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&

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editors

THE 5TH CONFERENCE ON HARDWOOD RESEARCH AND UTILISATION IN EUROPE 2012

UNIVERSITAS HUNGARIAE OCCIDENTALIS
UNIVERSITY PRESS
ANNO 1735
UNIVERSITY OF WEST HUNGARY PRESS

Proceedings of the „Hardwood Science and Technology" - The 5th Conference on Hardwood Research and Utilisation in Europe. Sopron, Hungary, 10-11 September 2012

Printing: Lővér-Print Nyomdaipari Kft., Sopron, Hungary
Technical editors: Péter Szeles & Róbert Németh

The manuscripts have been peer-reviewed by the editors and have not been subjected to linguistic revision.

ISBN 978-963-9883-97-0

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SESSION I STRUCTURE & PROPERTIES

Properties of trunk and briarwood of tree heath (*Erica arborea* L.) from island Rab

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Key words: Tree heath (*Erica arborea* L.), briarwood, trunk, physical properties, mechanical properties

ABSTRACT

Tree heath *(Erica arborea* L.) is an evergreen shrub that grows mainly in Mediterranean region. This species tends to grow in areas such as macchia shrub lands, dry evergreen scrublands, forest roadsides and forest outskirts which have a lot of light and sun though daytime. Tree heath is not a commercial timber species, it occurs as a result of forest roads and forest fireroads construction. This wood species is interesting because of its briarwood. Briarwood is tumour like outgrow that develops between root and trunk and it's commonly used in making bowls of tobacco smoking pipes and knife handles. The trunk can also be used for variety of products because of its relatively good mechanical properties and nice colour and texture. Material for this study was taken from tree heath (*Erica arborea* L.) shrubs growing on island of Rab in Croatia. In this study density and dimensional stability of briarwood and trunk of tree heath were investigated. Also some mechanical properties of trunk such as bending strength and compression strength parallel to the grain were studied.

AIM OF RESEARCH

Knowing technological characteristics of wood is important postulate for rational usage of wood recourses. It is important to define anatomical, chemical, physical and mechanical properties of some wood species to determine its technological characteristics.

The aim of this research was to define some physical and mechanical properties of tree heath (*Erica arborea* L.) for further and more complete determination of its technological characteristics. Two different

parts of tree heath were studied. One was the trunk and the other was its root also known as briarwood. Briarwood was studied for its physical properties; density in absolutely dry condition, nominal density, and total volume shrinkage. Only total volume shrinkage was studied because briarwood has specific and complex structure and it is impossible to determent direction of grain on specimens. Trunk was studied for some of its physical and mechanical properties. The following physical properties of trunk were studied: density in absolutely dry condition, nominal density, total radial, tangential and volume shrinkage. Mechanical properties that were studied are ultimate compression strength parallel to the grain and ultimate bending strength.

MATERIAL AND METHODS OF RESEARCH

The tree heath (*Erica arborea* L.) is a shrub or small evergreen tree (Hirc, 1891) that grows mainly in Mediterranean region. These are particularly difficult conditions for most plants to grow in as the soil in the mountainous clime is often dry and rocky, but the hearty briar roots can work their way through the tiniest crevices or slowly break apart rock to reach the rare soil. It has a typical height of 1 to 4meters, with some specimens reaching even 7 meters. This species tends to grow in areas such as macchia shrub lands, dry evergreen scrublands, forest roadsides and forest outskirts which have a lot of light and sun though daytime. It occurs as a result of forest roads and forest fire roads construction. The tree heath grows bright green needle-like leaves and each spring its greyish-white flowers bloom (Marčić, 1918), producing a delightful honey scent. Between the acidic and rocky soil it grows in and the long summer droughts it endures, this small trees root develops outgrow that is called briarwood.

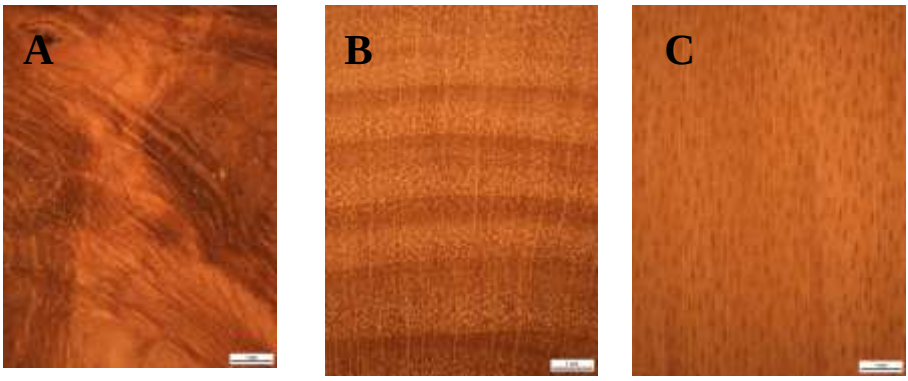

Figure 1 Macroscopic preview of briarwood and trunk wood: A – Briarwood, B – Trunk wood cross section, C – Trunk wood tangential section

Briarwood (Tsoumis, 1988) is tumor like outgrow that develops between root and trunk and its commonly used in making bowls of tobacco smoking pipes, knife handles and it was used by blacksmiths for large wood heating power (Lasman, 1906). The use of briar as an ideal material to make bowls of pipes dates back to at least the 1850s. The bush must be at least 50 years old for the briar to grow to the necessary size, about the size of a football, weighing around 3 kg. Briarwood is a material that never alters. It is extremely hard and heat-resistant and in addition has a lovely grain that can give a sense of flames and never repeats itself. Each piece is unique.

The trunk of tree heath can also be used for variety of products because of its relatively good mechanical properties and interesting esthetic properties such as nice colour and texture.

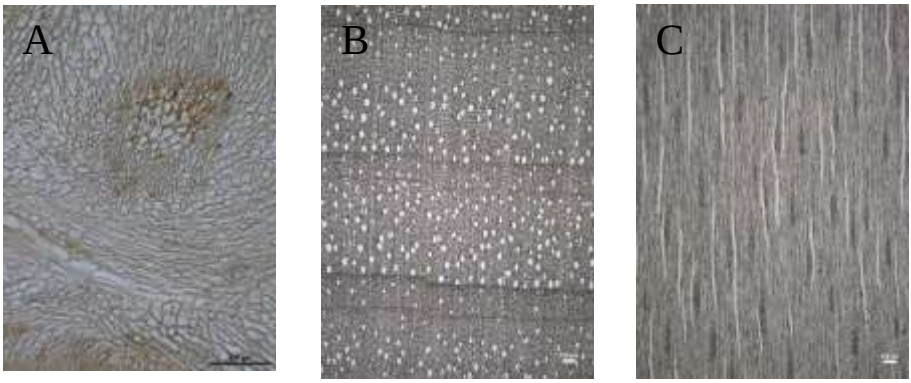

Figure 2 Photomicrographs of briarwood and trunk wood: A – Briarwood (20×), B – Trunk wood cross section (4×) and C – Trunk wood tangential section (4×)

On Figure 1 macroscopic preview of briarwood and trunk is presented. Figure 2 presents photomicrographs of briarwood and trunk wood. On both figures the difference in normal structure of trunk wood in comparison to the irregular structure of briarwood is shown.

Material for this study was taken from three tree heath (*Erica arborea* L.) shrubs growing on island of Rab in Croatia. These shrubs were 20 to 30 years old and (horizontal) diameter of the tumors was about 30 to 50 cm. Total height of shrubs was about 5 to 6 meters. The shrubs were sampled for trunk and tumor as it’s shown in Figure 3 and specimens were prepared to study test or examine the physical and mechanical properties.

Figure 3 Briarwood and trunk wood (Erica arborea L.)

Physical properties of trunk and tumor were determined on sharp-edged samples dimensions 20×20×25 mm (R×T×L). Samples were then soaked in water during the period in which they exceeded water content higher then fiber saturation point. After attaining wanted water content, the samples were dried on temperature of 103±2ºC until they reached constant mass. As well, after attaining absolutely dry condition measurements were again completed and data were processed, all according to valid norms.

Ultimate compression strength parallel to the grain was determined on sharp-edged samples of trunk with dimensions 20×20×40 mm (R×T×L) according to the standard HRN ISO 3787:1999, and ultimate bending strength on samples with dimensions 20×20×300 mm (R×T×L) according to the standard HRN ISO 3133:1999.

RESULTS OF RESEARCH

Physical properties

Table 1 Statistical values of density in absolutely dry condition, nominal density and total, radial, tangential and volume shrinkage of tree heath trunk wood and briarwood.

Tree heath (trunk wood)						Tree heath (briarwood)		
ρ_0	ρ_y	β_{rmax}	β_{tmax}	β_{vmax}		β_{vmax}	ρ_y	ρ_0
g/cm^3	g/cm^3	%	%	%		%	g/cm^3	g/cm^3
21	21	21	21	21	N	137	137	136
0,743	0,627	4,4	6,0	12,4	MIN	10,4	0,573	0,698
0,770	0,648	6,2	10,0	15,9	AVE	20,5	0,666	0,833
0,803	0,673	9,9	13,1	17,8	MAX	92,4	0,732	0,973
0,0191	0,0149	1,6109	1,9939	1,2384	SD	7,2126	0,0370	0,0482
0,0004	0,0002	2,595	3,975	1,534	VAR	52,021	0,0014	0,0023

Key: ρ_o - density in absolutely dry condition, ρ_y – nominal density, $\beta_{r\ max}$ - total radial shrinkage, $\beta_{t\ max}$ - total tangential shrinkage and $\beta_{v\ max}$ - total volume shrinkage

According to Table 1 mean values of researched physical properties of trunk wood are smaller in all segments then the ones of briarwood. Mean value of density in absolutely dry condition of briarwood is higher by 7,6 % then the same value of density in absolutely dry condition of trunk wood. Mean value of nominal density of briarwood is only by 2,7 % higher than the same value of trunk wood. Mean values of total volumetric shrinkage of briarwood is higher by 22,4 % then mean value of trunk wood.

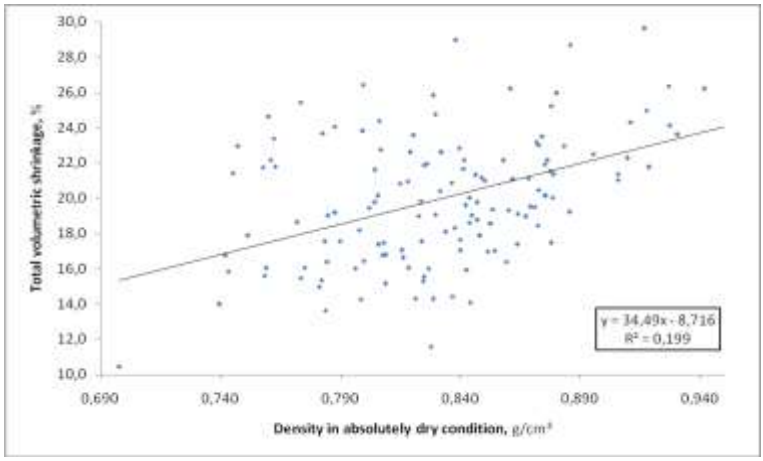

Figure 4 Relation between total volumetric shrinkage and density in absolutely dry condition of briarwood

Figure 4 shows growth trend of total volumetric shrinkage in relation to the density in absolutely dry condition of briarwood. The same growth trend occurs at trunk wood (Figure 5) only with smaller correlation coefficient.

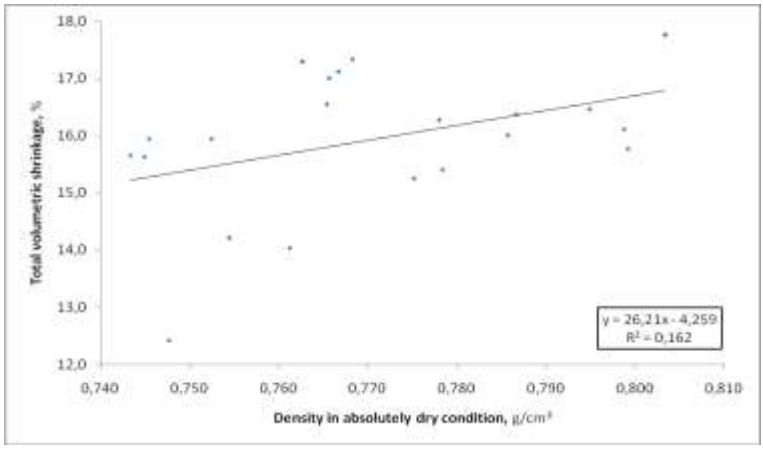

Figure 5 Relation between total volumetric shrinkage and density in absolutely dry condition of trunk wood

Mechanical properties

Table 2 Statistical values of density at 12% water content, ultimate bending strength at 12% water content, ultimate compression strength parallel to the grain at 12% water content of tree heath trunk wood.

Tree heath (trunk wood)				
$\sigma_{b12\%}$	$\rho_{12\%}$		$\rho_{12\%}$	$\sigma_{c12\%}$
MPa	g/cm^3		g/cm^3	MPa
12	12	N	7	7
18,8	0,863	MIN	0,864	54,9
49,1	0,920	AVE	0,951	58,9
110,2	1,004	MAX	1,002	61,8
29,304	0,0405	SD	0,0525	2,910
167,972	0,0010	VAR	0,0028	8,466

Key: $\rho_{12\%}$ - density at 12% water content, $\sigma_{b12\%}$ – ultimate bending strength at 12% water content, $\sigma_{b12\%}$ – ultimate compression strength parallel to the grain at 12% water content

According to Table 2 mean value of ultimate bending strength at 12% water content of trunk wood is 49,1 MPa. Mean value of ultimate

compression strength parallel to the grain at 12% water content of trunk wood is 58,9 MPa.

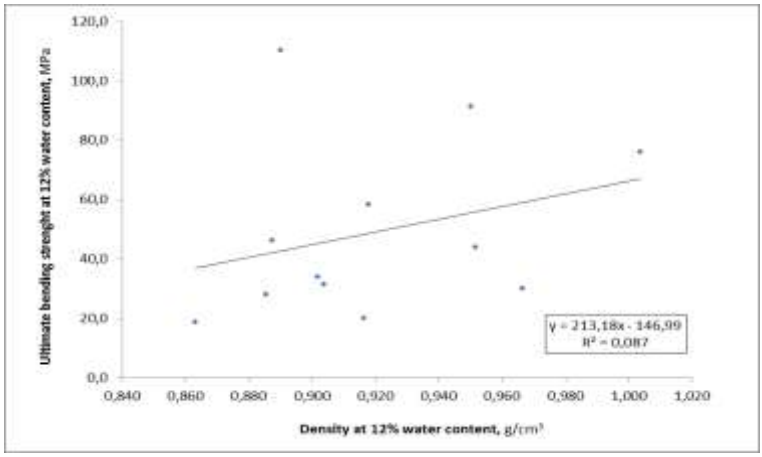

Figure 6 Relation between ultimate bending strength at 12% water content and density at 12% water content of trunk wood

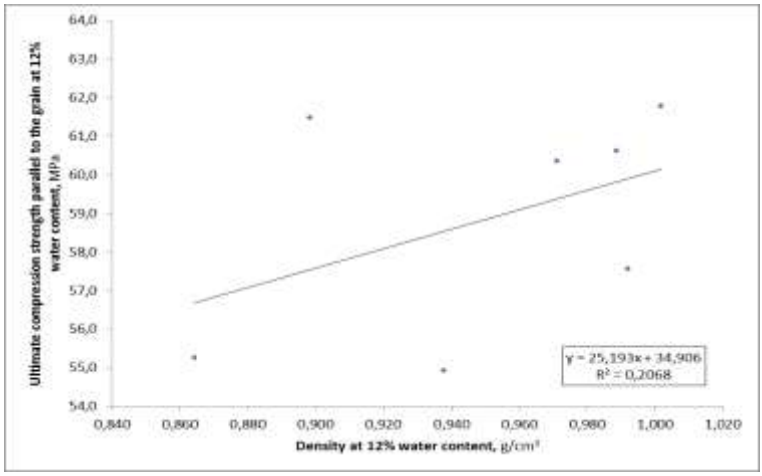

Figure 7 Relation between ultimate compression strength parallel to the grain at 12% water content and density at 12% water content of trunk wood

Figure 6 shows that ultimate bending strength at 12% water content has a growth trend with the increase in density at 12% water content of trunk wood. Figure 7 shows that ultimate compression strength parallel to the

grain at 12% water content also has growth trend with the increase in density at 12% water content.

CONCLUSIONS

Conducted study, measuring of samples and analysis of data that have been made on trunk of tree heath (*Erica arborea* L.) resulted in mean value of density in absolutely dry condition is 0,770 g/cm^3, and mean value of nominal density is 0,648 g/cm^3. Mean value of total radial shrinkage is 6,2 %, total tangential shrinkage is 10,0 %, and mean value of total volume shrinkage is 15,9 %. Mean value of ultimate compression strength parallel to the grain at 12% water content is 58,9 MPa and mean value of ultimate bending strength at 12% water content is 49,1 MPa. Mean value of density in absolutely dry condition of briarwood is 0,833 g/cm^3, and mean value of nominal density is 0,666 g/cm^3. Studied briarwood has mean value of total volume shrinkage of 15,9 %.

REFERENCES

1. Hirc, D., 1891: Pogled u floru hrvatskoga Primorja s osobitim obzirom na šumsko drveće i grmlje. Šumarski list 15 (3) 107-118.

2. HRN ISO 3787:1999 Određivanje čvrstoće na tlak paralelno s vlakancima.

3. HRN ISO 3133:1999 Određivanje statičke čvrstoće na savijanje.

4. Lasman, D., 1906: Šumarenje na otoku Rabu. Šumarski list 30 (4) 138-163.

5. Marčić, M., 1918: Sredozemna flora u drvoredima i parkovima na istočnim obalama Jadrana. Šumarski list 62 (5) 129-137.

6. Tsoumis, G., Kezos, N., Fanariotou, I., Voulgaridis, E. and Passialis, C., 1988: Characteristics of Briarwood. Holzforschung 42 (1988) 71-77.