TIMBER TECHNOLOGY BULLETIN
NO. 80, 2018
ISSN: 139-258

WOOD PROPERTIES OF TWO SELECTED PIONEER SPECIES: LUDAI (*SAPIUM* SP.) AND MAHANG (*MACARANGA* SP.)

AS Nordahlia, UMK Anwar, H Hamdan, SC Lim, MM Iskandar & SS How

INTRODUCTION

There are 14 pioneer species that grow fast and have the potential for forest plantation, and they are: samak (*Adinandra* spp.), pulai (*Alstonia* spp.), kelempayan (*Neolamarckia cadamba*), terap (*Artocarpus* spp.), mendong (*Elaeocarpus* spp.), sesendok (*Endospermum* sp.), ubah (*Glochidion* spp.), mahang (*Macaranga* spp.), balik angin (*Mallotus* spp.), batai (*Paraserianthes falcataria*), mempoyan (*Rhodamnia* spp), ludai (*Sapium* spp.), mengkirai (*Trema* spp.) and binuang (*Octomeles sumatrana*) (Cheah 1995). From these 14 pioneer species 4 of them have been planted as plantation timbers, and they are: kelempayan, sesendok, batai and binuang. The information on their properties has been presented in the Timber Technology Bulletin No. 51 & 54. Fast growing species like *Acacia mangium*, *Gmelina arborea* and *Paraserianthes falcataria* have been planted in the early 1980s. Among these species, *Acacia mangium* is one of the most widely planted with the objective to produce general utility timber (Abdul Rasip et al. 2004). Other fast growing species that are promoted for forest plantation program are *Azadirachta excelsa* (sentang), *Khaya ivorensis* (African mahogany) and *Hevea brasiliensis* (rubberwood) (Zaini Ithnin 2010). In addition to the species mentioned above, it is also planned that future forest plantation program should include pioneer species as they are fast growing and probably easy to care for. In this paper, selected wood properties, viz. density, shrinkage from green to air dry, modulus of rupture, modulus of elasticity, compression stress, shear stress parallel to the grain and also anatomical features of two pioneer timbers, i.e., ludai (*Sapium* sp.) and mahang (*Macaranga* sp.) with potential for forest plantation are described.

Ludai and mahang belong to the family of Euphorbiaceae. There are four species of Ludai in Peninsular Malaysia namely *S. baccatum*, *S. discolor*, *S. indicum* and *S. insigne* (Whitmore 1972). Trees of ludai range from small to large size up to 36 m height and 180 cm girth. They are found scattered throughout the country and could be found in the lowlands up to 600 m level, along rivers and inland edges of mangrove swamps. Ludai trees could be identified by smooth bark or finely fissured and dark grey in colour (Figure 1). The leaves of Ludai are in spiral form, with a long stalk and often with glands near tip.

Mahang trees range from small to medium size up to 24 m tall and 150 cm girth and grow very fast and gregarious in cleared areas. Mahang trees could be characterized by smooth and grey bark. The leaves are in spiral form, large, palmately nerved, and the stalk is often long (Figure 2). There are 27 species of Mahang in which 7 of them may grow to timber size namely *M. amissa*, *M. conifera*, *M. diepenhorstii*, *M. gigantea*, *M. hosei*, *M. puncticulata* and *M. recurvate* (Whitmore 1972). Figures 3–4 shows logs of ludai and mahang respectively.

Figure 1 Ludai tree

Figure 2 Mahang tree

Figure 3 Logs of ludai

Figure 4 Logs of mahang

GENERAL CHARACTERISTICS

Ludai: The sapwood is not differentiated from the heartwood, which is light yellow-brown, with a pinkish tinge (Figure 5). Dark coloured core wood may be present. Texture is moderately coarse but even, with straight or deeply interlocked and sometimes wavy grain. Latex traces in the form of small holes can be seen on the flat-sawn surface (Lim & Chung 2002).

Mahang: Sapwood is not well-defined from the heartwood which is light brown, occasionally with a pinkish tinge (Figure 6). Texture is moderately fine and even, with straight to shallowly interlocked grain (Lim & Chung 2002).

Figure 5 Disc of ludai tree

Figure 6 Cross-cut section of mahang log

PROPERTIES, DURABILITY AND TREATABILITY

Ludai: The timber is soft and light with a density of 285–470 kg m^{-3} air dry. It is easy to saw and works well with all tools. The planed surface is smooth. However, the timber has a slight blunting effect on sawteeth due to the fibrous nature of the wood. The timber seasons fairly rapidly with little defects, except for some insect attacks and some staining by fungi. In terms of drying, 15 mm thick boards take 2 months to air dry, while 40 mm thick boards take 3 months. Shrinkage is very low, radial shrinkage averages at 0.8% while tangential shrinkage averages at 1.8%. The timber is non-durable under exposed conditions, but the timber can be impregnated with preservatives easily. The modulus of rupture, modulus of elasticity, compression parallel to grain and shear parallel to grain are 79 Nmm^{-2}, 9 209 Nmm^{-2}, 19.3 Nmm^{-2} and 5.1 Nmm^{-2} respectively (Lim et al. 2016).

Mahang: The timber is soft to moderately hard and light to moderately heavy, with density of most species ranging 270–495 kg m^{-3} air dry. The timber is classified under light hardwood in Malaysia. The timber is very easy to work, and the timber is non-siliceous. The timber dries fairly fast. Drying defects include split, bow and spring. Mahang timber is non-durable, it is succeptible to powder-post beetles and termite attacks. The timber is easy to treat with preservatives. The modulus of rupture, modulus of elasticity, compression parallel to grain and shear parallel to grain are 49.6 Nmm^{-2}, 6 728 Nmm^{-2}, 26.7 Nmm^{-2} and 6.56 Nmm^{-2} respectively (Lim et al. 2016).

A comparison of the properties and durability of ludai and mahang with seven other plantation species are shown in Table 1, and they are found to be comparable. Although most of the species from plantation are rated as non-durable they can easily be treated with preservative to enhance their durability.

Table 1 Comparison of ludai and mahang timbers with other plantation species

Timber	Timber classification	Density (kg m^{-3})	Shrinkage from green to air-dry %	MOR Nmm^{-2}	MOE Nmm^{-2}	Compression parallel to grain Nmm^{-2}	Shear parallel to grain Nmm^{-2}	Durability
Ludai	light hardwood	285–470	Tangential: 1.8 Radial: 0.8	79.0	9209	19.3	5.1	non-durable
Mahang	light hardwood	270–495	Tangential: 2.4 Radial: 1.5	49.6	6 728	26.7	6.6	non-durable
*Acacia	light hardwood	290–580	Tangential: 6.4 Radial: 2.7	111.0	10 764	53.0	16.0	non-durable
*Batai	light hardwood	220–430	Tangential: 3.7 Radial: 2.0	51.0	6 800	28.0	7.3	non-durable
*Binuang	light hardwood	270–465	Tangential: 7.0 Radial: 3.0	49.0	6 700	32.0	5.4	non-durable
*Kelempayan	light hardwood	370–465	Tangential: 2.1 Radial: 0.8	73.0	9 300	44.0	8.0	non-durable
*Sentang	light hardwood	550–780	Tangential: 1.2 Radial: 0.5	60.0	6 770	31.0	23.0	non-durable
*Sesenduk	light hardwood	305–655	Tangential: 1.3 Radial: 1.2	40.0	8 500	20.8	5.4	non-durable
*Rubberwood	light hardwood	480–650	Tangential: 1.9 Radial: 0.8	66.0	9 240	32.0	9.5	non-durable

*Source : Lim & Chung (2002); Lim et al. (2016)

ANATOMICAL FEATURES

Ludai (Figure 7): Vessels are predominantly solitary and in radial multiples of 2–6, the vessels diameter ranges from 150–310 µm. Tyloses and deposit are absent. Axial parenchyma is abundant, irregularly wavy, in narrow bands, and more distinct with hand lens than in the microscope due to lack of contrast with fibres. Rays are very fine and exclusively uniseriate.

Mahang (Figure 8): Vessels are solitary and in radial multiples of 2–3, vessels diameter ranges from 110–220 µm. Tyloses and deposit are absent. Axial parenchyma is in narrow bands, and more distinct with hand lens than in the microscope due to lack of contrast with fibres. Rays are very fine, with 1–2 seriate.

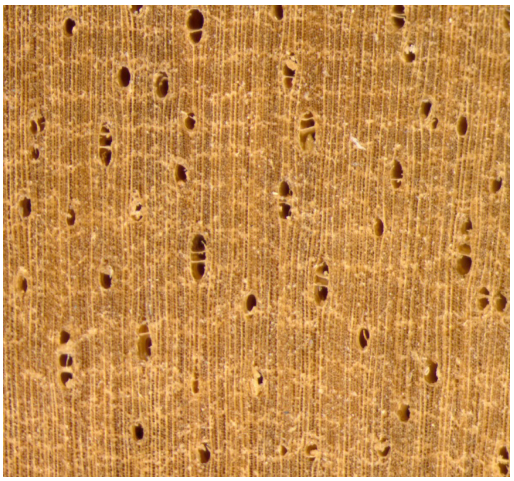

Figure 7 Anatomical features of ludai

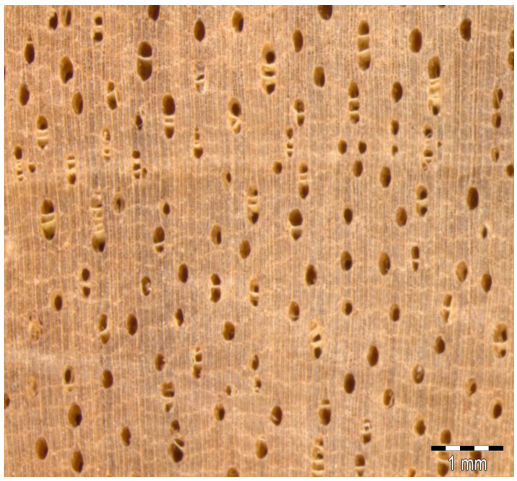

Figure 8 Anatomical features of mahang

The anatomical features of the two timbers can be categorized as large vessel according to the vessel category by Wheeler et al. (1989). According to Jayeola et al. (2009), generally species with large pores are light and suitable for general usage such as light weight furniture, cabinet making, boxes and others. Larger vessel, absent of tylosis and deposit, and having uniseriate rays make these two species suitable for impregnations and preservative treatment in enhancing their properties. As reported in the study by Sint et al. (2011) and Adeniyi et al. (2013) timbers with large pores, absent of tylosis and deposit, and having uniseriate rays are easy for impregnation and preservative treatment. Besides that, the anatomical features show that these two species have mostly uniseriate rays which can contribute to excellent nailing property. Okeke (1975) reported that timbers with multiseriate rays were poor in nailing property as compared to timbers with mostly uniseriate rays.

USES

Ludai: Suitable for the manufacture of boxes, crates, core veneer plywood manufacture, disposable chopstick, moulding, skirting, match boxes and splints. The timber is most likely to be suitable for pulp and paper manufacture (Lim & Chung 2002).

Mahang: Suitable for the manufacture of match splints, pulp and paper, particleboard, cement-bonded board, wall paneling, plywood, furniture and temporary construction. The timber of mahang also can be used for light framing, interior or trim, moulding and packing cases (Lim & Chung 2002).

CONCLUSION

The timbers of ludai and mahang have the potential for forest plantation since they are considered as fast growing species. On the other hand, their properties and durability are comparable to other plantation timbers. Ludai and mahang can also be easily treated with preservative to enhance their durability.

REFERENCES

Abdul Rasip AG, Ahmad Zuhaidi Y., Mohd Zaki A, Rosdi K, Mohd Noor M, Mohd Farid M & Mohd Fauzi MS. 2004. Matrix selected plantation species, Information Pamphlet, Forest Research Institute Malaysia.

Adeniyi IM, Adebagbo CA, Oladapo FM & Ayetan G. 2013. Utilisation of some selected wood species in relation to their anatomical features. *Global Journal of Science Frontier Research Agriculture and Veterinary* 13(9): 2249–4626.

Cheah LC. 1995. Pioneer Species for Fast Growing Tree Plantations in Malaysia-An Evaluation.

Jayeola AA, David OA & Abayomi EF. 2009. Use of wood characters in the identification of selected timber species in Nigeria. *Nat. Bot. Hort. Agrobot.* 37 (2): 28–32.

Lim SC & Chung RCK. 2002. A Dictionary of Malaysian Timbers. Second edition. *Malayan Forest Records* No.30. Kepong: Forest Research Institute Malaysia.

Lim SC, Nordahlia AS, Abd. Latif M., Gan KS & Rahim S. 2016. Identification and Properties of Malaysian Timbers. *Malaysian Forest Records No. 53*. Kepong: Forest Research Institute Malaysia.

Okeke RE. 1975. Wood anatomy and the identification of some Nigerian timber species. Forest Products Laboratory. Forestry Research Institute of Nigeria. Ibadan Pp 14.

Sint KM, Militz H & Hapla F. 2011. Treatability and penetration indices of four lesser-used Mynmmar Hardwoods. *Wood Research*. 56 (1):13–2.

Wheeler EA, Baas P, & Gasson PE. 1989. IAWA List of Microscopic Features for Hardwood Identification. *IAWA Bulletin* 10:219–332.

Whitmore TC. 1972. Tree Flora of Malaya: A Manual for Foresters. Volume 2. *Malayan Forest Records No. 26*. Kepong: Forest Research Institute Malaysia.

Zaini ithnin AR. 2010. Forest plantation programme in Malaysia—The way forward. Pp. 23–29 in Gan KS, Tan YE & Lim SC (eds) Proceedings of the Seminar and Workshop on improved utilization of tropical plantation timbers. FRIM.

Back issues

Available on-line (http://info.frim.gov.my/cfdocs/infocenter/booksonline/index cfm?menu=ttb)

TTB53	Focus on Forest Products
TTB54	Wood Properties of Selected Plantation Species: *Tectona grandis* (Teak), *Neolamarckia cadamba* (Kelempayan/Laran), *Octomeles sumatrana* (Binuang) and *Paraserianthes falcataria* (Batai)
TTB55	Identification of Selected Lesser-Known Timber 13: angsana/sena (*Pterocarpus* sp.), bayur (*Pterospermum* spp.), bebuta (*Excoecaria* spp.) and kekabu (*Bombax* spp.)
TTB56	Malaysian Timbers for Marine Scaffold Board Application
TTB57	Timber Properties and utilisation: Compilation of Timber Technology Bulletins 1995–2015
TTB58	Janka Hardness Rating of Malaysian Timbers
TTB59	Cross-Laminated Timber: Production of Panel Using Sesenduk Timber Species
TTB60	Comparison Between Graveyard and Laboratory Test Methods to Determine Natural Durability
TTB61	Natural Durability of Twenty Two Malaysian Commercial Timbers
TTB62	Relevant Mechanical Properties of Timber for Engineering
TTB63	An Overview of Manufacturing Process of Glued-Laminated Timber
TTB64	Introduction to Basic Wood Identification
TTB65	The potential of Activated Carbon From Bamboo for High End Electronic Applications
TTB66	Value Adding Wood Products by Wood Finishing
TTB67	The Essential of Wood Preservation for the Construction Industry
TTB68	Surface Functionalization of Nanocellulose and its Potential Application
TTB69	Scrimber from Sustainable Malaysian Bio-Resources
TTB70	Cross Laminated Timber (CLT) Structure: The First in Malaysia
TTB71	Verification of Products Sold As Gaharu
TTB72	Machining Properties of *Khaya ivorensis* and *Khaya senegalensis*
TTB73	Spacer Block: A Unique Timber Component in Canopy Walkway Structure
TTB74	Factors Influencing the Quality of Wood Adhesion Part 1: Chemical Interference
TTB75	Pocket Information on Malaysia Timbers
TTB76	Surface Quality of Some Malaysian Species Against Natural Weathering
TTB77	Durability Performance of Timber Grown on Ex-Mining and Bris Soil
TTB78	Factors Influencing The Quality of Wood Adhesion: Part 2: Glue Spreading
TTB79	Wood Coatings

It is planned that future forest plantation program should include pioneer species as they are fast growing and probably easy to care for. In this paper, two pioneer timbers, i.e., ludai (*Sapium* sp.) and mahang (*Macaranga* sp.) with potential for forest plantation are described. This paper reports selected wood properties, viz. density, shrinkage from green to air dry, modulus of rupture, modulus of elasticity, compression stress, shear stress parallel to the grain and also anatomical features of two pioneer timbers, i.e., ludai (*Sapium* sp.) and mahang (*Macaranga* sp.).

Series Editor : MK Mohamad Omar
Managing Editor : S Vimala
Typesetter : Y Rohayu

Set in NewBaskerville 11

MS ISO 9001:2015

Printed by Publications Branch, Forest Research Institute Malaysia
52109 Kepong, Selangor