

BLACK ELDER WOOD FOR THE SLOVAK FOLK WIND MUSICAL INSTRUMENTS MAKING

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Abstract: Black Elder wood is traditionally used for the folk wind musical instruments made in Slovakia. The big and soft pith which helps within the technology of a longitudinal drilling is typical for this wood. It also characterized by its structure and other characteristics. This paper deals with a measurement of elastic characteristics (density – ρ , acoustic constant – A , sound velocity – c and modulus of elasticity – E) of the Black Elder wood. The elastic characteristics were obtained by using of system called REZONÁTOR. From the view of physical acoustic the results from our experimental measurements have indicated that the black elder as a shrub shown to be appropriate as a hard wood, which are required for the production of wind musical instruments.

1 Slovak folk wind musical instruments

It can be said that there are the most specific and the largest group of Slovak folk musical instruments. It consists 103 types what composes 51% of our folk instruments [3].

Basic method at the production and improvement of musical instruments was empirism which came from natural music talent, experiences and from style. This work was very systematic but the main criterion was not inner physically-acoustic substance but final tone effect, external presentation and appearance side of problem [5].

This production is only in parts and on individual demand. By its organization and specialization it did not transform into large-scale production.

Wind instruments play a key role in the musical activity of Slovak instrumentalists what means that they create substantial part of Slovak folk instrumental music and they highly profile technologically-production and art activity of Slovak instrumentally-production basis [3].

Wood of black elder is in the production of aerophonic musical instrument used mainly for the production of whistle tubes. There are the following musical instruments in the original Slovak version:

- flautička
- kosáčik – koncovka
- fujara
- pastierska píšťalka
- jarmočná píšťalka
- detská jarmočná píšťalka
- kosáčik na šesť dierok
- dvojačka
- koncovka
- drček

Further important application of Black Elder is in the production of single plated reeds of „piskory“, which are parts of tone producing equipment of bagpipes.

Black Elder, presented in Figure 1., grows mainly as a bush, rarely as a small tree (sometimes more then 8 m). We can find this wood species almost in all European countries.

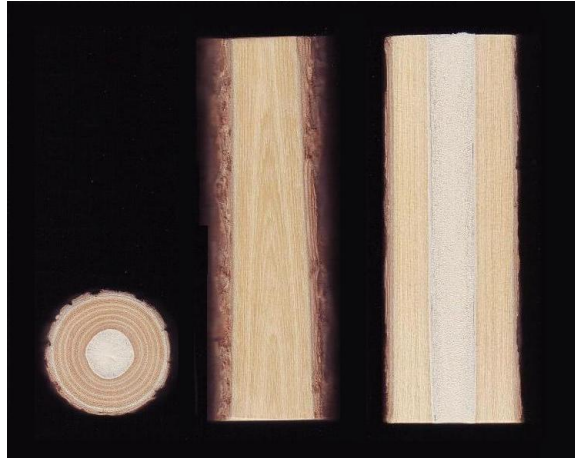


Figure 1. Black Elder wood presented in three basic sections

2 Experiments

For the measurement of Black Elder elastic characteristics we have chosen non-destructive resonant method by using REZONATOR equipment (Figure 2.). We have measured 15 samples of black elder from Slovak localities. Average value of 8% absolute moisture content was assessed by gravimetry. Stick shaped sample was fixed in the middle of the length and then were measured.

By the application of acoustic convertor is sample activated by the signal with sinusoidal mode and with variable frequency what causes its oscillation. On the other side of a sample there are monitored oscillation aberrances by the special sensor. It is reached dependency between aberrance and frequency. Measured data describe value of resonant frequency (f_r) based on which there can be calculated other important characteristics of material [4].

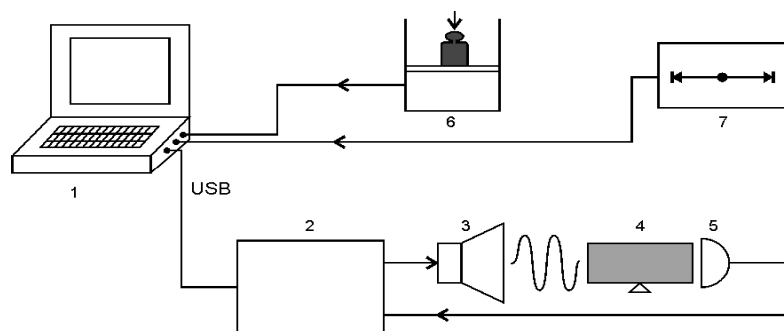


Figure 2. Basic scheme of system called REZONATOR

Wood as a material in the musical instruments production has to satisfy some technical and aesthetical parameters. Our experiments showed the most important characteristics of wood are: density – ρ , Young’s modulus of elasticity – E_L , acoustical constant – A [1], sound velocity – c . These characteristics are called physical and acoustical characteristics [2], or elastic characteristics.

3 Results

In the Table 1. there are presented basic results reached at the measurement of given samples by resonant dynamic method under conditions of absolute moisture content $w_a = 8 \%$ Based on these results there were statistically evaluated average values given in Table 2.

Table 1. Final results reached by resonant dynamic method for particular samples: ρ – wood density, f_r – resonant frequency, A – acoustic constant, c – sound velocity, E_L – longitudinal Young modulus of elasticity

Sample	ρ [kg/m ³]	f_r [Hz]	A [m ⁴ /kg.s]	E_L [GPa]	c [m/s]
BČ 01	646,03	3406	7,24	14,13	4676,44
BČ 02	643,47	3704	6,92	12,74	4450,36
BČ 03	616,11	2908	6,41	9,62	3950,52
BČ 04	682,48	2974	6,03	11,57	4117,50
BČ 05	631,11	3458	7,39	13,72	4663,11
BČ 06	607,48	3071	6,45	9,32	3917,06
BČ 07	653,47	3470	6,80	12,91	4445,07
BČ 08	620,62	2877	6,52	10,15	4045,06
BČ 09	668,96	2930	5,96	10,63	3986,27
BČ 10	620,68	2889	6,49	10,07	4027,27
BČ 11	743,48	3380	6,03	14,96	4485,26
BČ 12	626,10	3120	6,56	10,56	4105,92
BČ 13	614,97	3380	6,92	11,15	4257,11
BČ 14	627,70	3404	7,14	12,61	4481,37
BČ 15	633,12	3323	6,19	9,72	3917,82

Table 2. Statistical evaluation of measure values by resonant dynamic method; kde: MV - average of measured values, SD – standard deviation, CV – coefficient of variation

Statistics	ρ [kg/m ³]	A [m ⁴ /kg.s]	E [GPa]	c [m/s]
MV	642,38	6,60	11,59	4235,08
SD	34,82	0,45	1,80	273,42
CV	5,42	6,86	15,57	6,46

On the base of experimental results we can compare Black Elder wood with other deciduous hardwoods. We can assume that because of their physical and acoustical features there is suitable material for the production of wood aerophonic musical instruments. Wood of Black Elder enables smooth and outstanding processing of inner surface of wind musical instrument what creates stable space for the vibration of wind bar.

4 Conclusion

These following values of Black Elder were determined by the experimental measurement using resonant dynamic methods (absolut moisture content $w_a = 8\%$):

- density: $\rho = 642 \text{ kg}\cdot\text{m}^{-3}$
- acoustic constant: $A = 6,6 \text{ m}^4\cdot\text{kg}^{-1}\cdot\text{s}^{-1}$
- modulus of elasticity: $E_L = 11,6 \text{ GPa}$
- sound velocity: $c = 4235 \text{ m}\cdot\text{s}^{-1}$

Chosen values of elastic characteristics show that Black Elder wood can be compared to deciduous hardwoods which are highly demanded for the production of wind musical instruments. As an advantage of this wood species compared to other ones we can mention excellent possibility of drilling along with limb axis because of its soft medulla.

Acknowledgements

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