

Timber Notes - Medium Hardwoods I (Kapur, Kasai, Kelat, Keledang, Kempas)

by

K. S. Gan, & T. Choo & S. C. Lim

- Trade name:** Kapur
- Species:** *Dryobalanops aromatica* (kapur), *D. oblongifolia* (keladan).
- 1. Tree type and distribution:** *Dryobalanops aromatica* is a very tall tree exceeding a height of 60 m and girth of 9 m. Mainly confined to the east coast of Peninsular Malaysia except a small area near Rawang. Mainly in lowland dipterocarp forests, occsioally up to 365 m altitude. *Dryobalanops oblongifolia* is also a large tree exceeding 3 m girth. Mainly occurs in low-lying, poorly drained jungle in eastern Kelantan, Terengganu, Pahang and Johore. Rarely on the west coast of Peninsular Malaysia.
- 2. Wood characteristics:** Heartwood reddish-brown. Sapwood yellowish-brown and well defined. Texture moderately coarse and even. Grain straight or interlocked.
- 3. Timber classification:** MHW
- 4. Wood density:** Ranges from 575 to 815 kg m⁻³ air dry.
- 5. Drying and relative movement:** Air drying of 15 mm and 40 mm boards takes 2-4 months and 5-6 months respectively. For kiln drying, schedule E is recommended. Class V movement.
- 6. Machining properties:** Moderately easy to slightly difficult to resaw, cross-cut and plane. Nailing property is poor except for *D. rappa* which is good.
- 7. Durability:** Moderately durable. Difficult to treat.
- 8. Strength grouping:** B
- 9. Strength properties:** Data based on tests carried out on *Dryobalanops aromatica*.

Property (MPa)	Green	Air dry
Modulus of rupture	84	114
Modulus of elasticity	15 900	18 700
Maximum crushing strength	46.5	61.7

- 10. Uses:** Suitable for heavy construction, heavy duty flooring, plywood manufacture and railway sleepers, furniture, door and window frame, garden furniture.

- Trade name:** Kasai
- Species:** Trade name for the timber of *Pometia* species, family *Sapindaceae*. There are two species of *Pometia* found in Peninsular Malaysia, i.e. *Pometia ridleii* and *P. pinnata* with attendant forms.
- 1. Tree type and distribution:** The trees of kasai can achieve medium to quite large sizes when mature. Kasai is typically a timber tree of low altitudes, mainly below 500 m and rarely found above 1000 m.
- 2. Wood characteristics:** Heartwood light red-brown or red-brown weathering to dark red-brown. Sapwood lighter in colour and well defined. Planed surface moderately lustrous with a vague stripe figure on the radial surface. Texture moderately coarse and even. Grain straight to interlocked.
- 3. Timber classification:** MHW
- 4. Wood density:** Ranges from 735 to 915 kg m⁻³ air dry.
- 5. Drying and relative movement:** Air drying of 15 mm and 40 mm boards takes approximately 3 months and 5 months respectively. Type III movement.
- 6. Machining properties:** Easy to resaw and cross-cut when green but slightly difficult when dried. Planing is easy and planed surface is rough. Nailing property is rated good.
- 7. Durability:** Moderately durable.
- 8. Strength grouping:** C
- 9. Strength properties:** Data based on tests carried out on *Pometia ridleii*.

Property (MPa)	Green	Air dry
Modulus of rupture	81	106
Modulus of elasticity	15 700	17 000
Maximum crushing strength	41.2	53.5

- 10. Uses:** Suitable for furniture manufacture, tool handle, plywood, flooring, moulding and skirting.

- Trade name:** Kelat
- Species:** *Eugenia* spp. (there are 200 species of *Eugenia*, out of which 7 species are generally cultivated).
- 1. Tree type and distribution:** *Eugenia* occur in all parts of Peninsular Malaysia from high tide level to the summit of Gunung Tahan. A few species grow in limestone areas and many species are commonly found in secondary forests. *Eugenia* species range in size from dwarfed and shrubby treelets of the highlands to medium-sized or quite large-sized trees in the lowland forests.
- 2. Wood characteristics:** Heartwood grey-brown, deep-brown and not well defined from the lighter coloured sapwood. Planed surface figureless and non-lustrous. Texture moderately fine and even. Grain interlocked, irregular or wavy.
- 3. Timber classification:** MHW
- 4. Wood density:** Ranges from 570 to 945 kg m⁻³ air dry.
- 5. Drying and relative movement:** Air drying of 15 mm and 40 mm boards takes about 5 months and 10 months respectively. For kiln drying, schedule C is recommended.
- 6. Machining properties:** Easy to resaw, plane and cross-cut. Planed surface is smooth. Nailing property is poor.
- 7. Durability:** Moderately durable.
- 8. Strength grouping:** B
- 9. Strength properties:** Data based on tests carried out on *Eugenia griffithii*.

Property (MPa)	Green	Air dry
Modulus of rupture	-	116
Modulus of elasticity	-	17600
Maximum crushing strength	43.0	59.0

- 10. Uses:** Suitable for posts, beams, joists and rafters. Treated timber may be suitable for door and window frames, tramway, railway sleeper for secondary line, bridge, wharf and agricultural implement.

- Trade name: Keledang
- Species: *Artocarpus* spp. (family Moraceae).
1. Tree type and distribution: Small to large trees with thick white latex in all parts of the tree. Widely distributed throughout Peninsular Malaysia but nowhere abundant. It occurs from sea-level up to 610 m, on steep slopes and on flat land.
2. Wood characteristics: The timber is light to heavy. Heartwood orange-yellow-brown and weathering to gold-brown to dark orange-brown and moderately defined from the sapwood which is lighter in colour. Texture moderately coarse but even. Grain deeply interlocked.
3. Timber classification: MHW
4. Wood density: Ranges from 495 to 945 kg m⁻³ air dry.
5. Drying and relative movement: Air drying of 15 mm and 40 mm boards take 3 and 4 months respectively.
6. Machining properties: Difficult to resaw and cross-cut. Planing is easy to moderately easy and planed surface is smooth to rough in some tangential boards due to picking-up of grains. Nailing property is good.
7. Durability: Moderately durable. Heartwood is very difficult to treat. However, sapwood is readily treated.
8. Strength grouping: B
9. Strength properties: Based on the lower average of tests carried out on *Artocarpus lanceifolius* and *A. rigidus*.

Property (MPa)	Green	Air dry
Modulus of rupture	78	93
Modulus of elasticity	11 600	12 200
Maximum crushing strength	38.6	47.5

10. Uses: Suitable for general flooring, parquet flooring, medium duty construction, furniture and panelling. Much sought after for high class coffin making by the Chinese community in Malaysia.

- Trade name:** Kempas
- Species:** *Koompassia malaccensis* (family Leguminosae).
- 1. Tree type and distribution:** A very big tree reaching 55 m tall. Abundant throughout Peninsular Malaysia in all lowland forests and up to 610 m in the mountains, also in peat and fresh water swamps.
- 2. Wood characteristics:** Heartwood pinkish to orange-red or deep brown. Sapwood white or pale yellow and distinct. Texture coarse and even. Grain interlocked. Included phloem common.
- 3. Timber classification:** MHW
- 4. Wood density:** Ranges from 770 to 1120 kg m⁻³ air dry.
- 5. Drying and relative movement:** Air drying of 15 mm and 40 mm boards takes approximately 2 months and 4 - 6 months respectively. For kiln drying, schedule E is recommended. Type V movement.
- 6. Machining properties:** Slightly difficult to resaw and easy to cross-cut when green but difficult to resaw and slightly difficult to cross-cut when dried. Planing is easy and planed surface ranges from smooth to rough. Nailing property is poor.
- 7. Durability:** Non-durable. Susceptable to termite attacks. Treatment is easy.
- 8. Strength grouping:** A
- 9. Strength properties:** Data based on tests carried out on *Koompassia malaccensis*.

Property (MPa)	Green	Air dry
Modulus of rupture	100	122
Modulus of elasticity	16 600	18 600
Maximum crushing strength	54.7	65.6

- 10. Uses:** When treated the timber is suitable for all heavy constructional works, railway sleeper and power transmission pole. Untreated timber is suitable for structural use under cover, parquet and strip flooring, panelling and veneer.



Kapur



Kasai



Kelat



Keledang



Kempas

BACKGROUND INFORMATION

1. Tree type and distribution

The distribution and size of tree are given.

2. Wood characteristics

The colours of sapwood and heartwood, figure, appearance on planed surface and any other characteristic features of the timber.

3. Timber classification

Under the Malaysian Grading Rules (1984), timbers are classified as Heavy Hardwood (HHW) when their density exceeds 800 kg m^{-3} and the timbers are naturally durable. Medium Hardwoods (MHW) are timbers with density $720 - 800 \text{ kg m}^{-3}$ but lack sufficient natural durability. Light Hardwoods (LHW) are timbers with density below 720 kg m^{-3} and are not naturally durable in exposed condition.

4. Wood density

Green density of freshly sawn board, defined as green mass divided by green volume. It varies with the freshness of the log in the log yard before processing and seasoning. Air dry density is the average mass divided by volume at 15 per cent moisture content.

5. Drying and relative movement

Air drying time for 15 mm and 40 mm boards and moisture content are from Grewal (1979). "Air-seasoning Properties of Some Malaysian Timbers", Timber Trade Leaflet No. 41. Suitable kiln drying schedule is mentioned [schedules based on Grewal (1988), "Kiln Drying Characteristic of Some Malaysian Timbers", Timber Trade Leaflet No. 42]. The relative movement (whenever is available) is defined as the change in dimension of a piece of timber when exposed to the service conditions of 60 % RH/30 °C and 95 % RH/30 °C respectively, and expressed as percentage of the value at 60 % RH/30 °C. The movement ratings stated are based on values of the corresponding tangential movement [Choo *et al.* (1998), "Movement of Seasoned Timber in Service", FRIM Technical Information Handbook No. 18].

Movement rating	Tangential movement (%)
Type I	< 1.5
Type II	1.5-2.0
Type III	2.1-2.5
Type IV	2.6-3.0
Type V	> 3.1

6. Machining properties

Comments are made on the comparative ease or difficulty of sawing, planing, turning, boring, peeling, gluing and other wood working properties.

7. Durability

Durability ratings of Malaysian Timbers are based on performance of test-stacks in graveyard testing. Test-stacks of 50 x 50 x 600 mm are buried in test grounds and their performance monitored. The number of years that the timber can last under such condition is used to classify the durability of the timber. Under the system, timbers are classified as follows:

Rating	Number of years
Very durable	more than 10
Durable	5-10
Moderately durable	2-5
Non-durable	0-2

Susceptibility to fungal, termite attacks and treatability may be mentioned.

8. Strength grouping

In the strength grouping of timber under each trade name, ranking is allocated from A (strongest) to D (weakest). Minimum values for strength groups are based on common grade for dry timber (below 19 % moisture content) (units are in MPa).

Strength group	A	B	C	D
Modulus of elasticity	9700	6600	5500	3100
Bending and tension parallel to grain	12.41	9.65	7.24	4.83
Compression parallel to grain	11.03	7.93	5.51	4.14
Compression perpendicular to grain	1.45	0.90	0.55	0.45
Shear parallel to grain	1.45	0.90	0.62	0.62

9. Strength properties

Values are from Lee *et al.* 1979, "The Strength Properties of Some Malaysian Timbers", Malaysian Forest Service Trade Leaflet No. 34.

10. Uses

Various past and potential uses are given, but the list is obviously not exhaustive.

TIMBER TECHNOLOGY BULLETIN

Editor

K.T. Choo

Editorial Panel

Assoc. Prof. Dr. Mohd. Zamin Jumaat
Department of Civil Engineering
Faculty of Engineering, University Malaya
59100 Kuala Lumpur

Dr. Razali Abdul Kader
Golden Hope Plantation Bhd
Research & Development Department
Oil Palm Research Station
P. O. Box No. 207
42700 Banting, Selangor DE

Mr. C. T. Yap
26, Jalan 3, Eng Ann Estate
Klang, Selangor DE