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# THE INFLUENCE OF OAK RAW TIMBER DEFECTS ON DECORATIVE VENEER CUTTING

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***Abstract:*** *In this paper, specific notions regarding wood defects and quality conditions imposed on raw materials for veneer cutting are described. The case study focuses on identifying and analyzing defects on oak veneer for four regions: Târgovişte, Roşiori, Reşca and Băbeni. Based on this data, Pareto diagrams corresponding to each region were devised. These analyses allow making not only a hierarchy of the main defects but also decisions for improving the quality of the studied products.*

***Key words:*** *oak veneer, Pareto diagram, quality defects, decorative veneer.*

## 1. Introduction

Differences in structure and chemical composition in the same tree, between trees and between forest resorts are found in wood and fiber structure, very different, and the performance characteristics of the product.

When analyzing the relationship between wood properties and product performance it must be taken into account the specific destination of wood as raw material [4].

Wood is an anisotropic material with physical and mechanical properties which are very different from species to species and as biological material it presents a hierarchical structure at the nano, micro and macroscopic levels. Therefore, for effective measurement, a series of characteristics in various stages must be taken into account: trees, stem, wood, fiber, chemical composition of the fibers etc. Variability of different properties and relations between variables must be well known [5].

## 2. Quality Conditions Imposed to Raw Material for Cutting Veneers

In forestry and especially for the exploration and exploitation of wood, wood quality represents all the characteristics that give wood its ability to meet user needs.

Defects and abnormalities in tree growth, in structure, aspect and chemical composition of wood, which represent deviations from the normal, act in most cases as an impairment factor for the physical and mechanical characteristics.

Invariably present in all species of wood, defects are a basic factor for the sorting and classification of various types of quality wood [3].

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Wood defects can be classified as follows:

- Structure defects;
- Shape defects;
- Chromatic indicators;
- Defects of destruction;
- Specific defects for wood utilization;
- Defects of injury.

Wood structure defects are deviations from its normal structure. As structural defects, we can mention: fiber deviations, irregularity of annual rings, eccentricity, "hearts overgrown", "lunura".

Wood fibers are normally straight and parallel to the longitudinal axis of the trunk, branches and roots. As a result of deviations from this structure, it may encounter deviations of fibers. In the case of the oak trunk we encounter the twilled fiber, namely fibers with helical deviation around the longitudinal axis of round wood that remain parallel to each other.

The cutting of round wood timber with twilled fiber results in pieces with rough sides which are hard worked, especially in point of finishing drying being slightly deformed with a tendency to crack and cut fibers. Veneers show similar deficiencies, and with low value. By cleavage process are obtained more or less spiral surfaces.

Color is considered by users an essential quality parameter to determine the commercial value of the tree wood, especially when cumulated with the shape and dimensions considered when wood is used to obtain the veneer, but also for many other products.

The quality of oak veneer obtained by cutting a flat surface is evaluated by examining the appearance of veneer surface. Two elements are crucial: the color and design. The design resulting from filing successive annual rings in their areas of early wood, formed by vessels more or less large areas of wood and fiber later. The presence of rays also contributes to drawing. The design may vary according to cutting mode.

Abnormal colorations of wood are a type of defects consisting of the existence, on the surface and therein, of portions that differ in color from the healthy wood of the species considered without visible signs of decomposition. They are usually caused by fungi and bacteria that eat the sap of wood and the parenchyma cell content.

Fungi and bacteria can be associated with physiological causes (wood cell response to the attack of microorganisms and environmental factors' negative action), or chemical nature (especially oxidation). Since the cell walls remain intact, the physical and mechanical properties of wood do not change significantly.

An important category of wood defects is caused by biotic destruction (bacteria, fungi, parasitic plants, insects, marine pests) by which the structure is seriously affected, and by chemical composition and integrity. Wood may be affected by various forms of wood destroying factors both in standing trees and in the felled ones, whether it is raw or processed, used in construction or used for the production in various object.

Nodes are part of the branches of trees and are embedded in the wood due to the increase in trunk thickness. Their presence is dependent upon the branches and they are inevitable defects of wood.

Nodes in round wood can be classified according to the degree of adhesion to the surrounding wood, size, position, degree of health, coloration. Nodes' distribution across the tree is influenced by wood species and growing conditions.

Injuries are lesions of trees consisting of destruction of tissues and anatomical dislocation of elements and formations of their normal connections. The main defects of injury are: scars, bark, dead wood, cancer, wounds of pruning and burning of the bark.

## 3. Pareto Diagram

A Pareto Chart is a good tool to use when the process that we are investigating produces data that are broken down into categories and we can count the number of times/defects occurring in each category [1], [2], [5]. A Pareto diagram puts data in a hierarchical order which allows the most significant problems to be corrected first. The Pareto analysis technique is used primarily to identify and evaluate nonconformities, although it can summarize all types of data [6]. A Pareto Chart can help in focusing our efforts on achieving the greatest improvements. It is perhaps the diagram which is most often used in management presentations [7], [9].

## 4. Case Studies Regarding Defects' Analysis for Decorative Oak Veneer

The case study is based on the analysis of defects for oaks in four regions. Six categories of defects were identified: buds (m), "picoti" (p), curvature (c), insect holes (g), conicity (con), sprawl (l) and Pareto diagrams corresponding to each region were devised.

In Tables 1-4 are presented the categories of data that were studied for specific regions.

In Figures 1-4 are illustrated the cumulative relative frequency distributions specific to the four regions.

## 5. Conclusions

Analyzing the diagrams:

- In Figure 1 we can see that 54% are caused by the first two defects: buds and "picot".

- In Figure 2 we can see that 72% are caused by the first two defects: buds and "picot".

- In Figure 3 we can see that 71% are caused by the first two defects: buds and curvature.

- In Figure 4 we can see that 69% are caused by the first two defects: buds and curvature.

Taking into account that it is easier to reduce a high frequency than a low, charts indicate that for improvement it would be more useful to focus on primary causes - and less important than the secondary - many and significant.

The most important shape defects of the trunk are the curvature, conicity, sprawl and ovality. The curvature is the axial growing defect and the others are radial growing defects.

After we implement appropriate measures to eliminate these two cases, it another chart can be made to check the decrease in the number of defects [8].

Apart from the study of defects, an extremely important role in determining wood quality might be held by some data, determined by means of laboratory tests on the properties (physical, mechanical, technological). It could also be of interest to discover various macroscopic and microscopic characteristics, which would allow a better estimation of quality in the future.

A Pareto chart offers the following benefits:

- Solves problems effectively by identifying and prioritizing the main causes in the order their importance;
- Establishes the priority of many practical applications, such as efforts to improve the process, the needs of customers, suppliers, investment opportunities;
- It helps the team focus on the problems or causes of problems that have the greatest impact;
- It displays the relative significance of problems or problem's causes in a simple, quick-to-interpret, visual format;
- Shows on which path efforts should be directed;
- Improves the use of limited resources.

*Categories of data for Târgovişte region* Table 1

| Defects | Absolute frequency | Relative frequency | Cumulative relative frequency [%] |
|---|---|---|---|
| Buds (m) | 30 | 0.31578947 | 32 |
| "Picoti" (p) | 21 | 0.22105263 | 54 |
| Curvature (c) | 19 | 0.2 | 74 |
| Insect holes (g) | 14 | 0.14736842 | 88 |
| Conicity (con) | 8 | 0.08421053 | 97 |
| Sprawl (l) | 3 | 0.03157895 | 100 |

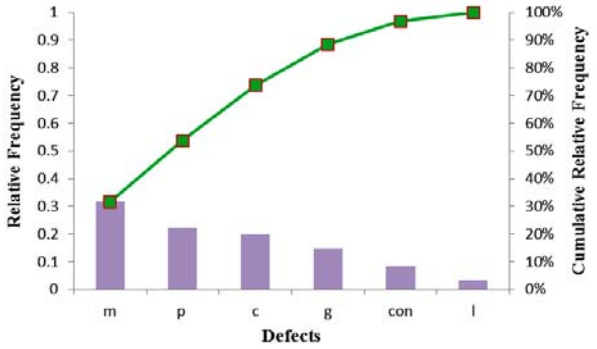


Fig. 1. *Pareto diagram for oak specific defects from Târgovişte region*

*Categories of data for Roşiori region* Table 2

| Defects | Absolute frequency | Relative frequency | Cumulative relative frequency [%] |
|---|---|---|---|
| Buds (m) | 5 | 0.35714286 | 36 |
| "Picoti" (p) | 5 | 0.35714286 | 71 |
| Curvature (c) | 3 | 0.21428571 | 93 |
| Conicity (con) | 1 | 0.07142857 | 100 |
| Sprawl (l) | 0 | 0 | 100 |
| Insect holes (g) | 0 | 0 | 100 |

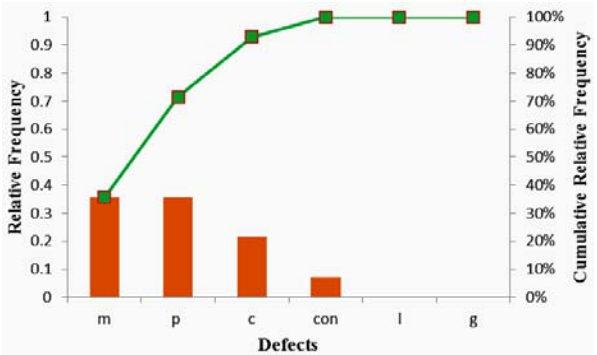


Fig. 2. *Pareto diagram for oak specific defects from Roşiori region*

*Categories of data for Reşca region* Table 3

| Defects | Absolute frequency | Relative frequency | Cumulative relative frequency [%] |
|---|---|---|---|
| Buds (m) | 14 | 0.5 | 50 |
| Curvature (c) | 6 | 0.21428571 | 71 |
| Insect holes (g) | 6 | 0.21428571 | 93 |
| "Picoti" (p) | 2 | 0.07142857 | 100 |
| Conicity (con) | 0 | 0 | 100 |
| Sprawl (l) | 0 | 0 | 100 |

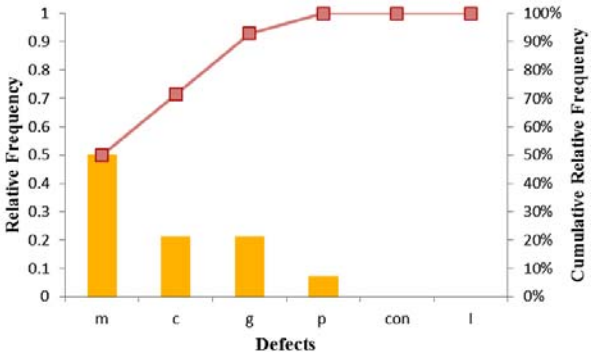


Fig. 3. *Pareto diagram for oak specific defects from Reşca region*

*Categories of data for Băbeni region* Table 4

| Defects | Absolute frequency | Relative frequency | Cumulative relative frequency [%] |
|---|---|---|---|
| Buds (m) | 12 | 0.4137931 | 41 |
| Curvature (c) | 8 | 0.27586207 | 69 |
| "Picoti" (p) | 4 | 0.13793103 | 83 |
| Conicity (con) | 2 | 0.06896552 | 90 |
| Insect holes (g) | 2 | 0.06896552 | 97 |
| Sprawl (l) | 1 | 0.03448276 | 100 |

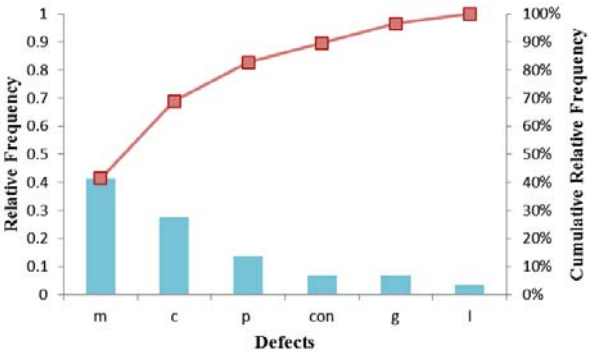


Fig. 4. *Pareto diagram for oak specific defects from Băbeni region*

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