
PHYSICAL QUALITIES, CURRENT USES
AND POTENTIAL USES OF PAULOWNIA

R. C. Tang

School of Forestry
Auburn University, Alabama 36849-5418

Kawakamii

MODERN CONCEPTS OF TIMBER MANAGEMENT

Rapid Growth

- Insect & Disease Resistance
- High Wood & Fiber Quality
- Multiple Industrial Uses
- Complete-Tree Utilization

GROWTH OF PAULOWNIA KAWAKAMII IN BRAZIL (Chiang 1973)

<u>Age</u>	<u>Dbh (in.)</u>	<u>Inventory Vol. ft³/acre</u>	<u>Removed Vol. ft³/acre</u>
1	4.3	649	649
2	6.0	1473	737
3	8.4	2947	982
4	11.6	5614	1404
5	14.0	8228	1646

STUDY OF PAULOWNIA WOOD/FIBER IN USA

Basic Properties

Products/Utilization

- Anatomical
- Physical
- Mechanical

- Solid Wood
- Thin Veneer
- Composite Panels
- Pulp/Paper
- medicine

MECHANICAL PROPERTIES OF PAULOWNIA WOOD

	<u>Fortunei^{1'}</u>	<u>Kawakamii^{2'}</u>
Bending MOR (psi)	5760	7020
MOE (10 ⁶ psi)	0.867	1.200
Compression () (psi)	2800	3560
(⊥)	300	440
Shear(), psi	800	1150

1. SFSRI
2. TFRI

DURABILITY OF PAULOWNIA

Tested under

1. Constant 65% RH at 75°F
2. Accelerated aging: 4-hr dried at 106 ± 2°C, 4-hr water soaking, and 16-hr under 26°F

	<u>MOR</u>	<u>MOE x 10⁶ psi</u>
Test 1	5740	0.758
Test 2	5420	0.735

- Change of Strength and stiffness was insignificant
- No visual splits, checks or severe twisting and bowing were observed.
- Color was slightly darkened

PHYSICAL PROPERTIES OF US-GROWN PAULOWNIA

Density:

At O.D. Cond. - 17.11 pcf

At 10% MC - 18.17 pcf

Balsa: 10 pcf (OD)

N. W. Cedar: 18.10 pcf (OD)

PHYSICAL PROPERTIES OF US-GROWN PAULOWNIA

Specific Gravity:

Maximum: 0.274

At 10% MC: 0.265

Basic: 0.251

N. W. Cedar: 0.29 (OD)

ABSORPTION PROPERTIES OF PAULOWNIA WOOD
(Ave of 6 China species)

<u>Water Absorption (%)</u>			<u>Moisture Absorption (%)^{1'}</u>		
<u>1-day</u>	<u>2-day</u>	<u>40-day</u>	<u>1-day</u>	<u>2-day</u>	<u>Max</u>
84	108	253	12	15	19

^{1'} OD condition to conditions of 92% RH at 20°C

<u>Species</u>	<u>Bound Water</u>		<u>Free Water</u>	
	<u>24-hr</u>	<u>fsp (days)</u>	<u>%</u>	<u>days</u>
Paulownia	17.8	25.8 (7.5)	148	48
Willow	15.2	28.5 (28)	116	53
Red Pine	12.6	24.8 (24)	189	44

SHRINKAGE COEFFICIENT (%) OF LIGHT WEIGHT SPECIES

Green → Oven-Dry

<u>Species</u>	<u>Specific* Gravity</u>	<u>Radial</u>	<u>Tangential</u>
Cottonwood	0.34	3.0	7.0
N.W. Cedar	0.31	2.2	4.9
E. W. Pine	0.35	2.1	6.1
Redwood	0.35-0.40	2.2	4.9
Paulownia	0.21-0.27	1.1-2.7	2.1-4.9

* Based on OD weight and 12% MC volume.

THERMAL CONDUCTIVITY COEFFICIENT OF PAULOWNIA (10% MC)
(kcal/m. hr. °C)

	<u>Radial</u>	<u>Tangential</u>	<u>Longitudinal</u>
Paulownia	0.0645-0.0829	0.0584-0.0775	0.133-0.155
Sweetgum	0.136	0.121	----
Elm	0.143	0.143	----

Data sources: Hunan Agriculture College, PRC

PAULOWNIA FLAKEBOARD

<u>Density (pcf)</u>	<u>MC (%)</u>	<u>MOR (psi)</u>	<u>MOE x 10⁶ psi</u>
19.5	8.3	1260	0.19
28.9	8.0	3540	0.98
P. wood(18.5)	12	5740	0.76
Sweetgum flakeboard (45)	8.7	7700	1.26

Data source: Tang

MULTIPLE USES

Furniture:

Dressers, Closets, Chests,
Cabinets, Book Shelves, etc.

STRUCTURAL MATERIALS:

Ceilings, Panels, Screens, Crates
& Boxes for shipping, Folding Partitions,

HOUSEWARES:

Decorative lantern & containers.
Lacquered boxes for needles, cigarettes, & jewels.
Interior linings for safety boxes.

ART MATERIALS:

High quality musical instruments

Carving materials

Charcoal bars for sketching

Picture frames

SPORTING GOODS & GAMES

Sail boats, Toys, Training airplane, Fishing net floats,

OTHER USES:

Wooden clogs, High Heels,

Charcoal for fireworks,

Activated charcoal,

Root cuttings for propagation.

HEALTH AND BEAUTY CARE

Flowers:

- To cure the ailment of liver or bile which causes dizziness

HEALTH AND BEAUTY CARE

Leaves & Capsules:

- Used in decoction as a wash for foul sores & to cure swollen ankles & feet
- To promote the growth of hair and to restore its color.

HEALTH AND BEAUTY CARE

Fibers:

- For making very soft tissues to be used in makeup

HEALTH AND BEAUTY CARE

Wood and Leaves:

- Used as an astringent and vermicide, in ulcers, in falling of the hair.
- To manage the delirium of typhoid fever.

8

9

RECENT RESEARCH OF MEDICAL USES OF PAULOWNIA IN CHINA
(Hunan Medical Science Research Institute)

- Old herb medicine:
scrambled eggs with Paulownia flowers for medication of bronchitis
- Research development:
Medicative effect of Paulownia flowers and capsules for bronchitis
 1. Liquid from boiled capsules
 2. Extractives from capsules
 3. Extractives from flowers
 4. Distillate from flowers
 5. # 2 plus other Chinese herbs.
 6. Chemical analysis of Paulownia flowers and capsules and synthesis development

OUTLOOK OF
PAULOWNIA'S UTILIZATION

1. Fast growing species for short pulp fiber supply
2. Flakeboard, Particleboard, OSB or mixed with high density species for ceiling, wall panel
 - reduce weight
 - improve dimensional stability
 - improve insulating performance
3. Solid wood: wall panels, sidings, picture frames
4. For shipping industries: pallets, crates, boxes
5. Low cost and high quality activated charcoal for water pollution use
6. Sale logs to Japan
7. Core materials for laminated boards/panels
8. Hair tonics?
9. Medicine?

USES OF Balsa IN HIGH-TECH DEFENSE APPLICATION

Balsa-cored sandwich construction: Face: Aluminum, Graphite, E-glass & Epoxy

- Floor panels for Boeing AWACS aircraft
- Superstructures of French/Belgium/Netherlands minesweepers
- LTV A-7 attack aircraft
- Air cargo containers
- Tactical shelters
- Air cargo pallets
- High mobility multi-purpose wheel vehicle (HMMPWV)
- Flight simulation domes
- Weather-shield doors in US nuclear- guided missile cruisers, LHA's and destroyers

Substitution: Low cost Paulownia and composite structural design techniques need to be developed