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11TH HARDWOOD CONFERENCE PROCEEDINGS

Róbert Németh, Christian Hansmann, Holger Militz, Miklós Bak, Mátyás Báder



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**Editors: Róbert Németh, Christian Hansmann, Holger Miltz,
Miklós Bak, Mátyás Báder**



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Content

Preface to the 11TH HARDWOOD CONFERENCE

Róbert Németh..... 9

Plenary Session - Keynotes of the 11TH HARDWOOD CONFERENCE

The role of black locust (<i>Robinia pseudoacacia</i>) in Czechia <i>Ivan Kuneš, Martin Baláš, Přemysl Šedivka, Vilém Podrázský</i>	11
Engineered wood products for construction based on beech and poplar resources in Europe <i>Joris Van Acker, Liselotte De Ligne, Tobi Hallez, Jan Van den Bulcke</i>	23
The situation in the hardwood sector in Europe <i>Maria Kiefer-Polz, Rainer Handl</i>	60

Session I - Silvicultural aspects and forest management of hardwoods

Monitoring xylogenesis as a tool to assess the impact of different management treatments on wood formation: A study case on <i>Vitis vinifera</i> <i>Angela Balzano, Maks Merela, Meta Pivk, Luka Krže, Veronica De Micco</i>	62
The History of Forests - Climate Periods of the Middle Ages and Forestry <i>Emese Berzsenyi, Dóra Hegyesi, Rita Kattein-Pornói, Dávid Kazai</i>	63
Climate change mitigation aspects of increasing industrial wood assortments of hardwood species in Hungary <i>Éva Király, Zoltán Börzsök, Attila Borovics</i>	71
Uncovering genetic structures of natural Turkey oak populations to help develop effective climate change strategies for forestry <i>Botond B. Lados, László Nagy, Attila Benke, Csilla É. Molnár, Zoltán A. Köbölkuti, Attila Borovics, Klára Cseke</i>	78
Ash dieback: infection biology and management <i>Nina E. Nagy, Volkmar Timmermann, Isabella Børja, Halvor Solheim, Ari M. Hietala</i>	86
The Role of Industrial Hardwood Production Plantations and Long-Term Carbon Sequestration in a Circular Economy via the New <i>Robinia pseudoacacia</i> ‘Turbo Obelisk’ Varieties <i>Márton Németh, Kálmán Pogrányi, Rezső Solymos</i>	95
Initial growth of native and introduced hardwoods at the afforested agricultural lands – preliminary results <i>Vilém Podrázský, Josef Gallo, Martin Baláš, Ivan Kuneš, Tama Abubakar Yahaya, Miroslav Šulitka</i>	102

Poster Session

Light response curve analysis of juvenile Püspökladányi and Üllői black locust <i>Tamás Ábri, Zsolt Keserű, József Csajbók</i>	111
Revealing the optimum configuration of heat-treated wood dowel joints by means of Artificial Neural Networks and Response Surface Methodology <i>Bogdan Bedeleian, Cosmin Spîrchez</i>	115
Artificial neural networks as a predictive tool for thrust force and torque during drilling of wood-based composites <i>Bogdan Bedeleian, Mihai Ispas, Sergiu Răcășan</i>	121

Research on the value retention of hardwood products in the spirit of sustainability <i>Daniel Bodorkós, József Zalavári, Péter György Horváth</i>	126
Abrasive Water Jet Cutting vs. Laser Jet Cutting of Oak Wood Panels <i>Camelia Cosoreanu, Gheorghe Cosmin Spirchez, Antonela Lungu, Sergiu-Valeriu Georgescu, Alexandru Catalin Filip, Sergiu Racasan</i>	131
Polyphenol content of underutilized wood species from Hungary <i>Tamás Hofmann, Haruna Seidu, Kibet Tito Kipkoror</i>	136
Wood quality evaluation of 32 grafted clone linages of Keyaki (<i>Zelkova serrata</i>) plus trees 12 years after planting <i>Kiyohiko Ikeda, Shigehiro Yamamoto</i>	141
Influence of the number of belts over vibrations of the cutting mechanism in woodworking shaper <i>Georgi Kovatchev, Valentin Atanasov</i>	146
The impact of litter forest fires on the internal structure of wood from stem of beech trees <i>Elena-Camelia Musat, Costin-Ovidiu Vantoiu, Emilia-Adela Salca</i>	153
Analysing innovative wood joints crafted by laser cut spline curves <i>László Németh, József Garab, Péter György Horváth</i>	158
Dynamic fatigue tests of hardwoods <i>Gábor Orbán, Antal Kánnár</i>	163
Restoration of an old painted oak boardsign - A case study <i>Gabriel Calin Canalas, Emilia-Adela Salca, Elena-Camelia Musat</i>	168
Some physical properties of native and thermo-treated <i>Fraxinus excelsior</i> timber <i>Cosmin Spirchez, Aurel Lunguleasa, Alin Olărescu, Camelia Coşoreanu, Bogdan Bedelea</i>	173
The surface morphology of sanded curly maple in comparison with straight grain maple selected for musical instruments <i>Mariana Domnica Stanciu, Lidia Gurau, Florin Dinulica, Catalin Constantin Roibu, Cristian Hiciu, Andrei Mursa, Marian Stirbu</i>	178
Analysis of changes in the composition of beech as an important industrial raw material in Hungary <i>Katalin Szakálosné Mátyás, Attila László Horváth</i>	183
Investigation of old hardwood structure element <i>Fanni Szőke, Antal Kánnár</i>	187
An investigation of the influence of coating film thickness on the light induced colour changes of clear coated maple (<i>Acer pseudoplatanus</i>) wood surfaces with natural aspect <i>Mihai-Junior Torcătoru, Maria Cristina Timar</i>	192
Composite Material Manufacturing from Plantation Paulownia Wood with Using Microwave Technology: Technical and Cost Analyses <i>Grigory Torgovnikov, Peter Vinden, Alexandra Leshchinskaia</i>	198
Thermal modification of wood as a tool for changing the colour of hardwoods <i>Vidholdová Zuzana</i>	203
High termite resistance of kempas (<i>Koompassia malaccensis</i>) hardwood protected with a novel vegetal extracts-cypermethrin wood preservative under outdoor aboveground tropical environment <i>Messaoudi Daouia, Wong Andrew H.H.</i>	209
Comparison of wood properties of pedunculate oak and non-native northern red oak from an anthropogenic site <i>Aleš Zeidler, Vlastimil Borůvka</i>	214
Acoustic Parameters of Pioneer Wood Species <i>Petr Horák, Vlastimil Borůvka</i>	219
Determination of Elastic Parameters of Birch and Oak Wood Using Optical Method <i>David Novák, Vlastimil Borůvka, Petr Horák, Tomáš Kytka</i>	224

Preliminary study on climate change impacts on annual wood growth development in Hungary <i>Péter Farkas, Zsolt György Tóth, Huba Komán</i>	230
Combustion characteristics of Russian olive (<i>Elaeagnus angustifolia</i> L.) <i>Szabolcs Komán, Krisztián Töröcsi</i>	236
Withdrawal capacity of Green ash (<i>Fraxinus pennsylvanica</i> Marsh.) and Box elder (<i>Acer negundo</i> L.) <i>Szabolcs Komán, Boldizsár Déri</i>	241
Formaldehyde emission from wood and wood-based products <i>Szabolcs Komán, Csilla Czók, Tamás Hofmann</i>	246
Finite element analysis of heat transfer of Turkey oak (<i>Quercus cerris</i>) <i>Sándor Borza, Gergely Csiszár, József Garab, Szabolcs Komán</i>	250
Possible alternative to creosote treated railway sleepers, Fürstenberg-System Sleeper (FSS) <i>Szabolcs Komán, Balogh Mátyás Zalán, Sándor Fehér</i> ,.....	255
Investigation of bendability characteristics of wood-based polymer composites <i>S. Behnam Hosseini, Milan Gaff</i>	260
Comparing the blossoming and wood producing properties of selected black locust clones <i>Alexandra Porcsin, Katalin Szakálosné Mátyás, Zsolt Keserű</i>	266
The influence of two different adhesives on structural reinforcement of oak-wood elements by carbon and glass fibres <i>Andrija Novosel, Vjekoslav Živković</i>	271
Investigating Kerf Topology and Morphology Variation in Native Species After CO ₂ Laser Cutting <i>Lukáš Štefančín, Rastislav Igaz, Ivan Kubovský, Richard Kminiak</i>	272
Comparison of fluted-growth and cylindrical hornbeam logs from Hungarian forests <i>Mátyás Báder, Maximilián Cziczzer</i>	279
Thermal modification affects the dynamic vapor sorption of tree of heaven wood (<i>Ailanthus altissima</i> , Mill.) <i>Fanni Fodor, Lukas Emmerich, Norbert Horváth, Róbert Németh</i>	285
How conditions after application affect the depth of penetration of gel wood preservative in oak <i>Jan Baar, Štěpán Bartoš, Anna Oberle, Zuzana Paschová</i>	290
The weathering of the beech wood impregnated by pigmented linseed oil <i>Jakub Dömény, Jan Baar</i>	294
Examination of the durability of beeswax-impregnated wood <i>Miklós Bak, Ádám Bedők, Róbert Németh</i>	299
Preparation of pleated oak samples and their bending tests at different moisture contents <i>Pál Péter Gecseg, Mátyás Báder</i>	304
Bending test results of small-sized glued laminated oak timber consisting of 2, 3 and 5 layers <i>Dénes Horváth, Sándor Fehér</i>	308
Homogenized dynamic Modulus of Elasticity of structural strip-like laminations made from low-grade sawn hardwood <i>Simon Lux, Johannes Konnerth, Andreas Neumüller</i>	314
Impact of varnishing on the acoustic properties of sycamore maple (<i>Acer pseudoplatanus</i>) panels <i>Aleš Straže, Jure Žigon, Matjaž Pavlič</i>	319
The effect of wood and solution temperatures on the preservative uptake of Pannonia poplar and common spruce – preliminary research <i>Luca Buga-Kovács, Norbert Horváth</i>	325

Session II - Hardwood resources, product approaches, and timber trade

Birch tar – historic material, innovative approach <i>Jakub Brózdowski, Monika Bartkowiak, Grzegorz Cofa, Grażyna Dąbrowska, Ahmet Erdem Yazici, Zbigniew Katolik, Szymon Rosołowski, Magdalena Zborowska</i>	330
Beech Wood Steaming – Chemical Profile of Condensate for Sustainable Applications <i>Goran Milić, Nebojša Todorović, Dejan Orčić, Nemanja Živanović, Nataša Simin</i>	336
Towards a complete technological profile of hardwood branches for structural use: Case study on Poisson's ratio <i>Tobias Nennung, Michael Grabner, Christian Hansmann, Wolfgang Gindl-Altmutter, Johannes Konnerth, Maximilian Pramreiter</i>	342
Low-value wood from non-native tree species as a potential source of bioactive extractives for bio-based preservation <i>Viljem Vek, Ida Poljanšek, Urša Osolnik, Angela Balzano, Miha Humar, Primož Oven</i>	349
Hardwood Processing - do we apply appropriate technologies? <i>Alfred Teischinger</i>	357

Session III - Surface coating and bonding characteristics of hardwoods

Influence of pretreatments with essential oils on the colour and light resistance of maple (<i>Acer pseudoplatanus</i>) wood surfaces coated with shellac and beeswax <i>Emanuela Carmen Beldean, Maria Cristina Timar, Dana Mihaela Pop</i>	365
Oak timber cross-cutting based on fiber orientation scanning and mechanical modelling to ensure finger-joints strength <i>Soh Mbou Delin, Besseau Benoit, Pot Guillaume, Viguiet Joffrey, Marcon Bertrand, Milhe Louis, Lanvin Jean-Denis, Reuling Didier</i>	376
From Phenol-Lignin Blends towards birch plywood board production <i>Wilfried Sailer-Kronlachner, Peter Bliem, Hendrikus van Herwijnen</i>	386
Flatwise bending strength and stiffness of finger jointed beech lamellas (<i>Fagus sylvatica</i> , L.) using different adhesive systems and effect of finger joint gap size <i>Hannes Stolze, Adefemi Adebisi Alade, Holger Militz</i>	395
Mode I fracture behaviour of bonded beech wood analysed with acoustic emission <i>Martin Capuder, Aleš Straže, Boris Azinović, Ana Brunčič</i>	402

Session IV - Hardwood structure and properties

Compression strength perpendicular to grain in hardwoods depending on test method <i>Marlene Cramer</i>	410
Compensatory Anatomical Studies on <i>Robinia</i> , <i>Sclerocarya</i> and <i>Ulmus</i> <i>Fath Alrhman A. A. Younis, Róbert Németh, Mátyás Báder</i>	420
The influence of the type of varnish on the viscous-elastic properties of maple wood used for musical instruments <i>Roxana Gall, Adriana Savin, Mariana Domnica Stanciu, Mihaela Campean, Vasile Ghiorghe Gliga</i>	426
XRF investigation of subfossil oak (<i>Quercus</i> spp) wood revealing colour - iron content correlation <i>Nedelcu Ruxandra, Timar Maria Cristina, Beldean Emanuela Carmen</i>	435
Investigating the Development of Heartwood in <i>Quercus robur</i> in Denmark <i>Andrea Ponzeccchi, Albin Lobo, Jill Katarina Olofsson, Jon Kehlet Hansen, Erik Dahl Kjær, Lisbeth Garbrecht Thygesen</i>	445

Modelling tensile mechanical properties of oak timber from fibre orientation scanning for strength grading purpose <i>Guillaume Pot, Joffrey Viguier, Benoit Besseau, Jean-Denis Lanvin, Didier Reuling</i>	452
Green oak building – small diameter logs for construction <i>Martin Huber, Franka Brüchert, Nicolas Hofmann, Kay-Uwe Schober, Beate Hörnel-Metzger, Maximilian Müller, Udo H. Sauter</i>	461
An evaluative examination of oak wood defect detection employing deep learning (DL) software systems. <i>Branimir Jambreković, Filip Veselčić, Iva Ištok, Tomislav Sinković, Vjekoslav Živković, Tomislav Sedlar</i>	466
Comparison of surface roughness of milled surface of false heartwood, mature wood, and sapwood within beech wood <i>Lukáš Adamčík, Richard Kminiak, Adrián Banski</i>	467

Session V - Hardwoods in composites and engineered materials

Developing Laminated Strand Lumber (LSL) based on underutilized Hungarian wood species <i>László Bejő, Tibor Alpár, Ahmed Altaher Omer Ahmed</i>	475
Feasibility study on manufacturing finger-jointed structural timber using <i>Eucalyptus grandis</i> wood <i>Adefemi Adebisi Alade, Hannes Stolze, Coenraad Brand Wessels, Holger Militz</i>	481
A novel approach for the design of flame-retardant plywood <i>Christian Hansmann, Georg Baumgartner, Christoph Preimesberger</i>	486
The use of beech particles in the production of particleboards based on recycled wood <i>Ján Iždinský, Emilia Adela Salca, Pavlo Bekhta</i>	493
Thermal properties of highly porous wood-based insulation material <i>Kryštof Kubista, Přemysl Šedivka</i>	501

Session VI - Modification & functionalization

Quantitative and qualitative aspects of industrial drying of Turkey oak lumber <i>Iulia Deaconu, Bogdan Bedeleian, Sergiu Georgescu, Octavia Zeleniuc, Mihaela Campean</i>	508
Changes in properties of maple by hygrothermally treatment for accelerated ageing at 135-142°C <i>Tobias Dietrich, Herwig Hackenberg, Mario Zauer, Holger Schiema, André Wagenführ</i>	518
Change of chemical composition and FTIR spectra of Turkey oak and Pannonia poplar wood after acetylation <i>Fanni Fodor, Tamás Hofmann</i>	525
Change of cellulose crystal structure in beech wood (<i>Fagus sylvatica</i> L.) due to gaseous ammonia treatment <i>Herwig Hackenberg, Tobias Dietrich, Mario Zauer, Martina Bremer, Steffen Fischer, André Wagenführ</i>	535
Evaluation of weathering performance of acetylated hardwood species <i>Rene Herrera Diaz, Jakub Sandak, Oihana Gordobil, Faksawat Poohphajai, Anna Sandak</i>	539
Unlocking a Potential Deacetylation of Acetylated Beech (<i>Fagus sylvatica</i> L.) LVL <i>Maik Slabohm, Holger Militz</i>	544
Fork and flying wood tests to improve prediction of board stress development during drying <i>Antoine Stéphane, Patrick Perré, Clément L'Hostis, Romain Rémond</i>	549
Modification of different European hardwood species with a bio-based thermosetting resin on a semi-industrial scale <i>Christoph Hötte, Holger Militz</i>	557

Combustion characteristics of Russian olive (*Elaeagnus angustifolia* L.)

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ABSTRACT

The majority of the timber of invasive wood species is used as fuel wood, as it is a forestry objective to control their spread. Knowledge of the higher heating value and ash content are important parameters for the use of wood for energy. In terms of these two parameters, the Russian olive does not lag behind other invasive species. The ash content of its timber is very low, only 2.7%, while its higher heating value is 19.2 MJ/kg. Its ash content is only a quarter of that of black locust, while there is no difference between their higher heating values. The use of Russian olive for energetical purposes is advisable as far as the properties examined are concerned, and it is in no respect inferior to other wood species.

INTRODUCTION

Russian olive is indigenous to the warm continental areas of Asia. It is native to the region starting from the eastern basin of the Mediterranean Sea through Asia Minor, Western and Central Asia, stretching to the Altai Mountains and the Gobi Desert. It is mostly abundant in the Caspian Depression and in the regions of the Aral Sea and Lake Balkhash, where it is a characteristic plant of the vegetation accompanying the watercourses of sandy semi-deserts. It has been cultivated for centuries in Western Asia and Europe, where it has also grown wild and became widely established (Bartha and Csiszár 2012).

In Hungary, it can primarily be found in wet areas. Its spread (Figure 1) significantly changes the subject habitat, and is of outstanding importance in certain parts of the country. It is difficult to remove from anywhere it has once become established. After cutting down, the stump begins to grow new shoots intensively; its roots are capable of binding nitrogen. Its rapid growth also contributes to its intensive propagation. It is often seen along motorways, used as a means of erosion protection and in protective forest bands of ploughfields.

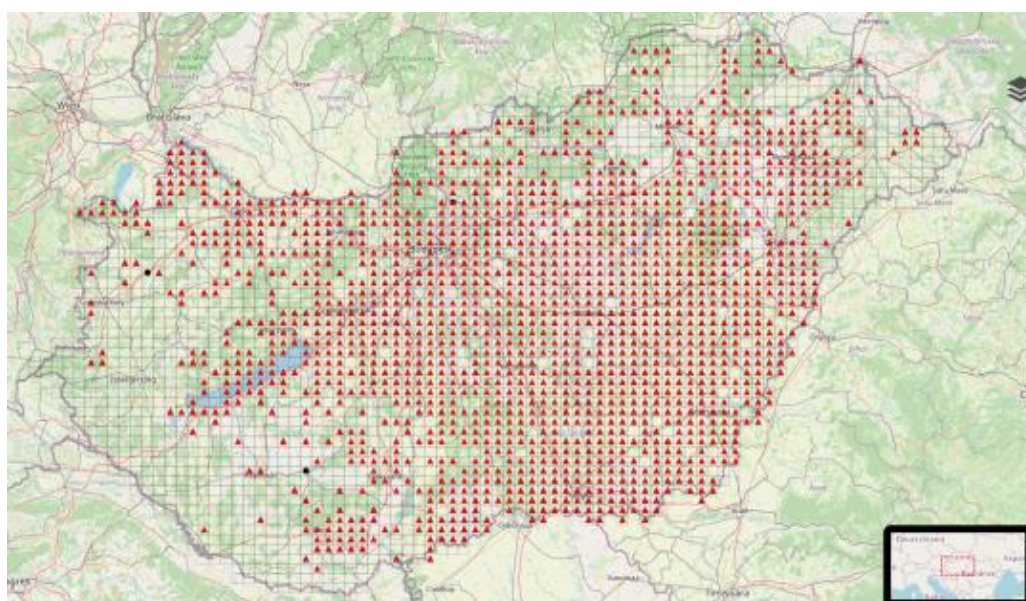


Figure 1: Spread of Russian olive in Hungary (invaziosfajok.hu 2024)

From the apiary perspective, the species gives excellent honey. Its pure monofloral honey has an intensive scent, reminiscent of flower of the tree. It is used as a flavour enhancer in mixed honeys. Its leaves, flowers and fruit rich in vitamin C are also used in folk medicine.

The use of various biomasses for energy is significantly determined by their calorific values, ash contents and other combustion parameters. The timber usually has a lower relative ash content, while that of the bark is significantly higher (Passialis et al. 2008, Nosek et al. 2016, Komán 2018). The noncombustible slag formed during the energy use of biomass raises special operational problems in larger firing plants. This is connected in part to damage caused to the firing equipment, and in part to the deposition of large volumes of ash. These problems can be primarily explained by the presence and the effect of chemical element incorporated into the biomass from the soil during its formation (Komán 2013).

During combustion of solid fuels such as wood, biomass and coal, significant volumes of non-combustible by-products are generated, including ash, slag and minerals. If these ash particles melt and get deposited in the firing equipment, they may hinder optimal heat exchange and flow. Therefore the removal of ash and the reduction of its quantity are of key importance to ensure the efficient and reliable operation of solid fuel firing equipment (Palotás 2011).

One of the key parameters of plantations is the energy yield determined based on higher heating value (Kenney et al. 1990). According to several studies, the bark's calorific value is lower than that of timber (Požgaj et al. 1997, Klačnja and Kopitovič 1999), but opposing opinions can also be found, according to which the bark's calorific value exceeds that of timber by a significant margin (Nurmi 2000).

Russian olive today has no timber industry related significance, primarily being used for firewood. The objective of the current research is to map its energetical characteristics in comparison to other wood species.

MATERIALS AND METHODS

A Russian olive trunk already having mature timber was examined, from a tree that grew in the area of the Fertő-Hanság Basin.

For the tests, 5 cm thick discs cut at the diameter at breast height were used. Ash content test took place on absolute dry samples (Figure 2). Following grinding, a 2 g quantity of the samples were analysed according to the EN ISO 18122:2026 standard, based on 3 samples.

To determine the higher heating value, 1 g pellets were pressed from the wood chips used to examine the timber's ash content (Figure 3). The samples were in absolutely dry condition of which 3 measurements were performed according to the EN ISO 1716:2019 standard.



Figure 2: Sample cross section



Figure 3: Sample of ground bark

RESULTS AND DISCUSSION

Of Russian olive's ash content, it can be said that it is very low in comparison to other wood species. Its ash content in comparison to other invasive wood species is likewise (Figure 3.) very low. Ash contents of tree of heaven, black locust and green ash are 2.5, 4 and 3 times higher than that of Russian olive, respectively.

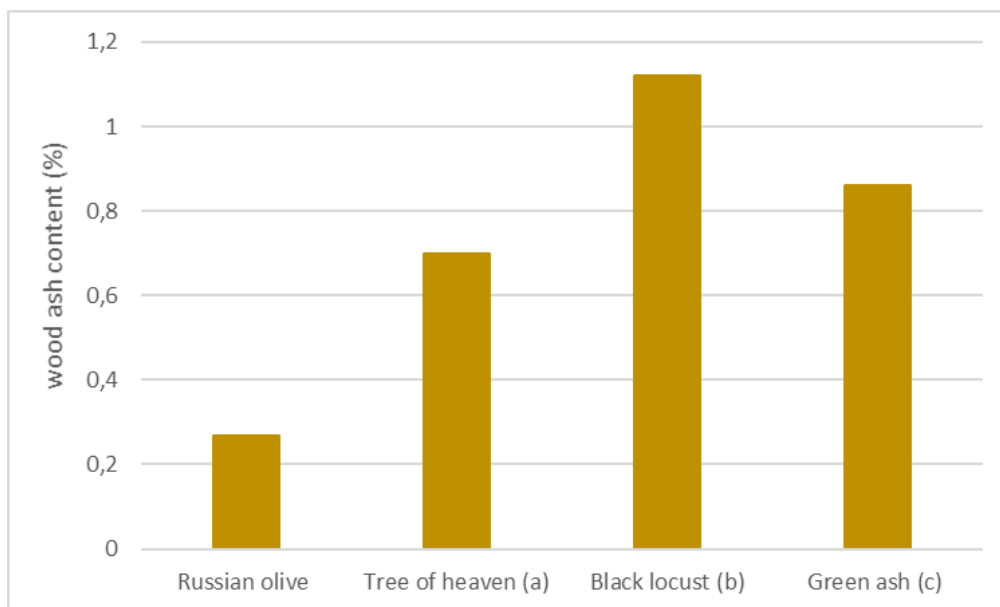


Figure 4: Ash content of Russian olive in comparison to other wood species (a – Terzopoulou and Kamperidou 2022; b – Komán 2018; c – Komán and Lehoczki 2022)

The Russian olive timber's higher heating value by weight is not inferior to the characteristic value of the majority of hardwood species. It is practically identical to the values of black locust and green ash, and is somewhat higher than that of tree of heaven. The value of its higher heating value is practically identical to that of beech and English oak (Telmo and Lousada 2011). The energetical utilisation of its timber is well advisable, considering this property.

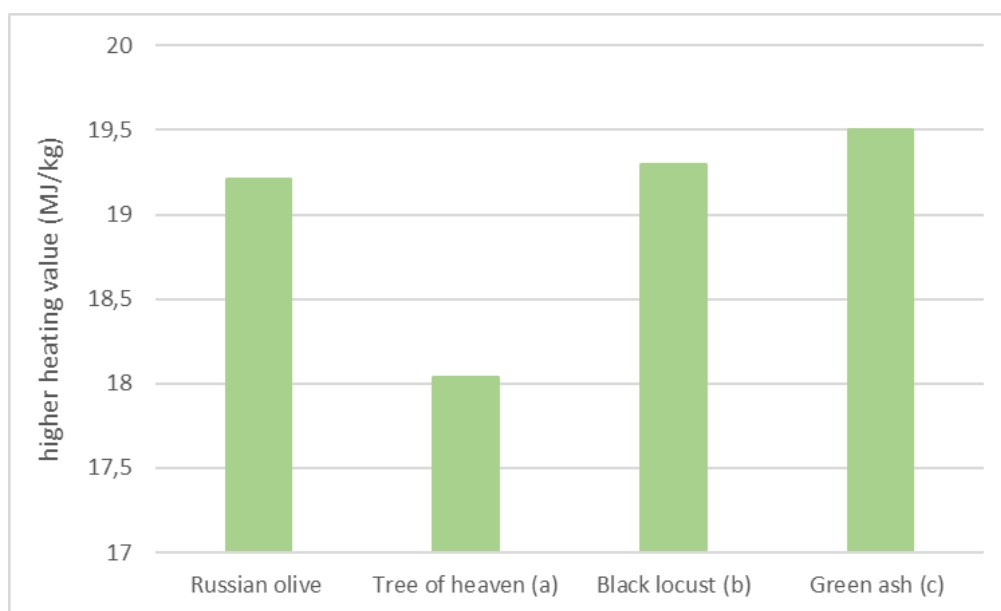


Figure 4: Higher heating value of Russian olive in comparison to other wood species (a – Kamperidou et al. 2018; b – Komán 2018; c – Komán and Lehoczki 2022)

CONCLUSIONS

The timber of Russian olive timber is of adequate quality for energetical utilisation in comparison to other invasive wood species, both in terms of ash content and higher heating value. As the volume of ash generated increases with the volume of wood burnt, its low ash content is a very favourable property. In the course of energetical utilisation, this has a positive affect on the operation of firing equipment and the deposition of the ash generated. The heat of combustion of its timber is equal to other hardwoods, therefore there is no reason not to exploit as an energy source.

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