposite wood side.

Cross sections microscopy observation of compression wood side, showed a large presence of reaction wood cells, especially in the zone of latewood and less earlywood (wood formed early in a ring has normal structure). Observations showed that the compression wood cell walls are thicker than the tracheids of earlywood and latewood, but where the compression wood, earlywood replaced, the walls are not as thick as in normal latewood. The observations, showed reaction wood had more frequent anticlinal divisions (Fig.2). These divisions occur in the cambium and reduced length of the compression wood tracheids. Wood rays and resin canal in compression wood does not show major changes. On the opposite side to compression wood observed a narrower annual rings, containing only a single cells of compression wood.

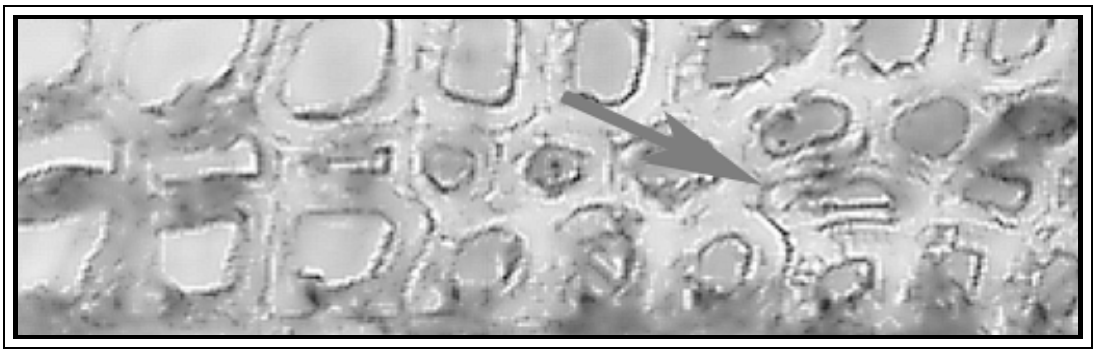

Fig.2. Compression wood tracheids in Scots pine at the cross section (arrow indicated the place of anticlinal division of cambium) (photo by A. Michalska)

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Streszczenie: *Zmiany anatomiczne drewna pni zdeformowanych drzew sosny zwyczajnej*. W województwie lubuskim, w Nadleśnictwie Lubsko, znajduje się drzewostan osobliwie zdeformowanych sosen (*Pinus sylvestris* L.) nazywany przez miejscową ludność „tańczącym lasem". W odziomkowej części pnia wykazują łukowate wygięcia. Dalej rosną już prosto w górę jak normalne drzewa. Celem niniejszej pracy była próba zbadania struktury anatomicznej drewna w zdeformowanych pniach 83-letnich drzew o zróżnicowanych kształtach na terenie Nadleśnictwa Lubsko, gdzie dotychczas nie przeprowadzono szczegółowych badań w tym zakresie.

Corresponding author:

Aneta Michalska
Departament of Forest Botany,
Warsaw University of Life Sciences,
Nowoursynowska 159 St., 02-776, Poland
E-mail address: Aneta.Michalska@wl.sggw.pl