

DAFTAR PUSTAKA

- Agati G, Azzarello E, Pollastri S, Tattini, M. 2012. Flavonoids as antioxidants in plants: location and functional significance. *Plant Science* Vol. 196: 67-76
- Alén R. 2000. Structure and chemical composition of wood. In: Stenius P. (Ed.) *Papermaking Science and Technology* Page 11–57. Forest Products Chemistry Department. Helsinki.
- Anouhe J S, Niamké F B, Faustin M, Virieux D, Pirat J, Adima A, Coulibaly S K, Amusan N. 2018. The role of extractives in the natural durability of the heartwood of *Dicorynia guianensis* Amsh: New insights in antioxydant and antifungal properties. *Annals of Forest Science* Vol. 75: 15-25
- Aregay N, Belew D, Zenebe A, Haile M, Gebresamuel G, Girma A. 2021. Tree age and harvesting season affected physicochemical and bioactive compounds of elite type of gunda gundo orange (*Citrus* Spp) in the Northern Ethiopia. *Fruit Science* Vol. 20: 1-14
- Aribowo T. 2016. Karakteristik sifat fisis dan keawetan kayu jati (*Tectona grandis* L.f.) cepat tumbuh terpadatkan. Skripsi Fakultas Kehutanan IPB. Bogor
- Arief I I, Suryati T, Afiyah D N, Wardhani D P. Chemical and organoleptic of beef sausages with teak leaf extract (*Tectona grandis*) addition as preservative and Natural Dye. *International Food Research Journal* Vol. 21: 2033-2042
- Arisandi R, Ashitani T, Takahashi K, Marsoem S N, Lukmandaru G. 2019. Lipophilic extractives of the wood and bark from (*Eucalyptus pellita*) F. Muell grown in Merauke, Indonesia. *Wood Chemistry and Technology* Vol. 40: 146-154
- Ashwell G. 1957. Colorimetric analysis of sugars. *Methods in Enzymology* Vol. 3: 73–105
- Ayadi N, Lejeune F, Charrier F, Charrier B, Merlin A. 2003. Color Stability of Heat-Treated During Artificial Weathering. *Holz als Roh- und Werkstoff* Vol. 61: 221–226.
- Ayton J, Mailer R J, Haigh A, Tronson D, Conlan D. 2007. Quality and Oxidative Stability of Australian Olive Oil According to Harvest and Irrigation. *Food Lipids* Vol. 14: 138–156

- Baillères P H, Durand P Y. 2000. Non-destructive techniques for wood quality assessment of plantation-grown teak. *Bois Forêts Tropica* Vol. 263:17–29
- Barbaroux C, Breda N. 2002. Contrasting distribution and seasonal dynamics of carbohydrate reserves in stem wood of adult ring-porous sessile oak and diffuse-porous beech trees. *Tree Physiology* Vol. 22: 1201–1210
- Barbaroux C, Bréda N, Dufrêne E. 2003. Distribution of above-ground and below-ground carbohydrate reserves in adult trees of two contrasting broad-leaved species (*Quercus petraea*) and (*Fagus sylvatica*). *New Phytologist* Vol. 157: 605–615
- Basri E, Wahyudi I. 2013. Sifat dasar kayu jati plus Perhutani dari berbagai umur dan kaitannya dengan sifat dan kualitas pengeringan. *Jurnal Penelitian Hasil Hutan* Vol. 31: 93-102.
- Basri E, Yuniarti K, Wahyudi I, Damayanti R. 2015. Effects of girdling on wood properties and drying characteristics of *Acacia mangium*. *Tropical Forest Science*. 27: 498-505.
- BeMiller J N. 1989. Carbohydrates. In: Rowe J.W. (eds) *Natural products of woody plants*. Springer Series in Wood Science. Berlin
- Bertaud F, Holmbom B. 2004. Chemical composition of earlywood and latewood in Norway spruce heartwood, sapwood and transition zone wood. *Wood Science Technology* Vol. 38: 245–256
- Bhat K M, Florence E J M. 2003. Natural Decay Resistance of Juvenile Teak Wood Grown in High Input Plantations. *Holzforschung* 57: 453-455
- Bhat K M, Priya P B. 2004. Influence of provenance variation on wood properties of teak from the Western Ghat region in India. *IAWA J* Vol. 25:273–282
- Bianchi S, Krosalakova I, Janzon R, Mayer I, Saake B, Pichelin F. 2015. Characterization of condensed tannins and carbohydrates in hot water bark extracts of European softwood species. *Phytochemistry* Vol. 120: 53-61
- Blainski A, Lopes G C, Mello J C P. 2013. Application and Analysis of the Folin Ciocalteu Method for the Determination of the Total Phenolic Content from *Limonium Brasiliense* L. *Molecules* Vol. 18: 6852-6865.

- Bowyer J L, Shmulsky R, Haygreen J G. 2007. Forest product and wood science an introduction fifth edition. Blackwell Publishing Professional. Iowa.
- Brown H P, Panshin A J, Forsaith C C. 1994. Textbook of wood technology. Volume I. McGraw-Hill Book Company Inc. 4th Edition. New York
- Burtin P J C, Charpentier J P, Janin G. 1998. Natural wood coloring process in *Juglans* sp (*J nigra*, *J regia* and *J nigra* 23 x *J regia*) depends on native phenolic compounds accumulated in the transition zone between sapwood and heartwood. Trees Vol. 12: 258-264
- Bustan A, Avni A, Lavee, S, Zipori I, Yeselson Y, Schaffer A A, Riov Joseph, Dag A. 2011. Role of carbohydrate reserves in yield production of intensively cultivated oil olive (*Olea europaea* L.) trees. Tree Physiology Vol. 31: 519–530
- Caron A, Clemens M A, Barry G, Michael C J. 2013. Distribution of extractives in sitka spruce (*Picea sitchensis*) grown in the northern UK. Wood Product Vol. 71: 697–704
- Chagas S F, Evangelista W V, Silva J C, Carvalho A M M L. 2014 Propriedades da madeira de teca de diferentes idades e oriundas de desbaste. Ciência da Madeira Vol. 5: 138-150
- Chapin F S, Schulze E, Mooney H A. 1990. The ecology and economics of storage in plants. Annual Review of Ecology and Systematics Vol. 21: 423–447
- Chen C M. 1970. Effect of extractive removal on adhesion and wettability of some tropical woods. Forest Product Vol. 20: 36–41
- Chikezie P C, Ibegbulem C O, Mbagwu F N. 2015. Bioactive principles from medicinal plants. Phytochemistry Vol. 9: 88–115.
- Choi H R, Choi J S, Han Y N, Bae S J, Chung H.Y. 2002. Peroxynitrite scavenging activity of herb extracts. Phytother Res Vol. 16: 364-367.
- Chow P S, Landhausser S M. 2004. A method for routine measurements of total sugar and starch content in woody plant tissues. Tree Physiology Vol. 24: 1129 –1136
- Chow P, Nakayama F S, Blahnik B, Youngquist J A, Coffelt T A. 2008. Chemical constituents and physical properties of guayule wood and bark. Industrial Crops and Products Vol. 28: 303–308

- Connor A M, Chad E F, Peter A A. 2005. Genotypic and enviromental variation in antioxidant activity and total phenolic content among blackbeery and hybridberry cultivars. American Society of Horticultural Science. Vol. 130: 527–533
- Croft K D. 1998. The chemistry and biological effects of flavonoids and phenolic acids. Annals of The New York Academi of Science Vol. 854: 435-442.
- Da Costa E W B, Rudman F.J G. 1958. Investigations on the durability of *Tectona grandis*. Empire Forestry Review Vol. 37: 291-298.
- Damayanti R. 2010. Struktur makro, mikro, dan ultramikroskopik kayu Jati Unggul Nusantara dan kayu jati konvensional. Tesis Fakultas Kehutanan Institut Pertanian Bogor. Bogor
- Damayanti R, Ozarska B, Pandit I K N, Febrianto F, Gustan P. 2018. Wood properties of 5-years-old fast grown teak. Wood research Vol. 9: 29-34
- Damesin C, Lelarge C. 2003. Carbon isotope composition of current-year shoots from (*Fagus sylvatica*) in relation to growth, respiration and use of reserves. Plant Cell and Environtment Vol. 26: 207–219
- Dedrie M, Jacquet N, Bombeck P, Hébert J, Richel A. 2015. Oak barks as raw materials for the extraction of polyphenols for the chemical and pharmaceutical sectors: A regional case study. Industrial Crops and Products Vol. 70: 316–321
- De la Rosa L A, Moreno-Escamilla J O, Rodrigo-García J, Alvarez-Parrilla E. 2019. Phenolic compounds. Postharvest Physiology and Biochemistry of Fruits and Vegetables Vol. 2: 253–271
- Del Rio D, Rodriguez-Mateos A, Spencer J P E, Tognolini M, Borges G A. 2013. Dietary (Poly) phenolics in human health: structures, bioavailability, and evidence of protective effects against chronic diseases. Antioxidants and Redox Signaling Vol. 18: 1818–1892
- Domingues R M A, Sousa G D A, Freire C S R, Silvestre A J D, C Pascoal Neto 2010. *Eucalyptus globulus* biomass residues from pulping industry as a source of high value triterpenic compounds. Industrial Crops and Products Vol. 31: 65–70
- Donnelly D M X. 1975 Neoflavonoids. In: Harborne B, Mabry T J, Mabry H (eds) The flavonoids. Chapman and Hall. London
- Drózdź P, Pyrzynska K. 2018. Assessment of polyphenol content and antioxidant activity of oak bark extracts. European Journal of Wood and Wood Products Vol. 76: 793–795
- Dubois M, Gilles K A, Hamilton J K, Rebers P A, Smith F. 1956. Colorimetric method for determination of sugars and related substances. Anal Chem 28:350–356

- Dunisch O, Richter H G, Koch G. 2010. Wood properties of juvenile and mature heartwood in *Robinia pseudoacacia* L. Wood Science and Technology Vol. 44: 301-313.
- Efansyah M N, Djofrie M H B, Limbong W H. 2011. Prospek usaha bagi hasil penanaman Jati Unggul Nusantara (studi kasus Koperasi Wanabhakti Nusantara di Kabupaten Bogor). Tesis Fakultas Kehutanan IPB. Bogor
- Ekman R, Holmbom B. 2000. The chemistry of wood resin. In: Back E L, Allen L H (Eds.) Pitch Control Wood Resin and Deresination. GA: Tappi Press. Atlanta
- Fatimah S, Susanto M, Lukmandaru G. 2013. Studi komponen kimia kayu *Eucalyptus pellita* F. Muell dari pohon plus hasil uji keturunan generasi kedua di Wonogiri Jawa Tengah. Jurnal Ilmu Kehutanan. Vol. 7: 1-13
- Fengel D, Wegener G. 1989. Kayu: Kimia, ultrastuktur, reaksi-reaksi. Gadjah Mada University Press (diterjemahkan oleh Sastrohamidjojo, H.). Yogyakarta.
- Ferreira J P A, Miranda I, Gominho J, Pereira H. 2015. Selective fractioning of *Pseudotsuga menziesii* bark and chemical characterization in view of an integrated valorization. Industrial Crops and Products Vol. 74: 998–1007
- Fitri A, Toharmat T, Astuti D A, Tamura H. 2015. The Potential use of secondary metabolites in *Moringa oleifera* as an antioxidant source. Media Peternakan Vol. 38: 169-175
- Gan R Y, Chan C L, Yang Q Q, Li H B, Zhang D, Ge Y Y, Corke H. 2019. Bioactive compounds and beneficial functions of sprouted grains. Sprouted Grains Vol. 1: 191–246
- Gao H, Shupe T F, Eberhardt T, Hse C Y. 2006. Antioxidant activity of extracts from the wood and bark of Port-Orford cedar. Wood Science Vol. 53: 147-152
- Genet H, Breda N, Dufrene E. 2010. Age-related variation in carbon allocation at tree and stand scales in beech (*Fagus sylvatica* L.) and sessile oak (*Quercus petraea* (Matt.) Liebl.) using a chronosequence approach. Tree Physiology Vol. 30: 177–192
- Gominho J, Figuera J, Rodrigues C J. 2001. Within tree variations of heartwood, extractions and wood density in the eucalyptus hybrid urograndis. Wood and Fiber Science Vol. 33: 3-8
- Gruber A, Pirkebner D, Oberhuber W, Wieser G. 2011. Spatial and seasonal variations in mobile carbohydrates in *Pinus cembra* the timberline ecotone of the Central Austrian Alps. European Journal of Forest Research Vol. 130: 173–179
- Gust J, Suwalski J. 1994. Use of mössbauer spectroscopy to study reaction products of

- polyphenols and iron compounds. *Corrosion* Vol. 50: 355–365
- Hall M, Hansen N W, Rudra A B. 1973. The effect of species, age and wood characteristics on eucalypt kraft pulp quality. *Appita* Vol. 26: 348 – 354
- Harborne J B. 1980. Secondary plant products: encyclopedia of plant physiology. New Series Volume 8. *Phytochemistry* Vol. 19: 2803–2804
- Hart J H, Shrimpton D M. 1979. Role of stilbenes in resistance of wood to decay. *Phytopathology* Vol. 69: 1138-1143
- Hart J H. 1989. The Role of wood Exudate and extractives in protecting wood from decay. In: Rowe J.W. (eds) *Natural products of woody plants*. Springer Series in Wood Science. Berlin
- Hata K, Sogo M. 1952. The difficulty of sulfite digestion of pine heartwood. *Japan Forest Society* Vol. 35: 74-77
- Haupt M, Leithoff H, Meier D, Puls J, Richter H G, Faix O. 2003. Heartwood extractives and natural durability of plantation-grown teakwood (*Tectona grandis* L.) – a case study. *Holz Roh Werkst* Vol. 61: 473–474
- Heim K E, Tagliaferro A R, Bobilya D J. 2002. Flavonoid antioxidants: chemistry, metabolism and structure-activity relationships. *Nutrition Biochemistry* Vol. 13: 572-584.
- Hidayati F, Marsoem S N. 2010. Anatomi dan sifat fisika kayu jati unggul (*Tectona grandis* L.f.) umur 5 tahun yang tumbuh di Gunung Kidul pada berbagai laju pertumbuhan. Tesis Fakultas Kehutanan Universitas Gadjah Mada. Yogyakarta
- Hidayati F, Fajrin I T, Ridho M R, Nugroho W D, Marsoem S N, Na'iem M. 2016. Sifat fisika dan mekanika kayu jati unggul mega dan kayu jati konvensional yang ditanam di Hutan Pendidikan Wanagama, Gunungkidul, Yogyakarta. *Jurnal Ilmu Kehutanan* Vol. 10: 98-107
- Higgins H G. 1984. Pulp and paper. In: Hillis W E, Brown A G (eds) *Eucalypts for wood production*. CSIRO Academic Press. New York
- Hillis W E. 1971. Distribution, properties and formation of Some wood extractives. *Wood Science and Technology* Vol. 5: 272—289
- Hillis W E. 1987. *Heartwood and tree exudates*. Springer. New York
- Hillis W E, Sumimoto M. 1989. Effect of extractives on pulp. In: Rowe J W (eds) *Natural products of woody plants*. Springer Series in Wood Science. Berlin

- Hillis W E, Hasegawa M. 1963. The formation of polyphenols in trees I. Administration of c glucose and subsequent distribution of radioactivity. *Phytochemistry* Vol. 2: 195–199
- Howard E T. 1972. Physical and chemical properties of slash pine tree parts. *Wood Science* Vol. 5: 312 – 317
- Hoch G, Richter A, Korner C. 2003. Non-structural carbon compounds in temperate forest trees. *Plant, Cell and Environment* Vol. 26: 1067–1081
- Hse C, Kuo M. 1988. Influence of extractives on wood gluing and finishing. *Forest Products Journal* Vol. 38: 52-56
- Ihda F V. 2019. Kadar ekstraktif dan sifat warna dari jenis permudaan jati. Skripsi Fakultas Kehutanan UGM. Yogyakarta
- Irawati D, Azwar N R, Syafii W, Artika I M. 2009. Pemanfaatan serbuk kayu untuk produksi etanol dengan perlakuan pendahuluan delignifikasi menggunakan jamur *Phanerochaete chrysosporium*. *Jurnal Ilmu Kehutanan* Vol. 3: 13-22.
- Kabtni S, Sdouga D, Bettaib R I. 2020. Influence of climate variation on phenolic composition and antioxidant capacity of *Medicago minima* populations. *Scientific Report* Vol. 10: 82-93
- Kadambi K. 1972. Silviculture and management of teak. Stephen F Austin State University. Texas
- Kampe A, Magel E. 2013. New insights into heartwood and heartwood formation: Cellular aspects of wood formation. Springer. Berlin
- Kannan S, Kelly R G. 1996. The role of dihydroxybenzenes and oxygen on the corrosion of steel in black liquor. *Corrosion Science* Vol. 38: 1051–1069
- Kaosa-ard A. 1981. Teak (*Tectona grandis* Linn. f)- its natural distribution and related factors. *Natural His Siam Society* Vol. 29: 55-74.
- Kaškonienė V, Maruška A, Kornysova O, Charczun N, Ligor M, Buszewski B. 2009. Quantitative and qualitative determination of phenolic compound in honey. *Chemine Technologija* Vol. 3: 74-80
- Kininmonth J A. 1986. Wood from fast-grown, short-rotation trees. Proceedings 18th IUFRO World Congress. Division 5 Forest Products. Ljubljana.

- Klein T, Hoch G, Yakir D, Korner C. 2014. Drought stress, growth and nonstructural carbohydrate dynamics of pine trees in a semi-arid forest. *Tree Physiology* Vol. 34: 981–992
- Kokutse A D, Stokes A, Bailleres H, Kokou K, Baudasse C. 2006. Decay resistance of Togolese teak (*Tectona grandis* L.) heartwood and relationship with colour. *Trees* Vol. 20: 219–223.
- Kollert W, Kleine M. 2017. The global teak study: Analysis, evaluation and future potential of teak resources. International Union of Forestry Organizations. IUFRO World Series Volume 36. Viena
- Korner C. 2003. Carbon limitation in trees. *Journal of Ecology* Vol. 91: 4–17
- ozlowski T T. 1992. Carbohydrate sources and sinks in woody plants. *The Botanical Review* Vol. 58: 107–222
- Krisdianto, Sumarni G. 2006. Perbandingan persentase volume teras kayu jati cepat tumbuh dan konvensional umur 7 tahun asal Penajam, Kalimantan Timur. *Jurnal Penelitian Hasil Hutan* Vol. 24: 385-394
- Król A, Amarowicz R, Weidner S. 2014. Changes in the composition of phenolic compounds and antioxidant properties of grapevine roots and leaves (*Vitis vinifera* L.) under continuous of long-term drought stress. *Acta Physiologiae Plantarum* Vol. 36: 1491–1499
- Kubczak M, Khassenova A B, Skalski B, Michlewska S, Wielanek M, Aralbayeva A. N, Murzahkmetova M K, Zamaraeva M, Sklodowska M, Bryszewska M I M. 2020. Bioactive compounds and antiradical activity of the *Rosa canina* L. leaf and twig extracts. *Agronomy* Vol. 10: 1-20
- Ku C S, Jang J P, Mun S P. 2007. Exploitation of polyphenol-rich pine barks for antioxidant activity. *Wood Science* Vol. 53: 524-528.
- Labosky P. 1979. Chemical constituents of four southern pine parks. *Wood Science* 12: 80–85.
- Lachowicz H, Hanna W, Rafal W, Magdalena S. 2019. The effect of tree age on the chemical composition of the wood of Silver Birch (*Betula pendula* Roth) in Poland. *Wood Science and Technology* Vol. 53: 1135–1155

- Laks P E. 1991. Chemistry of bark. In: Hon, D N S, Shiraishi N (ed), Wood and cellulosic chemistry. NY: Marcel Dekker Inc. New York
- Lamounier K C, Cunha L C S, de Moraes S A L, de Aquino F J T, Chang R E, do Nascimento R T, de Souza M G M, Martins C H G, Cunha W R. 2012. Chemical analysis and study of phenolics, antioxidant activity, and antibacterial effect of the wood and bark of *Maclura tinctoria* (L.) D. Don ex Steud. Evidence-based Complementary and Alternative Medicine Vol. 2012: 1-8
- Lattanzio V, Kroon P A, Quidheau S, Treutter D. 2008. Recent advances in polyphenol research plant phenolics secondary metabolites with diverse functions. Blackwell Publishing. Foggia
- Lelis R. 1992. Zum verhalten von splint-und kernholz der kiefer bei der verleimung mit harnstoffformaldehydharzen (UF-harzen) und diisocyanat-klebstoffen (PMDI). Magisterarbeit an der Forstlichen Fakultät der Georg-August-Universität Göttingen. Göttingen
- Le Normand M, Ulrica E, Holmbom B, Monica E K. 2012. Hot-water extraction and characterization of spruce bark non-cellulosic polysaccharides. Nordic Pulp and Paper Research Journal Vol. 27: 18–023
- Li-Paul H. 1989. Low temperature stress physiology in crops. CRC Press Inc. Florida
- Lloret F, Sapes G, Rosas T, Galiano L, Saura-Mas S, Sala A, Martínez-Vilalta J. 2018. Non-structural carbohydrate dynamics associated with drought-induced die-off in woody species of a shrubland community. Annals of Botany Vol. 121: 1383–1396
- Lukmandaru G, Takahashi K. 2008 Variation in the natural termite resistance of teak (*Tectona grandis* Linn.fil.) wood as a function of tree age. Annals of Forest Science Vol. 65: 708
- Lukmandaru G. 2009a. Pengukuran kadar ekstraktif dan sifat warna pada kayu teras jati doreng (*Tectona grandis*). Jurnal Ilmu Kehutanan Vol. 3: 67-73
- Lukmandaru G. 2009b. Sifat kimia dan warna kayu teras jati pada tiga umur berbeda. Tropical Wood Science and Technology Vol. 7: 1-8
- Lukmandaru G, Takahashi K. 2009. Radial distribution of quinone in plantation teak (*Tectona grandis* L.f.). Annals of Forest Science Vol. 66: 605

- Lukmandaru G. 2011. Variability in the natural termite resistance of plantation teak wood and its relations with wood extractive content and color properties. *Indonesian Journal of Forestry Research* Vol. 8:17–31
- Lukmandaru G. 2013. The natural resistance of teak wood grown in community forest. *Ilmu dan Teknologi Kayu Tropis* Vol. 11: 131-139
- Lukmandaru G. 2016. Hubungan kadar ekstraktif dengan sifat warna kayu teras jati. *Jurnal Penelitian Hasil Hutan* Vol. 34: 207 - 216.
- Lukmandaru G. 2015. Antitermitic activity of the bark extracts of teak. *Proceeding of The Fifth International Symposium of Indonesia Wood Research Society*.
- Luo Z B, Calfapietra C, Liberloo M, Scarascia-mugnozza G, Polle A. 2006. Carbon partitioning to mobile and structural fractions in poplar wood under elevated CO₂ (Euroface) and N fertilization. *Global Change Biology* Vol. 12: 272–283
- Magel E, Einig W, Hampp, R. 2000. Carbohydrates in trees in carbohydrate reserves in plants - Synthesis and regulation. *Elsivier Science*. Ludhiana
- Martawijaya A, Kartasujana I, Kadir K, Prawira S.A. 2005. Atlas kayu Indonesia jilid I. Badan Penelitian dan Pengembangan Kehutanan. CV. Miranti. Bogor
- Masendra, Ashitani T, Takahashi K, Susanto Mudji, Lukmandaru, G. 2019. Hydrophilic extracts of the bark from six pines species. *Korean Wood Science Technology* Vol. 47: 80-89
- Matangaran J R, Romadoni A. 2012. Limbah pemanenan jati di Bayuwangi Jawa Timur. *Perennial* Vol. 8: 88.
- Maulida F, Meiganati K B, Maslahat M. 2020. Komponen kimia kayu trubusan Jati Unggul Nusantara (JUN) pada bagian pangkal, tengah, ujung. *Sains Natural UNB* Vol. 10: 55-60
- Mawardi P. 2012. Kaya dari investasi jati barokah. PT Agro Media Pustaka. Jakarta
- McDonald M, Mila I, Scalbert A. 1996. Precipitation of metal ions by plant polyphenols: optimal conditions and origin of precipitation. *Agriculture Food Chemistry* Vol. 44: 599-606
- McGinnis G D, Parikh, S. 1975. The chemical constituents of loblolly pine. *Wood Science* Vol. 7: 295–297

- Meiganati K B. 2017. Riap pertumbuhan jati unggul nusantara rotasi kedua di kebun percobaan Cogreg Universitas Nusa Bangsa. *Nusa Sylvae* Vol. 17: 101 - 105
- Metsamuuronen S, Siren H. 2019. Bioactive phenolic compounds, metabolism and properties: a review on valuable chemical compounds in Scots pine and Norway spruce. *Phytochem Review* Vol. 18: 623-664
- Midgley S J, Stevens P R, Arnold R J. 2017. Hidden assets: Asia's smallholder wood resources and their contribution to supply chains of commercial wood. *Australian Forestry* Vol. 80: 10-25
- Migita N Y, Yonezawa, Kondo T. 1968. Wood chemistry (in Japanese). Kyoritsu Shupan. Tokyo
- Miranda I, Souza V, Pereira H. 2011. Wood properties of teak (*Tectona grandis*) from a mature unmanaged stand in East Timor. *Wood Science* Vol. 57: 171-178
- Miranda I, Pereira H. 2002. The variation of chemical composition and pulping yield with age and growth factors in young *Eucalyptus globulus*. *Wood Fiber Science* Vol. 34:140-145
- Morais M C, Helena P. 2012. Variation of extractives content in heartwood and sapwood of *Eucalyptus globulus* trees. *Wood Science and Technology* Vol. 46:709-719.
- Mota G S, Sartori C J, Miranda I, Quilhó T, Mori F A, Pereira H. 2017. Bark anatomy, chemical composition and ethanol-water extract composition of *Anadenanthera peregrina* and *Anadenanthera colubrina*. *Plos One* Vol. 12: 1-14
- Moya R, Ledezma V A. 2003. Effect of plantation spacing on physical properties of teakwood along the stem (in Spanish). *Madera Bosques* Vol. 9: 15-27
- Narayanamurthi D, George J, Pant H C, Singh J. 1962. Extractives in teak. *Sylvae geneticae* Vol. 11: 57-63.
- Negi A, Nimisha S, Reetika P, Singh M F. 2012. Determination of total phenolic content of stem the stem bark of *Bauhinia variegata* Linn; an Approach to Standardization. *Pharma Research* Vol. 7: 16 - 22
- Neiva D M, Araujo S, Gominhoa J, Carneiro A D C, Pereira H. 2018. Potential of *Eucalyptus Globulus* industrial bark as a biorefinery feedstock: Chemical and fuel characterization. *Industrial Crops and Products* Vol. 123: 262-270
- Newell E A, Mulkey S S, Wright J S. 2002. Seasonal patterns of carbohydrate storage

in four tropical tree species. *Oecologia* Vol. 131: 333–342

Niamké B F, Amusant N, Kokutse A D, Chaix G, Charpentier J-P, Adima A A, Kati Coulibaly S, Jay-Allemand C. 2010. Radial distribution of non-structural carbohydrates in Malaysian teak. *Biological and Chemical Science* Vol. 4: 710-720

Niamké B F, Amusant N, Charpentier J-P, Chaix G, Baissac Y, Boutahar N, Adima A A, Kati-Coulibaly S, Jay-Allemand C. 2011. Relationships between biochemical attributes (non-structural carbohydrates and phenolics) and natural durability against fungi in dry teak wood (*Tectona grandis* L.). *Annals Forest Science* Vol. 68: 201-211

Niamke B F, Adima A A, Seraphin K, Amusant N, Jay-Allemand C. 2018. Heartwood formation process in teak (*Tectona grandis* L): fate of non-structural carbohydrates and characterization of forsythoside B. *International Journal of Biological and Chemical Sciences* Vol. 12: 1102-1112

Niinemets Ü. 2010. Responses of forest trees to single and multiple environmental stresses from seedlings to mature plants: Past stress history, stress interactions, tolerance and acclimation. *Forest Ecology and Management* Vol. 260: 1623–1639

Nisula L. 2018. Wood extractives in conifer : A study of stemwood and knots of industrially important species. Abo Academy University Press. Tavastgatan

Noel J P, Austin M B, Bomati E K. 2005. Structure–function relationships in plant phenylpropanoid biosynthesis. *Plant Biology* Vol. 8: 249–253

Noreen H, Semmar N, Farman M, McCullagh J S O. 2017. Measurement of total phenolic content and antioxidant activity of aerial parts of medicinal plant *Coronopus didymus*. *Asian Pacific Journal of Tropical Medicine* Vol. 10: 792-801

Oberhuber W, Swidrak I, Pirkebner D, Gruber A. 2011. Temporal dynamics of nonstructural carbohydrates and xylem growth in (*Pinus sylvestris*) exposed to drought. *Canadian Journal of Forest Research* Vol. 41: 1590–1597

Panshin A.J, Zeeuw C D, Brown H P. 1964. Textbook of wood technology. Volume I-structure, identification, uses, and properties of the commercial woods of the United States. McGraw-Hill Book Company.

Payá M, Halliwell B, Hoult J R S. 1992. Interactions of a series of coumarins with reactive oxygen species. Scavenging of superoxide, hypochlorous acid and

- hydroxyl radicals. *Biochemistry and Pharmacology* Vol. 44: 205-214
- Pereira D M, Patricia V, Jose A P, Paula B A. 2009. Fenolics : From chemistry to biology. *Molecules* Vol. 14: 2202-2211
- Pereira H. 1986. Variability in the chemical composition of plantation eucalypts (*Eucalyptus globulus*). *Wood and Fiber Science* Vol. 20: 82 - 90
- Pérez L D, Kanninen M. 2003. Heartwood, sapwood and bark content, and wood dry density of young and mature teak (*Tectona grandis*) trees grown in Costa Rica. *Silva Fenn* Vol. 37: 45–54
- Pérez L D, Kanninen M. 2005. Effect of thinning on stem form and wood characteristics of teak (*Tectona grandis*) in a humid tropical site in Costa Rica. *Silva Fenn* Vol. 39: 217–225
- Piper F I, Fajardo A. 2011. No evidence of carbon limitation with tree age and height in *Nothofagus pumilio* under Mediterranean and temperate climate conditions. *Annals of Botany* Vol. 108(5), 907–917
- Piper F I. 2020. Decoupling between growth rate and storage remobilisation in broadleaf temperate tree species. *Functional Ecology* Vol.34: 1180-1192
- Plavcová L, Jansen S. 2015. The role of xylem parenchyma in the storage and utilization of nonstructural carbohydrates: Functional and Ecological Xylem Anatomy. Springer. Cham
- Posch B, Wegener G, Grosser D, Wagner L. 2004. Physikalische und mechanische Untersuchungen an Teakholz (*Tectona grandis* L.f.) aus Plantagen in Panama. *Holz Roh Werkst* Vol. 63: 31–35
- Pratiwi D D. 2018. Komposisi kimia ekstraktif kulit luar dan dalam kayu *Araucaria cunninghamii*, *Araucaria papuana*, *Agathis loranthifolia* dan *Podocarpus imbricatus*. Skripsi Fakultas Kehutanan UGM. Yogyakarta
- Purba B A V. 2019. Kandungan dan aktivitas antioksidan ekstraktif kayu tiga klon hibrid akasia (*Acacia mangium* x *Acacia auriculiformis*). Skripsi Fakultas Kehutanan UGM. Yogyakarta
- Putri K. 2009. Pengelolaan hutan berbasis masyarakat tersertifikasi di Kabupaten Konawe Selatan , Sulawesi Tenggara. Skripsi Fakultas Kehutanan IPB. Bogor
- Putro G S, Marsoem S N, Sulistyo J, Hadiwinoto S. 2020. Sifat kayu jati unggul nusantara (*Tectona grandis* L.f) pada tiga kelas diameter pohon. Pemuliaan

Tanaman Hutan Vol 14: 9 - 18.

Qiu H, Ru L, Ling L. 2019. Analysis of chemical composition by acetone and the chromatic aberration of teak (*Tectona grandis* L.f) from China. *Molecules* Vol. 24: 1-11

Reddy C V K, Sreeramulu D, Raghunath M. 2010. Antioxidant activity of fresh and dry fruits commonly consumed in India. *Food Research International* Vol. 43: 285–288.

Richardson A D, Carbone M S, Keenan T F, Czimczik C I, Hollinger D Y, Murakami P, Schaberg P G, Xu X. 2013. Seasonal dynamics and age of stemwood nonstructural carbohydrates in temperate forest trees. *New Phytologist* Vol. 197: 850–861

Rizanti D E, Wayan D, Beatrice G, Andre M, Stephane D, Hubert C, Christiane G, Eric Gelhaye, Phila R, Rita K S, Syafii W, Rozi M, Philippe G. 2018. Comparison of teak wood properties according to forest management: Short versus long rotation. *Annals of Forest Science* Vol. 75: 39

Roffael E. 2016. Significance of wood extractives for wood bonding. *Applied Microbiol Biotechnology* Vol. 100: 1589–1596

Rosales-Castro M, Honorato-Salazar J A, Reyes-Navarrete M. G, González-Laredo R F. 2015. Antioxidant phenolic compounds of ethanolic and aqueous extracts from pink cedar (*Acrocarpus fraxinifolius*) whight & arn bark at two tree ages. *Wood Chemistry and Technology* Vol. 35: 270–279

Rosell J A. 2019. Bark in woody plants: understanding the diversity of a multifunctional structure. National Laboratory of Sustainability Sciences, Institute of Ecology University Nacional Autónoma de México. Mexico

Rosell J A, Piper F I, Jiménez-Vera C, Vergílio P C B, Marcati C R, Castorena M, Olson M. E. 2020. Inner bark as a crucial tissue for non-structural carbohydrate storage across three tropical woody plant communities. *Plant, Cell & Environment* Vol. 44: 156-170

Rudman P, Da Costa EWB. 1959. Variation in extractive content and decay resistance of *Tectona grandis*. *Inst Wood Science* Vol. 3: 33–42

Routa J, Perttu A, Antti A. 2017. Wood extractives of finnish pine, spruce and birch – availability and optimal sources of ompounds: A Literature Review. Juvenes. Helshinki.

- Rowell R M, Roger P, Mandla A T. 2012. Wood chemistry and wood composites. CRC Press. London
- Sakai K. 2001. Chemistry of bark in wood and cellulosic chemistry: Second edition, revised and expanded. Marcel Decker Inc. New York
- Sala A, Hoch G. 2009. Height-related growth declines in ponderosa pine are not due to carbon limitation. *Plant, Cell and Environment* Vol. 32: 22–30
- Sandermann W, Dehn U V. 1951. Einfluß chemischer Faktoren auf die Festigkeitseigenschaften zementgebundener Holzwolleplatten. *Holz Roh Werkst* Vol. 9: 97–101
- Santana W M S, Natalino C, Arantes M D C, Trugilho P F. 2012. Effect of age and diameter class on the properties of wood from clonal eucalyptus. *Cerne, Lavras* Vol. 18: 1-8
- Sarawong C, Schoenlechner R, Sekiguchi K, Berghofer E, Nguyen P K W. 2014. Effect of extrusion cooking on the physicochemical properties, resistant starch, phenolic content and antioxidant capacities of green banana flour. *Food Chemistry* Vol. 143: 33–39
- Savage J. A, Clearwater M. J, Haines D. F, Klein T, Mencuccini, M, Sevanto S, Turgeon Robert, Zhang C. 2016. Allocation, stress tolerance and carbon transport in plants: how does phloem physiology affect plant ecology? *Plant, Cell & Environment* Vol. 39: 709–725
- Scheffer T C, Cowling E B. 1966. Natural resistance of wood to microbial deterioration. *Annal Review Phytopathology* Vol. 4: 147-170
- Schofield P, Mbugua D M, Pell A N. 2001. Analysis of condensed tannins: A review. *Anim. Feed ScienceTechnology* Vol. 91: 21–40
- Silverio F O, Barbisa L C A, Maltha C R A, Silvestre A J D, Veloso D P, Gomide J L. 2007. Lipophilic Extractives of *E. urogandis*. *Bioresources* Vol. 2(2): 157-168.
- Simard S, Giovannelli A, Treydte K, Traversi M L, King G M, Frank D, Fonti P. 2013. Intra-annual dynamics of non-structural carbohydrates in the cambium of mature conifer trees reflects radial growth demands. *Tree Physiology* Vol. 33: 913-923
- Singh R, Singh S, Kumar S, Arora S. 2007. Studies on antioxidant potential of methanol extract/fractions of *Acacia auriculiformis* A. Cunn. *Food Chemistry* Vol. 103: 505–511

- Singleton V. L, Orthofer R, Lamuela-Raventós R. M. 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means of folin-ciocalteu reagent. *Methods in Enzymology* Vol. 299: 152-178
- Sjostrom E. 1995. Kimia kayu, dasar-dasar dan penggunaan edisi kedua. Diterjemahkan oleh Sastrohamidjojo, H. Terjemahan dari: Wood chemistry, fundamentals and application second edition. Gadjah Mada University Press. Yogyakarta.
- Someya S, Yoshiki Y, Okubo K. 2002. Antioxidant compounds from bananas (*Musa Cavendish*). *Food Chemistry* Vol. 79: 351–354
- Street R J. 1962. Exotic forest trees in the British Commonwealth. Clarendon Press. Oxford
- Sturgeon R J. 1990. Monosaccharides. In methods in plant biochemistry. Carbohydrates. Ed. P.M. Dey. Academic Press. London
- Sukardi, Mulyarto A R, Safera W. 2007. Optimasi waktu ekstraksi terhadap kandungan tanin pada bubuk ekstrak daun jambu biji (*Psidium folium*) serta biaya produksinya. *Jurnal Teknologi Pertanian* Vol. 8: 88 - 94
- Sumarna Y. 2003. Budi daya jati. Penebar Swadaya. Jakarta
- Supriono B, Setyaningsih L. 2012. Pertumbuhan Tanaman Jati Unggul Nusantara dengan Pola Agroforestry Umur Lima Tahun. *Jurnal Sains Natural Universitas Nusa Bangsa* Vol. 2: 179-185
- Susrusa I K B, Ardhana I P G. 2007. Kelayakan finansial budidaya tanaman jati (*Tectona grandis* Linn) varietas unggul di Kabupaten Buleleng. *Sosial Ekonomi Pertanian* Vol. 10: 189-198
- Swan B. 1968. Seasonal variations in the extractives of spruce wood and sulfite pulps. *Sven Papperstidn* Vol. 71: 436–440.
- Swason J W, Cordingly. 1959. Surface chemical studies on pitch. 11. The mechanism of the loss of absorbancy and development of self-sizing in paper made from wood pulp. *TAPPI* Vol. 42: 812-819
- Syafii W. 2000. The basic properties of Indonesia teakwood at various age classes. *Proceeding of the Third International Wood Science Symposium*. Kyoto
- Taylor A, Cooper P. 2002. The effect of stem girdling on wood quality. *Wood and Fiber Science* Vol. 34: 212-220.
- Thulasidas PK, Bhat KM 2007 Chemical extractive compounds determining the

- brown-rot decay resistance of teak wood. *Holz Roh Werkst* Vol. 65: 121–124
- Umezawa T. 2001. Chemistry of extractives in wood and cellulosic chemistry: Second edition, revised and expanded. Marcel Decker Inc. New York
- Valentão P, Fernandes E, Carvalho F, Andrade P.B, Seabra R.M, Bastos M.L. 2002. Antioxidative properties of cardoon (*Cynara cardunculus* L.) infusion against superoxide radical, hydroxyl radical and hypochlorous acid. *Agriculture Food Chemistry* Vol. 50: 4989-4993
- Valentão P, Fernandes E, Carvalho F, Andrade P.B, Seabra R.M, Bastos M.L. 2003. Hydroxyl radical and hypochlorous acid scavenging activity of small centaury (*Centaureum erythraea*) infusion. A comparative study with green tea (*Camellia sinensis*). *Phytomedicine* Vol. 10: 517- 522.
- Van-Sumere C.F. 1989. Phenols and phenolic acids. In: *Methods in Plant Biochemistry*, Vol. 1. Plant Phenolics (eds P.M. Dey & J.B. Harborne). Academic Press. London.
- Vázquez-León L. A, Páramo-Calderón D E, Robles-Olvera V J, Valdés-Rodríguez O A, Pérez-Vázquez A, García-Alvarado M. A, Rodríguez-Jimenes G. C. 2017. Variation in bioactive compounds and antiradical activity of *Moringa oleifera* leaves: influence of climatic factors, tree age, and soil parameters. *European Food Research and Technology* Vol. 243: 1593-1608
- Vermerris W, Nicholson R. 2006. Chemical Properties of Phenolic Compounds. *Phenolic Compound Biochemistry*. Springer. Florida
- Villagomez H Z, Peterson D M, Herrin L, Young R A. 2005. Antioxidant activity of different component of pine species. *Holzforschung*, Vol. 59: 156–162
- Vora D.J.D, 2017. Insight into the biochemical link between biodiversity and nutraceuticals. *IOSR Journal of Environmental Science, Toxicology and Food Technology* Vol. 11: 22–25
- Vuolo M. M, Lima V. S, Maróstica Junior M. R. 2019. Phenolic compounds: structure, classification, and antioxidant power. *bioactive compounds* Vol. 1: 33–50
- Wahyudi I, Arifien A F. 2005. Perbandingan struktur anatomis, sifat fisis, dan sifat mekanis kayu jati unggul dan kayu jati konvensional. *Jurnal Ilmu & Teknologi Kayu Tropis* Vol. 3: 9-15.
- Wahyudi I, Priadi T, Rahayu I S. 2014a. Karakteristik dan sifat-sifat dasar kayu jati unggul umur 4 dan 5 tahun asal Jawa Barat. *Jurnal Ilmu Pertanian Indonesia* Vol. 19: 50-56.
- Wahyudi I, Sinaga DKD, Muhran, Jasni LB. 2014b. Pengaruh jarak tanam terhadap pertumbuhan pohon dan beberapa sifat fisis-mekanis kayu jati cepat tumbuh.

- Jurnal Ilmu Pertanian Indonesia Vol. 19: 204-210.
- Waliszewska B, Wlodzimierz P, Magdalena Z, Agata S W, Hanna W, Agnieszka S D. 2015. The diversification of chemical composition of pine wood depending on tree age. *Forestry and Wood Technology* Vol. 91: 182-187
- Wardani B W, Budi S. 2009. Pertumbuhan tanaman jati dari berbagai ras lahan di Pulau Muna. *Jurnal Penelitian Hutan Tanaman* Vol. 6: 63 – 71
- White K. J. 1991. Teak: some aspects of research and development. Publication 1991/17. FAO Regional Office for Asia and the Pacific (RAPA). Bangkok
- Windeisen E, Klassen A, Wegener G. 2003. On the chemical characterisation of plantation teakwood from Panama. *Holz Roh Werkst* Vol. 61: 416–418
- Withouck H, Boeykens A, Luyten W, Lavigne R, Wagemans J, Broucke M V. 2019. Phenolic composition, antimicrobial and antioxidant properties of belgian apple wood extracts. *Journal of Biologically Active Products from Nature* Vol. 9: 24–38
- Woo W L, Watson P, Mansfield S D. 2005. The effect of pine mountain beetle attack on lodgepole pine wood morphology and chemistry: implication for wood and fiber quality. *Wood and Fiber Science* Vol. 37: 112–126
- Woodruff D R, Meinzer F C. 2011. Water stress, shoot growth and storage of non-structural carbohydrates along a tree height gradient in a tall conifer. *Plant, Cell Environment* Vol. 34: 1920–1930
- Würth M K R, Peláez-Riedl S, Wright S J, Körner C. 2004. Non-structural carbohydrate pools in a tropical forest. *Oecologia* Vol. 143: 11–24
- Yang C S, Landau J M, Huang M T, Newmark H L. 2001. Inhibition of carcinogenesis by dietary polyphenolic compounds. *Annual Review Nutrition* Vol. 21: 381-406.
- Yeh T F, Braun J L, Goldfarb B, Chang H, Kadla J F. 2006. Morphological and chemical variations between juvenile wood, mature wood, and compression wood of loblolly pine (*Pinus taeda* L.). *Holzforschung* Vol. 60: 1–8
- Yongram C, Sungthong B, Puthongking P, Weerapreeyakul N. 2019. Chemical composition, antioxidant and cytotoxicity activities of leaves, bark, twigs and oleo-resin of *Dipterocarpus alatus*. *Molecules* Vol. 24: 3083–3090
- Yu L W Y, Jin J W, Gangcheng J Q, Wang X. 2020. Effects of tree age on the chemical compositions and antioxidant activities of ‘Coratina’ and ‘Koroneiki’ olive oils from youth trees in China. Jiangnan University. Wuxi
- Zelinka S L, Stone D S. 2011. The effect of tannins and pH on the corrosion of steel in wood extracts Vol. 62: 739–744

- Zhang H, Wang C, Wang X. 2014. Spatial variations in non-structural carbohydrates in stems of twelve temperate tree species. *Trees* Vol. 28: 77–89
- Zhang Q, Jia X, Shao M, Ma C. 2018. Unfolding non-structural carbohydrates from Sapling to dying black locust on China's Loess Plateau. *Journal of Plant Growth Regulation* Vol. 37: 794–802
- Zobel B J, Buijtenen J P. 1989. Wood variation – Its causes and control. *International Association of Wood Anatomists Journal* Vol. 10: 1-363
- Villagomez H Z, Peterson D M, Herrin L, Young R A. 2005. Antioxidant activity of different components of pine species. *Holzforschung* Vol. 59: 156-162
- Zule J, Cufar Ca, Tisler V. 2015. Lipophilic extractives in heartwood of european larch (*Larix decidua* Mill). *Drvna Industrija* Vol. 66: 305 – 313
- Zulkahfi. 2019. Kadar ekstraktif dan ketahanan terhadap jamur pada kayu Jati Plus Perhutani dengan perlakuan peneresan. Tesis Fakultas Kehutanan UGM. Yogyakarta.
- Zulkahfi, Irawati D, Listyanto T, Rodiana D, Lukmandaru, G. 2020. Kadar ekstraktif dan sifat warna kayu jati plus Perhutani umur 11 tahun dari KPH Ngawi. *Ilmu Kehutanan* Vol. 14: 213-227