WOOD RESEARCH
55 (2): 2010
39-52

DECAY RESISTANCE OF LAMINATED VENEER LUMBERS FROM BLACK LOCUST WOOD

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ABSTRACT

Wooden composites for exterior without contact with field, it means suitable for the 3rd hazard class by EN 335-3, have to be adequately resistant against moisture and wood-destroying basidiomycetes. The aim of this work was to establish the effect of the hydrothermal treatment of black locust wood (*Robinia pseudoacacia* L.) at temperatures of 50 °C, 60 °C or 70 °C on the decay resistance of Laminated Veneer Lumber (LVL) boards:- against the brown-rot fungus *Coniophora puteana* and the white-rot fungus *Trametes versicolor*. Mycological tests were carried out by the EN 113 during 16 weeks. Decay resistance of LVL-s, bonded with PVAc adhesive, was valued on the basis of these criteria:- actual humidity after rot (w); - weight loss (Δm); - drop of tension strength perpendicularly to board plane "drop of delamination strength" (Δσ). On the base of Δσ was determined also the humidity resistance of LVL-s. Experiments showed that LVL-s better withstand to *T. versicolor* (Δm from 1.55 % to 1.70 %; Δσ from 34.6 % to 51.9 %) as to *C. puteana* (Δm from 6.74 % to 13.9 %; Δσ from 57.3 % to 64.5 %), at which their resistance only against moisture in the humidity test was not sufficient (Δσ from 14.5 % to 39.8 %). In principal, the hydrothermal treatments of black locust logs did not have a more apparent effect on changes in the decay resistance of LVL-s comparing with resistance of massive black locust wood.

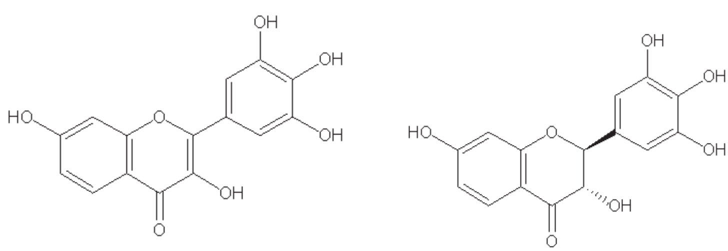
KEY WORDS: black locust, hydrothermal treatment, LVL-s, natural durability, *Coniophora puteana, Trametes versicolor*

INTRODUCTION

Laminated Veneer Lumbers (LVL-s) have wide utilization in building constructions, for production of stairs, windows, doors and furniture. They are produced from various species of wood, till now mainly from conifers, in Europe from spruce, or in North America, Australia and New Zealand mainly from Douglas and Scots pine. LVL-s prepared from more durable black locust or oak wood have higher resistance against biological attacks, and can be applied also in exterior expositions. Durability of LVL-s is influenced in certain measure also by technological parameters of production of veneers, in which is focused on experiments of this work.

Black locust (*Robinia pseudoacacia* L.) is important species due to its excellent durability and very good physical and mechanical properties (Stringer and Olson 1987, Barrett et al. 1990, Molnar 1995, Adamopoulos and Voulgaridis 2003). But by Tequbloc – project (2000) there were introduced also certain disadvantages of black locust wood, like is for example crooked stems and their smaller diameters, irregular color of heartwood (from yellow to green-olive hue), insufficient and not always authentic dates about its biological, physical and mechanical properties, comparatively long times of drying and high residual stresses at drying. Negri et al. (1999) show problems with wood of black locust connected with recovery and gluing. Transformation of black locust by peeling in order to production of LVL boards maybe achieve his higher recovery, utilize also less valuable bolts, with smaller dimensions, reduce the times of drying, eliminate influence of growth and internal stresses, as well as improve selected physical and mechanical properties of solid wood (Zubková 2009).

Increased resistance of black locust wood against biological attack is reflex of its chemical composition (Adamopoulos et al. 2005). Along its basic building components:- 41 % cellulose, 22.58 % pentozans, 31 % lignin (Kohán 1998); 40-50 % cellulose, 15-22 % hemicellulose 25-30 % lignin (Molnár and Bariska 2002); 50.1 % cellulose, 23.7 % hemicellulose, 20.6 % lignin (Fengel and Wegener 1984), include also higher portion of poly-phenol substances sort of tannin and others ranging from 2 till 4 % (Molnár and Bariska, 2002) or also more than 6.2 till 8.3 % (Stringer 1992). These extractives cause green-yellow-brown (Adamopoulos 2002) till green-grey color of heartwood from black locust (Molnár and Bariska 2002). In heartwood of black locust is high presence of condensate tannins (Reinprecht 1997). Roux and Paulus (1962) determined more than 14 flavonoids in heartwood of black locust. Magell et al. (1994) exactly quantified in wood of black locust presence of two flavonoids: dihydroflavonol → dihydrorobinetin (3,7,3',4',5"pentahydroxydihydroflavonol) and flavonol → robinetin. Mayer et al. (2006) also describe these two significant accessory compounds: dihydrorobinetin and robinetin (Fig. 1), which increase durability of black locust wood. Noted substances are toxic against wood-destroying fungi, and in this consequence the heartwood of black locust become high resistant against decay processes (Molnár and Bariska 2002, EN 350-2 → 1st - 2nd durability class). Proportion of these substances in heartwood of black locust increase with the age of tree (Fig. 2), but they are not found in sapwood (Fig. 2). Sapwood of black locust does not resist decay attack (5th durability class according to EN 350-2). Narrow sapwood (about 2-6 growth rings) is light yellow, whereby include also many simple organic compounds, which attract fungi and insects (Molnár and Bariska 2002).



a) **b)**

Fig. 1: Chemical structure of components of black locust in heartwood a) Robinetin $C_{15}H_{10}O_7$, b) Dihydrorobinetin $C_{15}H_{12}O_7$ (Chemicals)

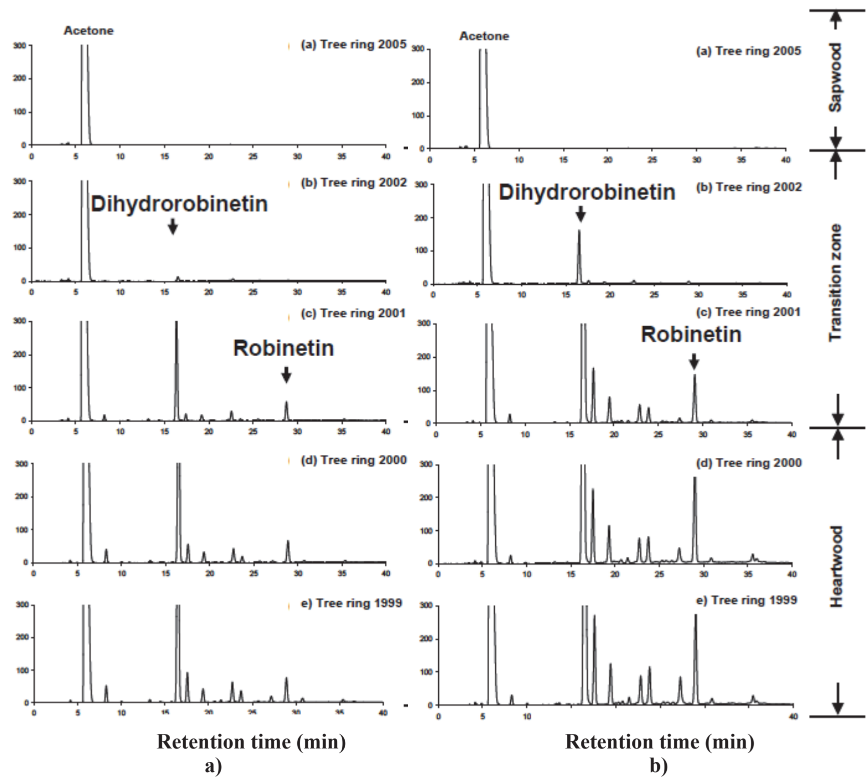


Fig. 2: Chemical composition of a) 11 years b) 59 years old wood of black locust – Robinia pseudoacacia (Mayer et al. 2006)

In term of durability and density the black locust belongs to the most suitable species for production of LVL-s (Zubková 2009). It is necessary to emphasize the differences within the framework of heart zone of black locust, and it is uncertain also the influence of its hydrothermal treatment for leaching of extractives and thereby also the change of durability of LVL-s. To avoid the problems caused by high portion of juvenile wood (less natural durability, high internal stresses), it is recommended to increase the age of felling from 30-35 years to 40-45 years (Tequbloc – project 2000). It is also documented by experiments of Mayer et al. (2006) mentioned in Tab. 1.

Tab. 1: Comparison of weight loss for juvenile and mature wood of black locust by action of fungi Coniophora puteana and Trametes versicolor (Mayer et al. 2006)

Black locust *Robinia pseudoacacia* L.	**Brown-rot fungus** *Coniophora puteana*	**White-rot fungus** *Trametes versicolor*
	Δm – weight loss (%) after 16 weeks	
Juvenile heartwood (1-5 growth rings)	2.9-9.4-31.4 (2nd durability class)	6.6-16.5-31.7 (4th durability class)
Mature heartwood (more than 20 growth rings)	0.1-0.7-2.5 (1st durability class)	0.5-1.7-4.8 (1st durability class)

According to Peszlen et al. (2000) the white-rot fungus *Trametes versicolor* was the most aggressive for hydrothermal treated juvenile (weight loss: Δm = 9.5 %) and mature (Δm = 3.4 %) black locust wood, whereby untreated mature wood of black locust had higher resistance (Δm = 0.1 %). The brown-rot fungus C*oniophora puteana* attacked hydrothermal treated juvenile black locust wood significantly (Δm = 11.6 %), mature wood considerably lesser (Δm = 3.1 %), whereby untreated wood was not tested due to technical reasons.

Nzokou et al. (2005) investigated, that excellent durability of black locust is also preserved in LVL-s. The steaming and heat treatment during the veneer and LVL manufacture did not lead to significant differences in durability of solid wood and LVL composite, what was in certain contradiction with expectations, because the steaming and heat treatments cause the leaching and evaporation of extractives and result in lower durability of LVL from black locust. Low weight losses of species durable against decay are base assumption, that nor production process do not influence significantly resistance of LVL-s against decay. According to ASTM D2017, an average weight loss of 0–10 % is an indication of high decay resistance, 11–24 % of resistance, 25–44 % moderately resistant, and above 45 % of non resistant. Weight losses of solid wood and LVL-s from black locust of age 45-50 years were obviously lower than 10 %, whereby was confirmed their high decay resistance (Tab. 2).

Tab. 2: Weight loss (Δm [%]) of samples of massive wood and LVL boards from black locust, after exposition of fungus Gloeophyllum trabeum, Poria placenta, Irpex lacteus and Trametes versicolor according of ASTM D2017 (Nzokou et al. 2005)

Wood species	Material	*G. trabeum*	*P. placenta*	*I. lacteus*	*T. versicolor*
Black locust	massive wood	3	6	9	4
	LVL	7	8	12	7

Decrease of mechanical properties of decayed wood is usually stronger at brown-rot comparing with white-rot, which is related with expressive depolymerization of cellulose by brown-rot fungi (Eriksson et al. 1990, Reinprecht 1992, Schmidt 2006). LVL-s for exterior, but sometimes also for interior, must preserve in dangerous expositions for long time the initial bending strength, compression strength, tension strength perpendicularly to board plane, hardness, and also other mechanical properties. It means, in conditions convenient for decay (often in exterior and accidentally also in interior) the fungus must not significantly interfere with structure of wood and either with adhesive connections of single veneers of LVL-s.

The aim of this work was to determine the influence of temperature during hydrothermal treatment of logs ranging from 50 to 70 °C for change the resistance of LVL-s from black locust against selected wood-destroying fungi.

MATERIAL AND METHODS

Preparation of black locust LVL-s

Black locust Laminated Veneer Lumber (LVL-s) were prepared from heartwood of black locust (*Robinia pseudoacacia* L.). One stem of black locust with the length of 13.6 m and the diameter from 160 mm to 313 mm (average 221 mm) was cut on bolts long 600 mm. The hydrothermal treatment of these bolts in hot water was carried out at 50, 60 or 70 °C during 24 hours. Peeling of 3 mm thick veneers from these bolts was performed on CNC peeling lathe in laboratory of ENSAM

Cluny in France. The veneers were afterwards manually cut in wet state on plates of size 500 x 500 mm without knots and sapwood. Finally they were dried to humidity of 7 till 9 % required for technological process of pressing. LVL-s from black locust of size 500 x 500 mm and constant thickness of 20 ± 1 mm were prepared by pressing of 7 veneers with thickness of 3 mm, using polyvinyl-acetate (PVAc) glue Supracolle 303 from firm Kleiberit with its spread of 150 g.m^{-2}. Pressing process at temperature of 80 °C (optimal temperature of hot pressing for this kind of glue) and specific pressure of 1.8 MPa lasted 14 minutes. Within every manner of hydrothermal treatment of black locust logs were pressed 4 LVL-s, overall 12 boards. LVL-s were air cooled, trimmed, conditioned 6 weeks at temperature of 20 ± 2 °C and relative humidity of air 65 ± 5 %, and then test samples with dimension of 50 x 50 x 20 mm were made from them (Tab. 3). To comparative tests were prepared also test samples from black locust massive wood, respectively also from beech massive wood, with dimensions of 50 x 25 x 15 mm (50 mm along grain) according to EN 113 (Tab. 3).

Test of decay resistance of LVL-s from black locust – mycological test by EN 113

At first, the test samples of LVL black locust boards, of massive black locust wood (*Robinia pseudoacacia* L.), and comparing test samples of massive beech wood (*Fagus sylvatica* L.) were dried into the oven dry state and weighted with accuracy of 0,001 g (m_0). Subsequently they were put to sterile distilled water for 15 minutes to increase their humidity to approximately 25-30 %. In this state they were exposed to mycological test by the standard EN 113 of their resistance against the brown-rot fungus *Coniophora puteana* (Schumach.) P. Karst., respective against the white-rot fungus *Trametes versicolor* (L.) Pilát. (Tab. 3).

Tab. 3: Samples of massive beech, massive black locust, and LVL black locust boards used for mycological tests and humidity tests accomplished in laboratory of TU Zvolen in Slovakia

Resistance test	**Massive beech + black locust** 50x25x15 mm		**LVL black locust boards** 50x50x20 mm (from 7 veneers thin 3 mm)	
	Hydrothermal Treatment	Number of samples	Hydrothermal treatment	Number of samples
Brown-rot fungus	No	2 + 2	50°C/24h	6
Coniophora puteana	No	2 + 2	60°C/24h	6
	No	2 + 2	70°C/24h	6
White-rot fungus	No	2 + 2	50°C/24h	6
Trametes versicolor	No	2 + 2	60°C/24h	6
	No	2 + 2	70°C/24h	6
	-		50°C/24h	6
Moisture	-		60°C/24h	6
	-		70°C/24h	6
	-		50°C/24h	6
Control	-		60°C/24h	6
	-		70°C/24h	6
		12 + 12		72

Mycological tests were effectuated in 1-litre glass Kolle's flasks in thermostats at temperature of 22 ± 1 °C during 16 weeks. Two test samples were put to every flask with enlarging mycelium of corresponding fungus on carrying support from stainless steel to ensure that surfaces of samples were not in direct contact with malt agar culture medium. At the end of test the samples were taken out from Kolle's flasks and it was determined their actual humidity according of relation (1):

$$w = [(m_{wd} - m_{0d}) / m_{0d}] \,.\, 100 \quad (\%) \tag{1}$$

where: m_{0d} – weight of sample after attack by wood-destroying fungus in the oven dry state, m_{wd} - weight of sample after attack by wood-destroying fungus at actual humidity "w" → at removal from Kolle's flask.

Surfaces of samples were consequently purified from mycelium of fungus and samples were submitted to two stage drying process to achieve the oven dry state after attack by wood-destroying fungus (m_{0d}). The first degree of natural drying was performed at moderate conditions (t = 20–25 °C, ϕ = 60–70%, τ = 100 h). The second degree of drying effectuated in laboratory drying chamber in three phases (I. t_1 = 60 °C, τ_1 = 1 h; II. t_2 = 80 °C, τ_2 = 1 h; III. t_3 = 103 ± 2 °C, τ_3 = 4 h). The aim of this drying was to avoid a formation of checks and deformations, as well as sterilize of samples to stop of decay process in a wood substance.

Decay resistance of samples from black locust LVL-s was evaluated on base of weight losses (Δm) according to relation (2), and also on base of drop of their strength in tension perpendicularly to plane of board "delamination strength" ($\Delta\sigma$) according to relation (3):

$$\Delta m = [(m_0 - m_{0d}) / m_0] \,.\, 100 \quad (\%) \tag{2}$$

where: m_0 – weight of sample before attack by wood-destroying fungus in the oven dry state, m_{0d} – weight of sample after attack by wood-destroying fungus in the oven dry state,

$$\Delta\sigma = [(\sigma - \sigma_d) / \sigma] \,.\, 100 \quad (\%) \tag{3}$$

where: σ_d – strength of LVL sample in tension perpendicularly to plane after attack by wood-destroying fungus and after conditioning on w = 8 ± 1 %, σ – average strength of six control LVL samples of given type (n = 6) in tension perpendicularly to plane at w = 8 ± 1 % which were not attacked by fungus.

Comparison test of humidity resistance of LVL-s from black locust

Moisture samples (Tab. 3) of the same dimensions like those ones used in mycological tests were prepared from the same black locust LVL-s. These samples were exposed only to activity of increased humidity of air $\varphi \cong 97$ %, at t = 22 ± 1 °C, during τ = 16 weeks without presence of wood-destroying fungus. Changes of their tension strength perpendicularly to plane were determined analogically like at the samples attacked by fungi *C. puteana* or *T. versicolor*, that is according to relation (3), in which instead of the σ_d values were used the σ_h values (σ_h – strength of the LVL moisture sample in tension perpendicularly to plane at w = 8 ± 1 %).

RESULTS AND DISCUSSION

Humidity of samples at the end of mycological tests

At the end of mycological tests (Fig. 7) the average humidity of samples from black locust LVL boards was in ranging of 33.5 % to 40.4 %, from black locust massive wood in ranging of 28.1 % to 31.7 %, and from beech massive wood in ranging of 38.1 % to 56.4 % (Fig. 3). Humidity of all samples was above 20 %, what is the critical minimal humidity of wood necessary for decay processes.

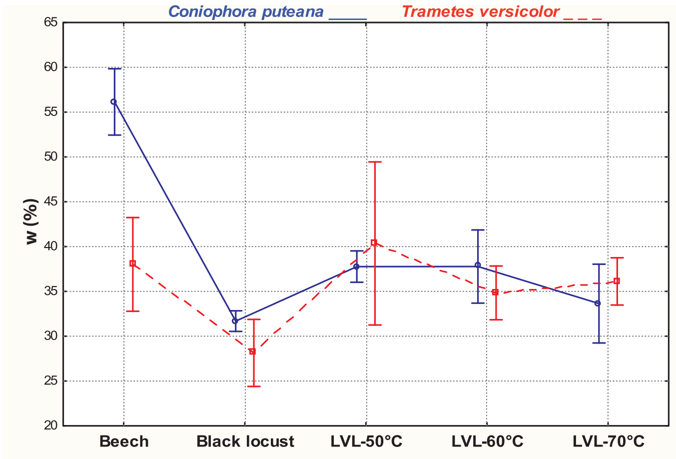


Fig. 3: Humidity (w) of massive beech, massive black locust, and LVL black locust boards at the end of mycological tests carried out with the fungi Coniophora puteana and Trametes versicolor (EN 113 - 16 weeks; n = 6) → 95 % confidence intervals

Weight loss of samples at the mycological tests

Decay resistance of samples from black locust LVL-s, classified on base of weight loss, was approximately on the level of massive black locust samples, however expressly higher like resistance of comparative massive beech samples (Fig. 4 and 5, Tab. 4 and 5).

Black locust LVL-s resisted better to the white-rot fungus *Trametes versicolor* (average weight loss from 1.55 % to 1.70 %) like to the brown-rot fungus *Coniophora puteana* (average weight loss from 6.74 % to 13.9 %). This result is in certain disproportion with work of Mayer et al. (2006), who determined approximately the same activity of these two fungi on heartwood from black locust. Certain differences between their results and the ones of this work can be explained by the next hypotheses:

- Non-defined proportion of „mature“ heartwood and „juvenile“ heartwood at this experiment, as either at the experiment according to Mayer et al. (2006),
- nearer non-quantified proportion of „mature“ heartwood and „juvenile“ heartwood in this experiment, when subsequent selection of test samples for test with fungus *C. puteana* and for test with fungus *T. versicolor* from four LVL-s of one series was random,
- higher activity of the strain of *C. puteana* used in our laboratory in comparison with the strain of this fungus used by Mayer et a al. (2006).

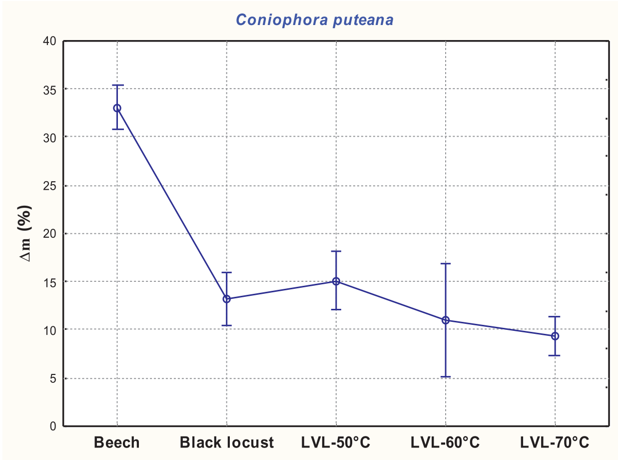


Fig. 4: Weight loss (Δm) of massive beech, massive black locust, and LVL black locust boards caused by the fungus Coniophora puteana (test according to EN 113 – 16 weeks; n=6) → 95 % confidence intervals

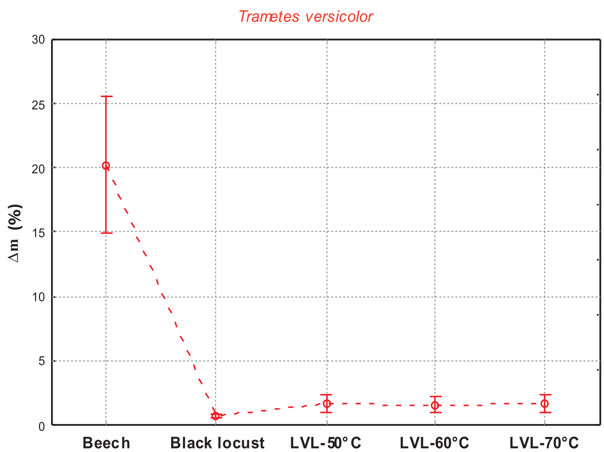


Fig. 5: Weight loss (Δm) of massive beech, massive black locust, and LVL black locust boards caused by the fungus Trametes versicolor (test according to EN 113 – 16 weeks; n = 6) → 95 % confidence intervals

The influences of increased temperature during hydrothermal treatment (50-60-70 °C/24h) on the change of decay resistance of black locust LVL-s, respective also the influences of hydrothermal treatments and other technological processes connected with LVL-s preparation on changes in their durability with regard to massive black locust wood, were tested in some statistic analyses (Tab. 4 and 5). These analyses, but in general also others statistical analyses, are only certain auxiliary in searching of sequences from experimental results. At general view for attained results is desirable simultaneously make provision for relatively higher variability of measured values, with which we often meet at mycological tests, as well as tendentious reversal of results at two tested fungi (Fig. 4 and 5):

- decay by *C. puteana*: the highest weight loss (Δm = 13.9 %) had the LVL composite from black locust veneers prepared from bolts treated at the lowest temperature of 50 °C; weight losses of untreated black locust wood (Δm = 11.51 %), but also of LVL-s prepared from bolts treated at higher temperatures of 60 °C and 70 °C (Δm = 8.72 % and 6.74 %) were moderately lower,
- decay by *T. versicolor*: the lowest weight loss had massive black locust wood (Δm = 0.64 %), while black locust LVL-s from hydrothermal treated wooden material had only moderately but not significantly higher weight losses (Δm = from 1.55 % to 1.7 %).

Tab. 4: Significance levels (≤ 0.05) of the Duncan´s test – analysis of weight losses (Δm) of beech wood, black locust wood, and black locust LVL-s after attack by the fungus Coniophora puteana

No.	Attack by *Coniophora puteana*	{1} Δm 36.36 %	{2} Δm 11.51 %	{3} Δm 13.90 %	{4} Δm 8.72 %	{5} Δm 6.74 %
1	Beech		0.000	0.000	0.000	0.000
2	Black locust	0.000		0.233	0.167	0.030
3	LVL-50°C - Black locust	0.000	0.233		0.019	0.003
4	LVL-60 °C - Black locust	0.000	0.167	0.019		0.321
5	LVL-70 °C - Black locust	0.000	0.030	0.003	0.321	

Tab. 5: Significance levels (≤ 0.05) of the Duncan´s test – analysis of weight losses (Δm) of beech wood, black locust wood, and black locust LVL-s after attack by the fungus Trametes versicolor

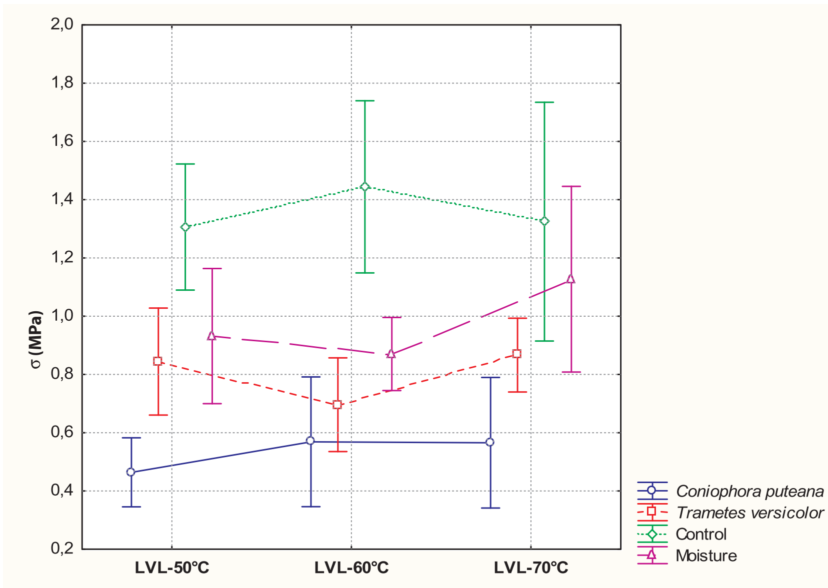
No.	Attack by *Trametes versicolor*	{1} Δm 20.24 %	{2} Δm 0.638 %	{3} Δm 1.700 %	{4} Δm 1.551 %	{5} Δm 1.699 %
1	Beech		0.000	0.000	0.000	0.000
2	Black locust	0.000		0.388	0.415	0.373
3	LVL-50°C - Black locust	0.000	0.388		0.900	0.999
4	LVL-60°C - Black locust	0.000	0.415	0.900		0.895
5	LVL-70°C - Black locust	0.000	0.373	0.999	0.895	

In general we can state that the selected technological parameters of LVL composites production from black locust wood, it means the conditions of hydrothermal treatment of its bolts at temperatures from 50 to 70 °C, respectively using of PVAc glue in pressing process, have not significantly and expressly defined effect on change of their decay resistance. Their weigh losses were overall the same like of massive black locust, with indications of moderate statistically insignificant increase at fungus *T. versicolor* (Fig. 5, Tab. 5).

According to criteria of EN 113 the produced black locust LVL-s can be classified either to durability of the 1st class resulted from tests against the fungus *Trametes versicolor* (x = $\Delta m_{BlackLocust\text{-}LVLs} / \Delta m_{Beech}$ = 0.077 till 0.084 ≤ *0.15*), or to durability of the 2nd class resulted from tests against the fungus *Coniophora puteana* (x = $\Delta m_{BlackLocust\text{-}LVLs} / \Delta m_{Beech}$ = 0.185 – 0.24 – (0.38) ≤ *0.30* - if we left out of consideration the result with LVL-50 °C).

Drop of delamination strength of LVL-s at the mycological and humidity tests

Tension strength perpendicularly to board plane “delamination strength” of black locust LVL-s evidently decreased, both after mycological and humidity tests (Fig. 6, Tab. 6). Effect of the different hydrothermal treatments of logs at 50 °C, 60 °C or 70 °C on this property was not confirmed. The largest drop of delamination strength was caused by the brown-rot fungus *Coniophora puteana* (Δσ = from 57.3 % to 64.5 %). However, statistically significant drops (Tab. 6) were also observed after action of the white-rot fungus *Trametes versicolor* (Δσ = from 34.6 % to 51.9 %), and after the humidity test when the moisture samples were undergone 16 weeks to 97 % relative humidity of air (Δσ = from 14.5 % to 39.8 %). Interesting is also the result, that statistically significant differences were not observed between delamination strength of LVL-s exposed to the *T. versicolor* (see minimal weight losses - Fig. 5 and Tab. 5), and of LVL-s exposed only to the humidity test (Tab. 6). However, this result clearly showed that LVL-s bonded with PVAc adhesive are not suitable for exterior expositions.



Δσ (%)	*LVL-50°C*	*LVL-60°C*	*LVL-70°C*
C. puteana	*64.5*	*60.6*	*57.3*
T. versicolor	*35.4*	*51.9*	*34.6*
Moisture	*28.6*	*39.8*	*14.5*

Fig. 6: Tension strength perpendicularly to board plane "delamination strength" (σ) of LVL black locust boards:- Control samples (n = 6); Moisture samples (conditioned 16 weeks at φ ≅ 97 % and t = 22 ± 1 °C; n = 6); Decayed samples by the fungi Coniophora puteana or Trametes versicolor (test according to EN 113 – 16 weeks; n = 6) → 95 % confidence intervals

Tab. 6: Significance levels (≤ 0.05) of the Duncan´s test – analysis of delamination strength (σ) of black locust LVL-s: – control, and attacked by moisture or by fungi Trametes versicolor or Coniophora puteana

No.	LVL-**50°C**	{1} σ 1.306 MPa	{2} σ 0.932 MPa	{3} σ 0.844 MPa	{4} σ 0.464 MPa
1	Control		0.007	0.002	0.000
2	Moisture	0.007		0.545	0.002
3	*Trametes versicolor*	0.002	0.545		0.009
4	*Coniophora puteana*	0.000	0.002	0.009	

No.	LVL-**60°C**	{1} σ 1.444 MPa	{2} σ 0.870 MPa	{3} σ 0.696 MPa	{4} σ 0.569 MPa
1	Control		0.000	0.000	0.000
2	Moisture	0.000		0.227	0.040
3	*Trametes versicolor*	0.000	0.227		0.328
4	*Coniophora puteana*	0.000	0.040	0.328	

No.	LVL-**70°C**	{1} σ 1.325 MPa	{2} σ 1.127 MPa	{3} σ 0.867 MPa	{4} σ 0.566 MPa
1	Control		0.155	0.002	0.000
2	Moisture	0.155		0.069	0.000
3	*Trametes versicolor*	0.002	0.069		0.040
4	*Coniophora puteana*	0.000	0.000	0.040	

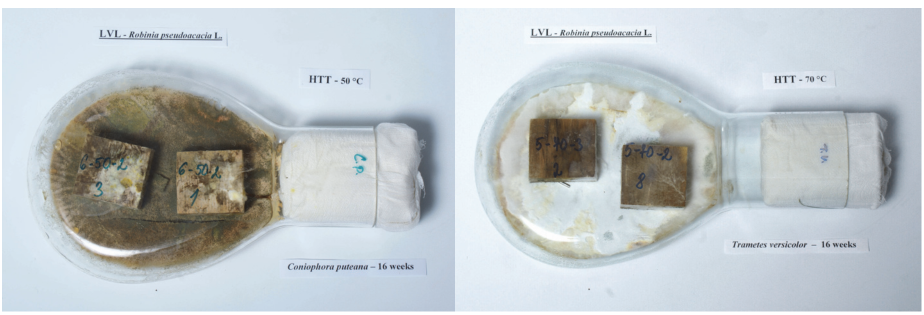


Fig. 7: Examples of mycelium growth of wood-destroying fungi T. versicolor on black locust LVL-s after 16 weeks (mycological test by EN 113)

CONCLUSIONS

Changed durability of LVL-s prepared from black locust logs primary hydrothermal treated at 50, 60 or 70 °C during 24 hours was studied in this work. Decay resistance of these compsites against the brown-rot fungus *Coniophora puteana* and the white-rot fungus *Trametes versicolor* was comparable with the resistance of solid black locust wood and apparently higher to solid beech wood. Effects of the different hydrothermal treatments of logs on the weight losses and the delamination strength decreases of LVL-s exposed to mycological tests were not usually confirmed. It indirectly means that the used hydrothermal treatments did not have a more significant influence on the substrate composition of black locust wood – on its extractives.

ACKNOWLEDGMENTS

The authors would like to express their thanks the ENSAM in France and the Ministry of Education of the Slovak Republic (project VEGA 1/0421/10) for financial support of this scientific work.

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