



# 台灣主要木材圖誌

## IMPORTANT WOOD SPECIES OF TAIWAN

中華林學會編印

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## 序 言

營林的重要目的之一，是生產木材及對於所生產之木材如何善加利用，期獲得其最高利用價值及最高之經濟收益。至於欲使木材盡其最高利用價值，厥以能辨識木材之品種為先決條件，而欲辨識木材品種，則應在木材之色澤、性狀、及品質上加以研究。以往在木材原始利用時期，對於木材品質等方面多不講求，此不徒使木材不能作適切之利用，浪費木材之經濟價值，抑且嚴重影響營林及木材利用事業之進步。現在科學進步，工業發達，無論木材加工，建築、傢具製造以及森林工業所使用之原料等，莫不求得木材之多方面利用為急務，因此公私營林業者，木材工商業者，林業學者專家，林業機關團體等，皆汲汲於木材性狀及品質之科學研究與探討，以期獲得木材利用事業之最高發展。

中華林學會年來對是項科學研究，曾作多方面之鼓吹與建議，希望能出版專書供應各界參考。茲值服務於林務局林產組及臺灣大學森林系等本會有關會友之合作，完成「臺灣主要木材圖誌」一稿，對臺灣原產各樹種之木材，有極詳明之剖析研究，為林業上不可多得之重要文獻，茲由本會予以複印以應需要。爰序數言，藉向作者諸會友致謝並寄望我林業界同仁能繼續深入研究，發揚光大，其對我國木材加工利用事業之發展，實所利賴。

中華林學會理事長沈家銘謹識

中華民國五十六年十月

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# 臺灣扁柏

## 1. 一般事項

名稱：學名 *Chamaecyparis taiwanensis* Masam. et Suzuki (Cupressaceae 柏科)

種名：臺灣扁柏；土名：松栢，厚殼楠

產地與蓄積：分佈於中央山脈海拔1,300～2,900 m之間成純林，海拔較低處與紅檜、鐵杉、臺灣杉、櫟大杉等混生。太平山、大元山、八仙山、大雪山、木瓜山、太魯閣、林田山及阿里山等地區尚存有大量之原生林。全省蓄積約計16,260,000 m<sup>3</sup>，蓄積量僅次於鐵杉及紅檜而居第三位。

樹木之通性：常綠大喬木，樹幹通直，徑可達3 m，高達35～40 m。

## 2. 構造

木材之外觀：邊心材顏色不同，但境界線不分明，邊材淡紅黃白色，心材淡紅黃色至黃褐色，年輪極狹，春材向秋材漸進移行而不明，木理通直均勻，木肌細緻；富光澤，木材具芳香。

纖維之大小：纖維長度最大5.08 mm，最小2.25 mm，平均3.94 mm，纖維寬度最大51 μ，最小24 μ，平均37.6 μ。

## 3. 物理性質

氣乾材之含水率為15.4%

生材重量	828 kg/m <sup>3</sup>	由生材至爐乾之收縮率
氣乾重量	484 kg/m <sup>3</sup>	徑向 2.89%
比重		弦向 4.15%
依據生材體積		體積 7.57%
及爐乾重量	0.411	
依據爐乾體積		
及爐乾重量	0.445	

## 4. 機械性質

靜力彎曲		縱向抗張強	630 kg/cm <sup>2</sup>
彈性係數123,200 kg/cm <sup>2</sup> ± 15,800		橫向抗張強	53 kg/cm <sup>2</sup> ± 12
破壞係數 1,039 kg/cm <sup>2</sup> ± 88		剪力強	121 kg/cm <sup>2</sup> ± 12
彈性限界之纖維應力		劈裂強	112 kg/cm <sup>2</sup> ± 12
		硬度	3.67
縱向抗壓強	452 kg/cm <sup>2</sup> ± 34		
橫向抗壓強	86 kg/cm <sup>2</sup> ± 16		

## 5. 化學性質

化學性質：全纖維素52.70%，α纖維素40.16%，戊糖5.73%，木質素32.70%，溫水抽出物4.75%，冷水抽出物3.80%，1% NaOH溶液抽出物25.50%，醇苯抽出物6.04%，灰分0.49%，溫水抽出物之pH值為5.47，冷水抽出物之pH值為5.58。

## 6. 加工性質

木材輕軟中庸；富彈性；耐腐性及耐蟻性；乾燥容易且乾燥狀況極良好，少反拱變形，收縮極小易割製，刨削加工容易，表面極光滑而精緻，釘著性良好；吸漆性佳，塗裝後更顯精良。

## 7. 用途

本樹種為省產最優良之木材，主要用途為建築物之一般結構，房屋建築、船艦、橋樑、車輛、傢俱、器具、農具、雕刻、棺木、薄板及膠合板等用材，製材廢料可供製鉛筆桿及火柴桿等。

## Taiwan yellow cypress

(*Chamaecyparis taiwanensis* Masam. et Suzuki)

**Range:** Taiwan cypress is distributed in the Central Ranges at elevation of 1,300 to 2,900 meters such as the Taipingshan, Tayuanshan, Fashienshan, Tahsueshan, Alishan, Lintianshan, Taroko and Mukuashan.

**Description:** Sapwood is pale red to yellowish white in color not clearly distinguishable from the heartwood which is light yellowish brown. Growth rings are inconspicuous, narrow and irregular in width. Transition from springwood to summerwood is gradual. The wood has characteristic odor but without characteristic taste. It is straight and even-grained, fine-textured and lustrous particularly on flat-grained surface. The average length and width of fiber are 3.94mm and 37.6 $\mu$  respectively.

**Properties:** Taiwan yellow cypress is classified as moderately light. The wood is moderately hard, extremely stiff, very strong in bending and moderately strong in endwise compression and tension parallel to the grain. It has a moderately high shock resistance, and is very durable when exposed to conditions favorable to decay. Its durability is almost equal to woods preservatives treated by pressure method. In working operation it works easily with tools, and finishes satisfactorily. It is easy to dry, stays in space exceedingly well when seasoned and has very little tendency to warp, split and capable of high polish. It glues well, takes and holds paints well and has a very high nail-holding ability.

### Physical Properties

**Weight:** Based on the moisture content 15.40%, air-seasoned.

Of green wood  
Of air-seasoned

828 kg/m<sup>3</sup>  
484 "

**Specific gravities:**

Based on weight of oven-dry and volume of green  
Based on weight and volume both of oven-dry

0.411  
0.445

**Shrinkage:** From green to oven-dry

Radial  
Tangential  
Volume

2.89%  
4.15%  
7.57%

### Mechanical Properties

**Static bending:**

Modulus of elasticity  
Modulus of rupture  
Fiber stress at elastic limit

123,200  $\pm$  15,800 kg/cm<sup>2</sup>  
1,039  $\pm$  88 "  
775  $\pm$  86 "

**Compressive strength:**

Compression parallel to grain  
Compression perpendicular to grain

452  $\pm$  34 "  
86  $\pm$  16 "

**Tensile strength**

Tension parallel to grain  
Tension perpendicular to grain

630 kg/cm<sup>2</sup>  
53  $\pm$  12 kg/cm<sup>2</sup>

**Shearing strength**

**Cleavage**

**Hardness**

121  $\pm$  12 "  
112  $\pm$  12 kg/cm

3.07

**Chemical Properties:** Results of chemical analysis of wood are as follows:

Holo cellulose  
Alpha cellulose  
Pentosan  
Lignin  
Hot water extracts  
Cold water extracts  
1% sodium hydroxide extracts  
Alcohol benzene extracts  
Ash  
pH value of cold water solubility  
pH value of hot water solubility

52.70%  
40.16%  
5.73%  
32.70%  
4.75%  
3.80%  
25.50%  
6.04%  
0.49%  
5.58  
5.47

**Uses:** The wood of Taiwan yellow cypress is regarded as the best of all conifers grown in Taiwan. It is chiefly used for general building and construction, houses, bridges, vehicles, agricultural implements, furniture, woodenware, carvings, veneer and plywood, mill products, pencil slats and coffins.

# 紅 檜

## 1. 一般事項

名稱：學名 *Chamaecyparis formosensis* Matsum. (Cupressaceae 柏科)

種名：紅檜；土名：松栢，薄皮。

分佈及產地與蓄積：分佈於中央山脈海拔1,000—2,800m之地區以1,500—2,150m處最常見主產於文山、插天山、阿里山、八仙山、大雪山、林田山、太魯閣、櫻大山、太平山、大元山、關山、木瓜山、小雪山、楠梓仙溪、南澳及大溪等地，成純林或與臺灣扁柏、鐵杉及潤葉樹等混生。臺灣大學實驗林溪頭營林區有建造人工林，生育頗佳，全省蓄積約計20,200,000m<sup>3</sup>，僅次於鐵杉居第二位。

樹木之通性：常綠大喬木，為東亞針葉樹中之最大者，其最大周圍可達20m，高50—60m，惟老樹幹心多呈空洞，或為多數同心圓蜂窩狀之腐朽根（俗稱蓮根材）致減低利用價值。本樹種種子於林緣或裸露地易發芽成苗，性耐乾燥，易於天然更新。

## 2. 構 造

木材之外觀：邊心材之境界分明，色較臺灣扁柏略帶淡紅色，邊材狹小，黃灰色，心材紅黃色至帶褐色，年輪明顯，春材向秋材漸進移行而分明，木理通直，木肌細緻均勻，密度小，弦切面具有美麗花紋，香氣強。

纖維之大小：纖維長度最大4.11mm，最小2.01mm平均3.084mm，纖維寬度最大53μ，最小21μ，平均37.6μ。

## 3. 物理性質

氣乾材之含水率為13.8%

生材重量	1.090kg/m <sup>3</sup>	由生材至爐乾之收縮率
氣乾重量	371kg/m <sup>3</sup>	徑 向 2.26%
比 重		弦 向 3.90%
依據生材體積		體 積 6.24%
及爐乾重量	0.333	
依據爐乾體積		
及爐乾重量	0.354	

## 4. 機械性質

靜力彎曲		縱向抗張強	550kg/cm <sup>2</sup>
彈性係數116,200kg/cm <sup>2</sup> ±20,400		橫向抗張強	41kg/cm <sup>2</sup> ±4
破壞係數 898kg/cm <sup>2</sup> ±76		剪力強	102kg/cm <sup>2</sup> ±19
彈性限界之纖維應力		劈裂強	90kg/cm <sup>2</sup> ±9
613kg/cm <sup>2</sup> ±66		硬 度	2.39
縱向抗壓強 365kg/cm <sup>2</sup> ±52			
橫向抗壓強 54kg/cm <sup>2</sup> ±14			

## 5. 化學性質

化學組成：全纖維素50.87%，α纖維素34.29%，戊醣6.34%，木質素31.04%，溫水抽出物2.70%，冷水抽出物1.86%，1%NaOH溶液抽出物24.10%，醇苯抽出物5.85%，灰分0.31%，溫水抽出物之pH值為6.15，冷水抽出物之pH值為6.06。

## 6. 加工性質

木材加工性質大致與臺灣扁柏相似，惟生材較臺灣扁柏重，氣乾材却較臺灣扁柏輕（含水量多），材質輕軟，至於耐蟻性與耐濕性則較臺灣扁柏為強。

## 7. 用 途

本樹種在木材市場上與臺灣扁柏通稱為檜木，為省產優良材，主要用途為建築物之結構材、建俱、車輛、橋樑、船艦、傢俱、器具、棺木、樽桶、雕刻花紋薄板及合板等。

## Taiwan red cypress

### (*Chamaecyparis formosensis* Matsum.)

**Range:** Taiwan red cypress grows at elevation of 1,000 to 2,800 meters. It is principally grown in Wenshan, Chatienshan, Alishan, Pashienshan, Tashueshan, Lintienshan, Taroko, Luntashan, Taipingshan, Tayuanshan, Kuanshan, Mukuashan, Hsiao-suehshan, Nanchuentshi, Nanchi and Tachi, and the reforestation at the Experimental Forest of National Taiwan University at Chitou. The tree forms pure forest or grows in mixture with Taiwan yellow cypress, Chinese hemlock and broad-leaved trees.

**Description:** Heartwood is light reddish brown, scarcely distinguishable from the sapwood which is narrow, light pinkish white. Growth rings are distinct, irregular in width and delineated by a narrow band of summerwood. Transition from springwood to summerwood is gradual. The wood is straight and even-grained, with attractive figure on flat-grained surface and luster on smoothed surface. It has a characteristic odor but without characteristic taste. The average fiber length and width are 3.084mm and 37.6  $\mu$  respectively.

**Properties:** Taiwan red cypress is a light wood and is rated as moderately soft, very stiff and strong in bending. It has a moderately weak endwise compressive strength and moderately in tension parallel to the grain and also has a fairly high in shock resistance and moderately high in nail-holding ability. Its workability with tools is similar to that of Taiwan yellow cypress. When used under conditions favoring decay Taiwan red cypress is exceedingly durable, and its resistance to termites is excellence. It shrinks very little and is easy to dry and holds its shape extremely well after seasoning and takes paint satisfactorily.

#### Physical Properties

**Weight:** Based on the moisture content 13.8%, air-seasoned.

Of green wood

1,090 kg/m<sup>3</sup>

Of air-seasoned

371 kg/m<sup>3</sup>

#### Specific gravities:

Based on weight of oven-dry and volume of green

0.333

Based on weight and volume both of oven-dry

0.354

#### Shrinkage: From green to oven-dry

Radial

2.26%

Tangential

3.90%

Volume

6.24%

#### Mechanical Properties

##### Static bending:

Modulus of elasticity

116,200  $\pm$  20,400 kg/cm<sup>2</sup>

Modulus of rupture

898  $\pm$  76 "

Fiber stress at elastic limit

613  $\pm$  66 "

##### Compressive strength:

Compression parallel to grain

365  $\pm$  52 kg/cm<sup>2</sup>

Compression perpendicular to grain

54  $\pm$  14 "

##### Tensile strength:

Tension parallel to grain

550 kg/cm<sup>2</sup>

Tension perpendicular to grain

41  $\pm$  4 kg/cm<sup>2</sup>

##### Shearing strength

102  $\pm$  19 "

##### Cleavage

90  $\pm$  9 kg/cm

##### Hardness

2.39

#### Chemical Properties: Results of chemical analysis of wood are as follows:

Holo cellulose

50.87%

Alpha cellulose

34.29%

Pentosan

6.34%

Lignin

31.04%

Hot water extracts

2.70%

Cold water extracts

1.86%

1% Sodium hydroxide extracts

24.10%

Alcohol benzene extracts

5.85%

Ash

0.31%

pH value of cold water solubility

6.05

pH value of hot water solubility

6.15

**Uses:** The wood of this species is of great utility and has many properties in common with Taiwan yellow cypress, with which it is often sold in mixture. It is principally used for general construction and building, vehicles, ship and boat-building, bridges, furniture, export logs and timbers, woodenware, carvings, coffins, veneer and plywood and miscellaneous planing mill products.

# 肖楠

## 1. 一般事項

名稱：學名 *Calocedrus formosana* Florin (Cupressaceae 柏科)

種名：臺灣肖楠；土名：肖楠，黃肉樹

產地與蓄積：分佈於北部與中部海拔300～1,900 m之山地溪谷或懸崖。阿里山、文山、太平山、大溪、八仙山、大甲溪、埔里、轆大山及木瓜山尚存有天然林。大甲溪流域之青山一帶有群生或與潤葉樹混生。八仙山佳保臺，臺北烏來，埔里蓮華池及中浦汙水等地有建造人工林。全省蓄積約為740,000 m<sup>3</sup>。

樹木之通性：常綠大喬木，徑可達3 m，高25 m，樹幹通常彎曲，老樹有板根。

## 2. 構造

木材之外觀：邊材心材之分界不明，邊材淡黃褐色，心材黃褐色，年輪不明，擬年輪多，春秋材之移行漸進而不明，木理通直均勻，木肌細緻，密度中庸，具香氣，紋理美麗，富光澤。

纖維之大小：纖維長度最大4.11 mm，最小1.58 mm，平均2.84 mm，纖維寬度最大58 μ，最小17 μ，平均29.8 μ。

## 3. 物理性質

氣乾材之含水率為14.2%

生材重量	1,015 kg/m <sup>3</sup>	由生材至爐乾之收縮率
氣乾重量	697 kg/m <sup>3</sup>	徑向 4.06%
比重		弦向 4.99%
依據生材體積		體積 9.77%
及爐乾重量	0.444	
依據爐乾體積		
及爐乾重量	—	

## 4. 機械性質

靜力彎曲		縱向抗張強
彈性係數	119,700 kg/cm <sup>2</sup> ± 12,100	橫向抗張強
破壞係數	859 kg/cm <sup>2</sup> ± 67	剪力強
彈性限界之纖維應力		劈裂強
	575 kg/cm <sup>2</sup> ± 64	硬度度
縱向抗壓強	551 kg/cm <sup>2</sup> ± 22	
橫向抗壓強	121 kg/cm <sup>2</sup> ± 22	

## 5. 化學性質

化學組成：全纖維素50.86%，α纖維素33.13%，戊糖10.19%，木質素34.18%，溫水抽出物3.86%，冷水抽出物2.89%，1% NaOH溶液抽出物14.01%，醇苯抽出物3.27%，灰分0.43%。

## 6. 加工性質

木材堅硬，但刨削及其他加工容易，刨面光滑，磨之顯其光澤，耐蝕性甚強，乾燥稍慢，如乾燥不充分易發生反彎，易生龜裂為缺點，收縮稍大，對洋漆之吸着性強而耐久。

## 7. 用途

主供高級傢俱，雕刻及裝飾材，亦可供一般建築，棺木、薄板及膠合板製造等。



# Taiwan incense cedar

## (*Calocedrus formosana* Florin)

**Range:** Taiwan Incense cedar grows at elevation of 300 to 1,900 meters in broad-leaved forests of the northern and central parts of the island. It is distributed in Alishan, Wenshan, Taipingshan, Tachih, Pashianshan, Tachiachih, Pulli, Luantashan and Mukuashan where it exists as natural stands. In the district of Shinshan in Tachiachih, it is found as in group or in mixture with broad-leaved forests.

**Description:** Heartwood and sapwood are pale yellowish brown in color and not clearly distinguishable. Growth rings are inconspicuous. Transition from springwood to summerwood is gradual. The wood has a characteristic fragrance and is fine-textured with attractive figure and luster. The average fiber length and width are 2.84mm and 29.8  $\mu$  respectively.

**Properties:** The wood of Taiwan incense cedar is moderately light and is classified as moderately hard and has a moderately high shrinkage. It is moderately stiff but weak in both endwise and sidewise compressive strength, and moderately strong in bending. Its tension parallel to the grain is moderately weak but very durable under conditions favoring decay. The wood is slow in drying, with little tendency to warp but is easy to split. It takes and holds paint well. In machine operation, it works easily. It is lustrous on smoothed surfaces, very resistant to termites.

### Physical Properties

<b>Weight:</b> Based on the moisture content 14.20%, air-seasoned.	
Of green wood	1,015 kg/m <sup>3</sup>
Of air-seasoned	697 "
<b>Specific gravities:</b>	
Based on weight of oven-dry and volume of green	0.44
Based on weight and volume both of oven-dry	—
<b>Shrinkage:</b> From green to oven-dry	
Radial	4.06%
Tangential	4.99%
Volume	9.77%

### Mechanical Properties

<b>Static bending:</b>	
Modulus of elasticity	119,700 $\pm$ 12,100 kg/cm <sup>2</sup>
Modulus of rupture	859 $\pm$ 67 "
Fiber stress at elastic limit	575 $\pm$ 64 "
<b>Compressive strength:</b>	
Compression parallel to grain	551 $\pm$ 22 "
Compression perpendicular to grain	121 $\pm$ 22 "
<b>Tensile strength:</b>	
Tension parallel to grain	
Tension perpendicular to grain	56 $\pm$ 8 kg/cm <sup>2</sup>
<b>Shearing strength</b>	138 $\pm$ 17 "
<b>Cleavage</b>	97 $\pm$ 8 kg/cm
<b>Hardness</b>	3.28

### Chemical Properties: Results of chemical analysis of wood are as follows:

Holo cellulose	50.86%
Alpha cellulose	33.13%
Pentosan	10.19%
Lignin	34.18%
Hot water extracts	3.86%
Cold water extracts	2.89%
1% Sodium hydroxide extracts	14.01%
Alcohol benzene extracts	3.27%
Ash	0.43%
pH value of cold water solubility	—
pH value of hot water solubility	—

**Uses:** The wood of Taiwan Incense cedar is principally used for furniture, carvings and engravings, general building, coffins, veneer and plywood making.

# 櫟 大 杉

## 1. 一般事項

名稱：學名 *Cunninghamia Konishii* Hay. (Taxodiaceae 杉科)

種名：櫟大杉；土名：香杉，烏杉。

產地與蓄積：分佈於中部以北1,300～2,800m，主產於櫟大山，太平山，鹿場大山，卑南山，八仙山、太雪山、小雪山、白狗大山、木瓜山、林田山、香杉山及研海等地，香杉山尚有相當面積之美麗純林。臺灣大學實驗林有大面積之人工林。全省蓄積約710,000m<sup>3</sup>。

樹木之通性：常綠大喬木，樹幹通直，徑可達2.5m高可達50m，常與紅檜，雲杉混生，生長速度較杉木稍慢。

## 2. 構造

木材之外觀：邊心材分明，心材淡黃褐色，具有紫色縱邊，但經久會變成紫色，邊材淡黃色，年輪有時寬，有時狹，春材向秋材急激移行，境界明顯，木理通直均勻，木肌精密度小，橫斷面有分泌針狀結晶物，芳香。

纖維之大小：纖維平均長度2.204mm，纖維平均寬度33.35 $\mu$ 。

## 3. 物理性質

生材重量	790kg/m <sup>3</sup>	由生材至爐乾之收縮率
氣乾重量	420kg/m <sup>3</sup>	
比重		
依據生材體積及爐乾重量	0.379	
依據爐乾體積及爐乾重量	0.396	
		徑 向 1.53%
		弦 向 2.70%
		體 積 4.23%

## 4. 機械性質

靜力彎曲			縱向抗張強	516kg/cm <sup>2</sup>
彈性係數	141,000kg/cm <sup>2</sup> ±16,700		橫向抗張強	33kg/cm <sup>2</sup> ±11
破壞係數	1,158kg/cm <sup>2</sup> ±	84	剪力強	90kg/cm <sup>2</sup> ±13
彈性限界之纖維應力			劈裂強	83kg/cm±9
	886kg/cm <sup>2</sup> ±	69		
縱向抗壓強	539kg/cm <sup>2</sup> ±	43	硬 度	3.02
橫向抗壓強	61kg/cm <sup>2</sup> ±	11		

## 5. 化學性質

無化學分析資料。木材含有Sesquiterpene油故具有強烈芳香。冷水抽出物之pH值為5.68，溫水抽出物之pH值為5.55。

## 6. 加工性質

材質輕軟，耐蟻性強，鉋削加工容易，鉋面光滑；乾燥快，乾燥狀況良好；不反應或裂開；收縮極小；塗漆及吸着性良好，釘着力弱。

## 7. 用途

建築（基礎材、樑、桁、天花板、壁板、門窗），棺木（上等品），鉛筆桿等用材。

# Luanta fir (*Cunninghamia Konishii* Hay.)

**Range:** Luanta fir grows at elevation of 1,300 to 2,800 meters. It is distributed principally at Luntashan, Taipingshan, Luchangtashan, Penantashan, Pashienshan, Tahsuehshan, Hsiaosuehshan, Pehkotashan, Mukuashan, Siangchanshan and Enhai. There is also a large area of reforestation of this species at the Experimental Forest of National Taiwan University at Chi-tou.

**Description:** It is easy to distinguish heartwood from sapwood. Heartwood is pale yellowish brown, sapwood pale yellow. The wood has characteristic odor. Growth rings are distinct and irregular in width. Transition from springwood to summerwood is abrupt and delineated by a narrow band of summerwood. It is straight-grained and fine-textured. It excretes white and needle-like crystals on the cross surface of heartwood and is lustrous on radial surface. Resin canals are absent. The average length and width of fiber are 2.204mm and 33.35  $\mu$  respectively.

**Properties:** The wood of Luanta fir is light in weight and is low in shrinkage, very stiff, strong in bending and has a moderately strong endwise compressive strength but with a moderately weak tensile strength of tension parallel to the grain. Its resistance to termites is remarkable. In working operation it works well with machines and tools. It is easy to dry and stays well when seasoned, without warping or splitting, takes and holds paint well, and has a low nail-holding ability.

## Physical Properties

### Weight:

Of green wood	790 kg/m <sup>3</sup>
Of air-seasoned	420 "

### Specific gravities:

Based on weight of oven-dry and volume of green	0.379
Based on weight and volume both of oven-dry	0.396

### Shrinkage: From green to oven-dry

Radial	1.53%
Tangential	2.70%
Volume	4.23%

## Mechanical Properties

### Static bending:

Modulus of elasticity	141,000 $\pm$ 16,700 kg/cm <sup>2</sup>
Modulus of rupture	1,158 $\pm$ 84 "
Fiber stress at elastic limit	886 $\pm$ 69 "

### Compressive strength:

Compression parallel to grain	539 $\pm$ 43 "
Compression perpendicular to grain	61 $\pm$ 11 "

### Tensile strength:

Tension parallel to grain	516 kg/cm <sup>2</sup>
Tension perpendicular to grain	33 $\pm$ 11 kg/cm <sup>2</sup>

### Shearing strength

Cleavage	90 $\pm$ 13 "
Hardness	83 $\pm$ 9 kg/cm
	3.02

## Chemical Properties: Results of chemical analysis of wood are as follows:

Holo cellulose	—
Alpha cellulose	—
Pentosan	—
Lignin	—
pH value of cold water solubility	5.55
pH value of hot water solubility	5.68
1% Sodium hydroxide extracts	—
Alcohol benzene extracts	—
Ash	—

**Uses:** Luanta fir is one of the most useful species of conifers grown in Taiwan. It is principally used for construction, coffins, pencils slats.

# 臺灣杉

## 1. 一般事項

名稱：學名 *Taiwania cryptomerioides* Hay. (Taxodiaceae 杉科)

種名：臺灣杉；土名：亞杉。

產地與蓄積：生育於海拔1,100~2,800 m之地區，太平山、八仙山、鸛大山、阿里山、木瓜山、林田山、太魯閣及大雪山均有分佈，惟產量不多，臺灣大學實驗林溪頭及林業試驗所六龜分所有小面積之人工林。全省蓄積約計860,000 m<sup>3</sup>。

樹木之通性：常綠大喬木，樹幹通直，徑可達3m，高可達60m，常與臺灣扁柏，紅檜，雲葉等混生。其他：本樹種為我國固有之單型種，生長極速能成大材，惟繁殖不易，為保留名種應予限制伐採，並設法造林增產。

## 2. 構造

木材之外觀：邊心材之分界很明顯，邊材淡紅黃色，心材黃色，或鮮黃色帶紫褐色之暈條，倘時間較久則變為暗黑色；年輪狹而可判明，春秋材之區別分明，老大樹之秋材部極狹；木理通直，木肌組織細緻乏光澤。

纖維之大小：纖維長度最大5.22mm，最小1.84mm，平均3.488mm，纖維寬度最大75  $\mu$ ，最小30  $\mu$ ，平均44.5  $\mu$ 。

## 3. 物理性質

氣乾材之含水率為15.0%

生材重量	1,200kg/m <sup>3</sup>	由生材至爐乾之收縮率
氣乾重量	420kg/m <sup>3</sup>	徑向 2.38%
比重		弦向 4.45%
依據生材體積		體積 7.29%
及爐乾重量	0.368	
依據爐乾體積		
及爐乾重量	0.397	

## 4. 機械性質

靜力彎曲	縱向抗張強	568kg/cm <sup>2</sup>
彈性係數126,500kg/cm <sup>2</sup> ±11,440	橫向抗張強	32kg/cm <sup>2</sup> ±7
破壞係數 914kg/cm <sup>2</sup> ±109	剪力強	92kg/cm <sup>2</sup> ±23
彈性限界之纖維應力	劈裂強	61kg/cm±5
869kg/cm <sup>2</sup> ±121	硬度	2.34
縱向抗壓強 387kg/cm <sup>2</sup> ±66		
橫向抗壓強 64kg/cm <sup>2</sup> ±20		

## 5. 化學性質

化學組成：全纖維素46.10%， $\alpha$ 纖維素36.80%，戊糖10.00%，木質素32.17%，溫水抽出物6.39%，冷水抽出物4.71%，1%NaOH溶液抽出物15.67%，醇苯抽出物6.84%，灰分1.41%，溫水抽出物之pH值為6.13，冷水抽出物之pH值約為5.69。

## 6. 加工性質

材質輕軟，割裂容易，耐蝕性極強（不亞於紅檜），對海港蝕材蟲之抗力特強，剝削及其他加工容易，易乾燥，乾燥狀況良好。收縮小；加工完成之材而良好；塗漆及吸着性亦佳。

## 7. 用途

建築（基礎材、柱、門窗、天花板、內壁板、地板）、傢俱、樽桶、棺材、船塢碼頭之防舷材，削切薄板供裝飾，鑲板及膠合板製造等。

# Taiwania

(*Taiwania cryptomeriodes* Hay.)

**Range:** *Taiwania* grows mainly in the Central Ranges such as the Taipingshan, Pashienshan, Luntashan, Mukuashan, Alishan, Lintianshan, Tahsuehshan and Taroko. It is usually found at elevations between 1,800 to 2,600 meters, usually in scattered stands with cypresses.

**Description:** Heartwood is yellow to yellowish red with purplish brown streaks and has no characteristic odor or taste. It is clearly distinguishable from the sapwood which is pale yellowish red in color. Growth rings are distinct, narrow and irregular in width frequently with false rings. Transition from springwood to summerwood is abrupt. The wood is straight-grained, fine-textured but without luster. The average fiber length and width are 3.488mm and 44.5 $\mu$  respectively.

**Properties:** The wood of *Taiwania* is moderately light and is rated as soft, very stiff and moderately strong in bending and weak in compression and in tension parallel to the grain. Its resistance to termites is similar to that of Taiwan red cypress, exceedingly resistant to marine borers. The wood is easy to work with tools and machines, stays well in place when seasoned. It takes and holds paint well and is easily glued.

## Physical Properties

**Weight:** Based on the moisture content 15.00%, air-seasoned.

Of green wood	1,200 kg/m <sup>3</sup>
Of air-seasoned	420 "

### Specific gravities:

Based on weight of oven-dry and volume of green	0.368
Based on weight and volume both of oven-dry	0.397

### Shrinkage:

 From green to oven-dry

Radial	2.38%
Tangential	4.45%
Volume	7.29%

## Mechanical Properties

### Static bending:

Modulus of elasticity	126,500 $\pm$ 11,440 kg/cm <sup>2</sup>
Modulus of rupture	914 $\pm$ 109 "
Fiber stress at elastic limit	869 $\pm$ 121 "

### Compressive strength:

Compression parallel to grain	387 $\pm$ 66 "
Compression perpendicular to grain	64 $\pm$ 20 "

### Tensile strength:

Tension parallel to grain	568 kg/cm <sup>2</sup>
Tension perpendicular to grain	32 $\pm$ 7 kg/cm <sup>2</sup>

### Shearing strength

	92 $\pm$ 23 "
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### Cleavage

	61 $\pm$ 5 kg/cm
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### Hardness

	2.34
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## Chemical Properties:

 Results of chemical analysis of wood are as follows:

Holo cellulose	46.10%
Alpha cellulose	36.80%
Pentosan	10.00%
Lignin	32.17%
Hot water extracts	6.39%
Cold water extracts	4.71%
1% Sodium hydroxide extracts	15.67%
Alcohol benzene extracts	6.84%
Ash	1.41%
pH value of cold water solubility	5.69
pH value of hot water solubility	6.13

**Uses:** *Taiwania* is principally used for general construction (ceiling, floors, sidings, sash and doors), furniture, slack cooperage because of its lightness and durability, boat plank, wharf, pilings, coffins, veneer and plywood.

# 鐵 杉

## 1. 一般事項

名稱：學名 *Tsuga Chinensis* Pritz. (Pinaceae 松科)

種名：鐵杉；土名：油松，樟木

產地與蓄積：分佈於海拔 2,000～3,000 m 之高山，主產於八仙山、大雪山、小雪山、南湖大山、鹿場大山、能高山、合歡山、樽大山、鹿林山、玉山、水山及大武山等地，常與臺灣扁柏、紅檜、松類、雲葉、紅豆杉等混生，於懸崖山脊線或乾燥地常成群生，蓄積極豐，全省蓄積約 24,620,000 m<sup>3</sup>，佔全省第一位。

樹木之通性：常綠大喬木，徑可達 2 m，高可達 50 m，幹直或稍彎曲。

## 2. 構造

木材之外觀：無邊心材之區分，色黃白或黃灰白；年輪狹，略成波狀而不整齊，春秋材之區別分明，假導管通常含有碳酸石灰之結晶體，在弦面上顯出白條紋樣；木理通直均勻，木肌稍粗，密度中庸。

纖維之大小：纖維長度最大 6.44 mm，最小 2.02 mm，平均 4.458 mm，纖維寬度最大 70  $\mu$ ，最小 20  $\mu$ ，平均 44.8  $\mu$ 。

## 3. 物理性質

氣乾材之含水率為 15.4 %

生材重量	1,103 kg/m <sup>3</sup>	由生材至爐乾之收縮率
氣乾重量	597 kg/m <sup>3</sup>	徑 向 3.65 %
比 重		弦 向 4.81 %
依據生材體積		體 積 8.82 %
及爐乾重量	0.499	
依據爐乾體積		
及爐乾重量	0.548	

## 4. 機械性質

靜力彎曲		縱向抗張強	500 kg/cm <sup>2</sup>
彈性係數	149,300 kg/cm <sup>2</sup> ± 33,200	橫向抗張強	44 kg/cm <sup>2</sup> ± 8
破壞係數	1,221 kg/cm <sup>2</sup> ± 114	剪力強	137 kg/cm <sup>2</sup> ± 21
彈性限界之纖維應力		劈裂強	84 kg/cm ± 10
	941 kg/cm <sup>2</sup> ± 106	硬 度	3.05
縱向抗壓強	511 kg/cm <sup>2</sup> ± 46		
橫向抗壓強	63 kg/cm <sup>2</sup> ± 11		

## 5. 化學性質

化學組成：全纖維素 52.63 %， $\alpha$  纖維素 41.01 %，戊糖 7.64 %，木質素 36.06 %，溫水抽出物 4.33 %，冷水抽出物 2.64 %，1 % NaOH 溶液抽出物 14.65 %，醇苯抽出物 3.98 %，灰分 0.37 %，冷水抽出物之 pH 值為 5.52，溫水抽出物之 pH 值為 5.49。

## 6. 加工性質

材質略堅硬；強度大，鉋削加工稍困難，耐朽性弱遇濕易腐；宜於防腐處理後使用，乾燥狀況良好，少反翹，釘着力中庸。

## 7. 用途

用途：建築（主供樑、桁、結構材），造紙、膠合板（茶箱用）、箱板、枕木等。

## Chinese hemlock

(Tsuga Chinensis Pritz.)

**Range:** Chinese hemlock grows at elevation of 2,000 to 3,000 meters. The species is principally distributed in mountain ranges such as the Pahsienshan, Tahsuehshan, Shiao-suehshan, Nanhutashan, Luchangtashan, Nenkaoshan, Hohuanshan, Luanshan, Lulinshan, Shuishan and Tawushan. The trees of this species are often found on cliffs or at ridges of mountains as pure stands.

**Description:** Heartwood is distinguishable from sapwood. They are yellowish white, with no characteristic odor or taste. Growth rings are narrow, more or less wavy and irregular in width. Transition from springwood to summerwood is abrupt. The wood is occasionally variegated with whitish streaks, straight-grained and medium-textured. The average length and width of fiber are 4.458mm and 44.8  $\mu$  respectively.

**Properties:** A moderately heavy wood. It is classified as hard, very stiff and strong in bending, moderately strong in endwise compression and in tension parallel to the grain. The wood has a moderately high nail-holding ability as well as high resistance to shock. It is moderately easy to work with tools and is easy to dry. When in contact with wet conditions it is not durable. Hence, the wood requires proper treatment before it is being put into service.

### Physical Properties

**Weight:** Based on the moisture content 15.40%, air-seasoned.

Of green wood	1,103 kg/m <sup>3</sup>
Of air-seasoned	597 "

#### Specific gravities:

Based on weight of oven-dry and volume of green	0.499
Based on weight and volume both of oven-dry	0.548

#### Shrinkage:

 From green to oven-dry

Radial	3.65%
Tangential	4.81%
Volume	8.82%

### Mechanical Properties

#### Static bending:

Modulus of elasticity	149,300 $\pm$ 33,200 kg/cm <sup>2</sup>
Modulus of rupture	1,221 $\pm$ 114 "
Fiber stress at elastic limit	941 $\pm$ 106 "

#### Compressive strength:

Compression parallel to grain	511 $\pm$ 46 "
Compression perpendicular to grain	63 $\pm$ 11 "

#### Tensile strength

Tension parallel to grain	500 kg/cm <sup>2</sup>
Tension perpendicular to grain	44 $\pm$ 8 kg/cm <sup>2</sup>

#### Shearing strength

137  $\pm$  21 "

#### Cleavage

84  $\pm$  10 kg/cm

#### Hardness

3.05

**Chemical Properties:** Results of chemical analysis of wood are as follows:

Holo cellulose	52.63%
Alpha cellulose	41.01%
Pentosan	7.64%
Lignin	36.06%
Hot water extracts	4.33%
Cold water extracts	2.64%
1% Sodium hydroxide extracts	14.65%
Alcohol benzene extracts	3.98%
Ash	0.37%
pH value of cold water solubility	5.52
pH value of hot water solubility	5.49

**Uses:** The wood is principally used for general construction (beams and stringers, structural timbers), papermaking, boxes and crates, miscellaneous planing products, railroad crossties.

# 杉 木

## 1.一般事項

名稱：學名 *Cunninghamia lanceolata* Hook. (Taxodiaceae 杉科)

種名：杉木；土名：廣葉杉，福州杉

產地與蓄積：原產大陸長江以南各省，本省產係由福建引種，宜生育於海拔 500 ~ 1,800m 之地區，新店、文山、宜蘭、桃園、竹東、竹南、南莊、大湖、東勢、埔里、集集、竹山、梅山、大埔、花蓮等地均有大面積之人工林。全省造林面積約 31,490 公頃（民國 40~47 年統計），全省蓄積約 780,000 m<sup>3</sup>。

樹木之通性：常綠喬木，徑可達 50cm 以上，高 30~40m，樹幹通直，繁殖容易，生長迅速。

## 2.構 造

木材之外觀：邊心材分明，心材淡黃褐色，邊材淡黃~黃白色。老齡木的心材，淡黃褐色略帶紅色，年輪明晰均勻，寬闊，春秋材明顯，秋材帶狹，年輪間界以細線；木理通直均勻，木肌中庸；徑切面具光澤；有香氣；單列髓線，在肉眼下可察及。

纖維之大小：纖維長度最大 5.55mm，最小 0.92mm，平均 3.192mm 纖維寬度最大 78μ，最小 17μ，平均 45.1μ。

## 3.物理性質

氣乾材之含水率為 16.7%

生材重量	790kg/m <sup>3</sup>	由生材至爐乾之收縮率
氣乾重量	420kg/m <sup>3</sup>	徑 向 2.56%
比 重		弦 向 4.17%
依據生材體積		體 積 6.50%
及爐乾重量	0.35	
依據爐乾體積		
及爐乾重量	0.364	

## 4.機械性質

靜力彎曲		縱向抗張強	643kg/cm <sup>2</sup> ±204
彈性係數	108,300kg/cm <sup>2</sup> ±11,900	橫向抗張強	14kg/cm <sup>2</sup> ±2
破壞係數	872kg/cm <sup>2</sup> ±61	前力強	115kg/cm <sup>2</sup> ±23
彈性限界之		衝擊彎曲（韌性）	
纖維應力	664kg/cm <sup>2</sup> ±40	吸收之能量	204kg-cm/試樣±41
縱向抗壓強	509kg/cm <sup>2</sup> ±25	劈裂強	28kg/cm±3
橫向抗壓強	48kg/cm <sup>2</sup> ±10	硬 度	2.68

## 5.化學性質

化學組成：全纖維素 51.32%，α 纖維素 38.60%，戊糖 9.82%，木質素 34.54%，溫水抽出物 3.59%，冷水抽出物 2.38%，1%NaOH 溶液抽出物 12.92%，醇苯抽出物 3.56%，灰分 1.02%。

## 6.加工性質

材質輕軟，保存期久，心材耐蟻性強，刨削加工容易，刨面光滑，乾燥快，不反翹裂開，釘着力弱。

## 7.用 途

一般建築（柱、樑、桁、椽、天花板、壁板、樓板、屋頂板、門窗等），橋樑、船艦、傢俱、農具、樽桶、電桿、棺材等用材，並可供造紙原料。



# China fir

(*Cunninghamia lanceolata* Hook)

**Range:** China fir is an introduced species into Taiwan from the Chinese mainland. It has been adopted as a major species for reforestation and planted over a large area. It grows at elevation of 500—1,800 meters, and is mainly found in Hsintien, Wenshan, Taoyuan, Chutung, Nan-chuang, Miaoli, Taifu, Taipingshan, Ilan, Pahsienshan, Experimental Forest of National Taiwan University at Chi-tou, Luantashan, Puli, Chichi, Alishan, Tapu, Peikang, Lintienshan and Mukuashan.

**Description:** Heartwood is pale yellowish brown with light red in older trees. Sapwood is pale yellow to yellowish white. It is distinguishable from heartwood to sapwood. The wood has a characteristic odor. Growth rings are generally conspicuous and regular in width. Transition from springwood to summerwood is abrupt. It is delineated by a narrow band of summerwood, with straight-grain, medium texture and somewhat lustrous on edge-grained surface. The average length and width of fiber are 3.192mm and 45.1  $\mu$  respectively.

**Properties:** China fir is a light wood and is rated as soft, low in shrinkage but is moderately stiff, strong in bending, compression and in tension parallel to the grain. It has a low in shock resistance and nail-withdrawal resistance. The wood is easy to work, finishes well and also easy to dry without warping and splitting. Its resistance to decay and termites is high.

## Physical Properties

**Weight:** Based on the moisture content 16.7%, air-seasoned.

Of green wood

790 kg/m<sup>3</sup>

Of air-seasoned

420 "

## Specific gravities:

Based on weight of oven-dry and volume of green

0.350

Based on weight and volume both of oven-dry

0.364

## Shrinkage:

From green to oven-dry

Radial

2.56%

Tangential

4.17%

Volume

6.50%

## Mechanical Properties

### Static bending:

Modulus of elasticity

108,300  $\pm$  11,900 kg/cm<sup>2</sup>

Modulus of rupture

872  $\pm$  61 "

Fiber stress at elastic limit

664  $\pm$  40 "

### Compressive strength:

Compression parallel to grain

509  $\pm$  25 "

Compression perpendicular to grain

48  $\pm$  10 "

### Tensile strength:

Tension parallel to grain

643  $\pm$  204 "

Tension perpendicular to grain

14  $\pm$  2 "

### Shearing strength

115  $\pm$  23 "

### Cleavage

28  $\pm$  3 kg/cm

### Hardness

2.68

## Chemical Properties: Results of chemical analysis of wood are as follows:

Holo cellulose

51.32%

Alpha cellulose

38.60%

Pentosan

9.82%

Lignin

34.54%

Hot water extracts

3.59%

Cold water extracts

2.38%

1% Sodium hydroxide extracts

12.92%

Alcohol benzene extracts

3.56%

Ash

1.02%

pH value of cold water solubility

—

pH value of hot water solubility

—

**Uses:** The wood is generally used for construction (posts, beams, stringers, staircases, ceilings, sidings, subfloor, window sash and doors), bridges, ship and boat-building, furniture, farm implements, coffins, boxes and crates, slack cooperage and paper-making.