
Caesalpinia pulcherrima

Scientific Name

Caesalpinia pulcherrima (L.) Sw.

Synonyms

Caesalpinia pulcherrima var. *flava* Bailey and Rehder, *Poinciana bijuga* Lour., *Poinciana elata* Lour., *Poinciana pulcherrima* L.

Family

Fabaceae also in Caesalpiniaaceae

Common/English Names

Barbados Flower-Fence, Barbados Pride, Barbados-Pride, Bird-Of-Paradise Flower, Dwarf Poinciana, Flower Crest, Flower-Fence, Flowerfence, Paradise Flower, Paradise-Flower, Peacock Flower, Peacock Tree, Poinciana, Poincillade, Pride of Barbados, Pride-Of-Barbados, Red Bird of Paradise, Spanish Carnation

Vernacular Names

Argentina: Chivato Chico

Brazil: Barba-De-Barata

Bolivia: Pajarillo; Chamorro: Caballero, Kabayeros

Burmese: Daungsop

Chuukese: Simmata, Simota, Warepik

Cook Islands: 'Ōva'I, 'Ōvai, Pt Tiare (Maori)

Czech: Sapan Nádherný

Danish: Páfuglebusk, Páfuglehale

German: Stolz Von Barbados

French: Aigrette, Poincillade, Faux Flamboyant, Orgueil De Chine, Petit Flamboyant

Hawaiian: Ohai Alii

India: Krishnachura (Assamese), Krishnachura, Krishanchura (Bengali), Guletura, Gul-Tora, Torai, Gulu Tora (Hindi), Kenjige, Komari, Ratnagandhi, Ratnaganhi, Kenjige Mara, Keneige, Kendge, Kenji Gida, Kanjage, Kenchige, Kencige, Ratnagandi, Channakeshava Gida, Eejimullu, Hote Seege, Kenjigemara, Kenjuga, Komaari, Nalligaane (Kannada), Settimandaram, Techimandaram, Tsjetti-Mandarum, Cekkimandaram, Chekkimandaram, Chettimandaram, Teccimandaram, Tsettimandaram (Malayalam), Krishanchura (Manipuri), Sankeshvara (Marathi), Tarra (Oriya), Krishnachuda, Krishnachura, Ratanagandhi, Sidhakhya, Sidhanasha, Sidheshwara (Sanskrit), Mayirkonrai, Mayuram, Nalal, Sirumayirkonrai, Mayilkonnai, Mayil-Konai, Cemmayirkkonrai, Cironakam, Cironakamaram, Cittimantarai, Cittimantaram, Irattinakanti, Kittimantaram, Kotinalal, Maikkonrai 1, Mancika 2, Mayikonrai, Mayilkonrai, Mayirkkonrai 1, Mayirpelavam, Mayirpelavamaram, Mayurakonnai, Mayuram 3, Mayuramaram, Perumayirkonrai, Pillicarikai, Pillicarikaimaram, Pirayakacceti,

Piriyakam 2, Ponmayirkkonrai, Puccilakkonnai, Pumalekkinam 2, Tuccimam, Tuccimamaram, Mucuppira, Mucuppiramaram, Muyarcevitakkonnai, Muyarcevitam, Nalal 2, Narikkonrai 2, Vatamatakki 2 (Tamil), Pamiditangedu, Ratnagandhi, Sinnaturayi, Turayi, Pamidi Tangedu, Peydi-Tangedu, Ratna Gandhi, Kapura Maddi, Chinaturayi, Cinnaturayi, Paidithangedu, Pamidithangedu, Rathnagandhi, Sinnathuraayi, Thuraayi (Telugu)

Indonesia: Bunga Merak, Kembang Merak, Kembang Patra

Khmer: Dok Fang, Kan Gok Meas, Fang Ham

Kosraean: Rapotin, Repawtin

Malaysia: Chana, Cuban Haji, Bunga Cina, Hambul Merak

Marshallese: Emenawa, Jeimata, Jeimota, Jeimōta, Jemata

Mexico: Maravilla, Siikim; Mokilese: Shimatada

Niuean: Fisihetau, Fitihtetau, Clavellina

Philippines: Bulaklak Ng Paraiso, Caballero (Tagalog)

Pingelapan: Seh Muatah

Pohnpeian: Sehmwida, Sem Tah, Semutha

Samoan: Lau Pa, Lau Pā

Satawalese: Waripik

Spanish: Flor De San Francisco, Caballero, Guacamaya; Macata, Francillade, Carzazo, Tabachín

Swedish: Påfågelsträd

Thailand: Khwaang Yoi (Eastern), Som Pho (Northern), Haang Nok Yuung Tai, Nok Yung Tai (Central)

Ulithian: Warapig

Vietnam: Diep Ta, Diep Cung, Kim Phuw Owng

to semi-drought conditions and tolerate extreme heat. It grows in a wide range of well-drained soils, from alkaline to acidic. It is moderately tolerant of saline conditions and is frost sensitive.

Edible Plant Parts and Uses

The flowers and young pods and seeds are eaten (Tanaka 1976; Pongpangan and Poobrasert 1985; Facciola 1990). Green seeds are sweetish and eaten raw in Thailand or cooked.

Botany

An erect, smooth much-branched shrub or small tree, 1.5–6 m high, branches unarmed or with a few straight prickles. The leaves are alternate, paripinnate, rachis 10–40 cm long, with 5–9 pairs of pinnae, stipules subulate, minute, caducous, leaflets opposite (Plates 1, 2 and 3), apetiolate, 6–12 pairs per pinnae, base unequal, rounded, apex rounded to retuse. Inflorescence in axillary and terminal raceme or panicle, 20–50 cm long; flowers bisexual, red, reddish-pink, orange, orangey-yellow, orange, bright yellow or creamy white; sepals 10–15 × 5–7 mm; petals crisped and clawed, 10–25 × 6–8 mm; stamens very long and very far exerted; ovary with 8–12 ovules (Plates 1, 2, 3, 4, 5 and 6). The pod is nearly straight, flat, smooth, 6–12 cm by 1.5–2 cm wide with 6–8 rectangular, brown or black seeds.



Plate 1 Reddish-pink flowers, young pods and pinnate leaves

Origin/Distribution

The plant is a native of the West Indies and Mexico and Central America. It is widely distributed and naturalized in the tropics.

Agroecology

A tropical tree species, adapted to temperatures of 15–35 °C in full sun to partial shade, from sea level to 1,000 m altitude or higher but is adapted



Plate 2 Close view of reddish-pink flowers



Plate 3 Orange-yellow flowers, pods and leaves



Plate 4 Orange and orange-yellow flowers with long exserted stamens



Plate 5 Bright yellow flowers, pods and leaves

bohydrates 39.1 %, 18.3 %; crude lipid 6.6 %, 5.65 %; crude fibre 9.06 %, 5.98 %; crude protein 48.08 %, 42.97 %; energy 312.15 kcal/100 g, 217.47 kcal/100 g; mineral composition per 100 g : Na 49.5 mg, 40.5 mg; K 39.5 mg, 31 mg; Ca 37.5 mg, 30.5 mg; Mg 58.5 mg, 69.5 mg; Fe 21 mg, 15 mg; P 56 mg, 124 mg; respectively. The results of another analysis conducted in Nigeria (Omole 2003) revealed that the crude protein and crude fat of the seeds were 33.50 and 16.80 %, respectively. The fatty acid profile indicated that the glycerides of oleic, linoleic and linolenic acid accounted for 82.46 % of the total glycerides. Iodine value and saponification number were 104.09 and 195.0, respectively, while the unsaponifiable matter showed a high value of 20 %.

Various scientific studies reported that *Caesalpinia pulcherrima* had antiviral, antiinflammatory, antitumorous, antiulcerogenic and antimicrobial properties.

Nutritive/Medicinal Properties

Analyses carried out in Nigeria (Yusuf et al. 2007) on the proximate composition of whole seeds and seed nuts (dehulled and dried) are % dry weight basis: moisture 9.5 %, 7.3 %; dry matter 90.95 %, 92.7 %; ash 4.5 %, 6.22 %; car-



Plate 6 Creamy-white flowers

Antiviral Activity

One study showed that aqueous extracts of *C. pulcherrima* and its related quercetin possessed a broad-spectrum antiviral activity against herpes viruses (HSV-1, HSV-2) and adenoviruses (ADV-3, ADV-8, ADV-11). Among them, the strongest activities against adenovirus ADV-8 were fruit and seed (EC_{50} =41.2 mg/l, SI=83.2), stem and leaf (EC_{50} =61.8 mg/l, SI=52.1) and flower (EC_{50} =177.9 mg/l, SI=15.5), whereas quercetin possessed the strongest anti-ADV-3 activity (EC_{50} =24.3 mg/l, SI=20.4). In conclusion, some compounds of *C. pulcherrima* which possess antiviral activities may be derived from the flavonoid of quercetin. The mode of action of quercetin against HSV-1 and ADV-3 was found to be at the early stage of multiplication and with SI values greater than 20, suggesting the potential use of this compound for treatment of the infection caused by these two viruses.

Antiinflammatory Activity

The following homoisoflavonoids, (*E*)-7-methoxy-3-(4'-methoxybenzylidene) chroman-4-one and (*E*)-7-hydroxy-3-(3',4',5'-trimethoxybenzylidene) chroman-4-one, (*Z*)-7-hydroxy-3-(4'-methoxybenzylidene) chroman-4-one (isobonducellin), (*E*)-7-hydroxy-3-(4'-methoxybenzylidene) chroman-4-one (bonducellin) and (*E*)-7-hydroxy-3-(2',4'-dimethoxybenzylidene) chroman-4-one, were isolated from the whole plant of *Caesalpinia pulcherrima*. Five flavonoids, namely, 5,7-dimethoxyflavanone (1), 5,7-dimethoxy-3',4'-methylenedioxyflavanone (2), isobonducellin (3), 2'-hydroxy-2,3,4',6'-tetramethoxychalcone (4) and bonducellin (5), exhibited significant antiinflammatory activity. They significantly and dose-dependently inhibited the inflammatory mediators: nitric oxide (NO) and cytokines [tumour necrosis factor (TNF)-alpha and interleukin (IL)-12]. According to their inhibitory results, the order of antiinflammatory potency was compounds 3>5>4>2>1. Furthermore, peritoneal macrophages were pre-activated with lipopolysaccharide LPS/IFN-gamma (interferon-gamma) for 24 hours and determined the inhibitory effects of the above-mentioned isolates on the production of NO after a further 24 hours. The findings supported the use of *Caesalpinia pulcherrima* for the treatment of inflammatory diseases in traditional medicine. Two new flavonoids, 5,7-dimethoxy-3',4'-methylenedioxyflavanone and isobonducellin along with 2'-hydroxy-2,3,4',6'-tetramethoxychalcone, 5,7-dimethoxyflavone and bonducellin, were isolated from the aerial parts of *Caesalpinia pulcherrima*. Both flavonoids also exhibited antimicrobial activity.

Antimicrobial Activity

A new cassane-type diterpene isovouacapenol E (1) was isolated from the leaves of *Caesalpinia pulcherrima*, together with the known compounds caesaldekarin A (3), spathulenol (4), caryophyllene oxide (5), phytol and sitosterol. Four new cassane-type furanoditerpenoids (1–4) were isolated from the air-dried leaves of

Caesalpinia pulcherrima. The exocyclic methylene compound 1 readily isomerized and oxidized to the benzofuran 4. Benzyl 2, 6-dimethoxybenzoate (5) was also identified in this study. Antimicrobial tests on 1–5 indicated that they were active against several bacteria (*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Bacillus subtilis*) and fungi (*Candida albicans* and *Trichophyton mentagrophytes*). An ethanolic extract of the dry fruits of *Caesalpinia pulcherrima* exhibited a broad spectrum of antimicrobial activity, particularly against *Escherichia coli* (enteropathogen), *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Antitumor Activity

Cassane diterpenoids: pulcherralin, pulcherrin A, pulcherrin B, pulcherrin C, neocaesalpin P, neocaesalpin Q and neocaesalpin R, together with eight known compounds: isovouacapenol C, 6-*p*-cinnamoyl-7 β -hydroxy-vouacapen-5 α -ol, pulcherrimin E, pulcherrimin C, α -cadinol, 7-hydroxycadalene, teucladiol and bonducellin—were isolated from the stem of *Caesalpinia pulcherrima*. Five new cassane diterpenoids (1–5) were isolated from the roots of *Caesalpinia pulcherrima*, along with the known isovouacapenol C (6), pulcherrimin A (11) and 6 β -cinnamoyl-7 β -hydroxyvouacapen-5 α -ol (12). Two cassane-furanoditerpenoids, 6 β -benzoyl-7 β -hydroxyvouacapen-5 α -ol (1) and 6 β -cinnamoyl-7 β -hydroxyvouacapen-5 α -ol (2), expressed moderate cytotoxic activity towards KB (human oral carcinoid cancer), BC (human breast cancer) and NCI-H187 (small cell lung cancer) cell lines. Compound 2 showed strong antitubercular activity with a minimum inhibitory concentration (MIC) of 6.25 μ g/ml, whereas the benzoyl analogue (1) was less active (MIC 25 μ g/ml).

Antiulcerogenic Activity

Caesalpinia pulcherrima also has antiulcerogenic property. Pretreatment of the petroleum ether

extract of *Caesalpinia pulcherrima* prevented the formation of gastric lesions in HCl/ethanol model in rats. In the aspirin and pylorus ligation model, the extract was able to significantly reduce the ulcer score and increased mucus content, but had no effect on gastric juice volume or acid content. Thus the results indicated that the extracts' antiulcerogenic effect was attributable to augmentation of gastric defence mechanisms.

Traditional Medicinal Uses

The bark, leaves, flowers, fruits and roots serve medicinal purposes in folkloric medicine. In general a decoction or infusion of roots, bark, leaves or flowers is used as a purgative and emmenagogue. Bark, root and flower have been used in traditional medicines for cutaneous and subcutaneous parasitic infection, febrifuges, pulmonary troubles; leaf especially for nasopharyngeal affections and as laxatives; and leaf and flower as abortifacients and ecbolics. Wood, leaf, root, flower and seed-pod provide tannins and astringents and seeds provide mucilage.

Medicine men in the Amazon Rainforest have long known some of the medicinal uses for *Caesalpinia pulcherrima*, which is known as *ayoowiri*. The juice from the leaves is said to cure fever, the juice from the flower is said to cure sores, and the seeds are said to cure bad cough, breathing difficulty and chest pain. Roots are used as abortifacient. In Papua New Guinea, the roots are used as an abortifacient, whereas the leaves are taken to relieve constipation. In Vietnam, the roots are used as an emmenagogue in folk medicine. In Indonesia, the pounded roots are given to children for convulsions, the bark employed for diarrhoea. The leaves are used with acorn and onions and applied to distended stomach. The leaves are also purgative and used as abortifacient to bring on abortion and used for fever infusion in Indochina. In the West Indies, the leaves and flowers are taken for fever. The flowers are reputed to have purgative, febrifuge and emmenagogue properties. A decoction is a popular remedy for erysipelas and for inflammation of the eyes. They are used also as a tonic.

The flowers are used as vermifuge and a decoction for coughs and chronic catarrh. The fruit is astringent and is employed against diarrhoea and dysentery. The seeds are used as an effective abortifacient.

Other Uses

Peacock flower is a popular ornamental throughout the tropics. It is commonly used for living fences, hedge plant and windbreaks in tropical countries. The flowers, in powder, are used as insecticides. The plant has been used as fish poison. By-products from the leaves include dyes, tannin, stains, inks, tattoos and mordants. The seeds contain galactomannans which can be used as food stabilizers. The firm heartwood serves the production of wooden pegs or tree nails. A yellow-flowering race of this species is used by the Chinese in Malaysia for ritual purposes. It is also the national flower of the Caribbean island of Barbados and is depicted on the Queen's personal Barbadian flag.

Comments

The plant is readily propagated from seeds or stem cuttings.

Selected References

- Andrade CT, Azero EG, Luciano L, Gonçalves MP (1999) Solution properties of the galactomannans extracted from the seeds of *Caesalpinia pulcherrima* and *Cassia javanica*: comparison with locust bean gum. *Int J Biol Macromol* 26(2–3):181–185
- Burkill IH (1966) A dictionary of the economic products of the Malay Peninsula. Revised reprint, 2 vols. Ministry of Agriculture and Co-operatives, Kuala Lumpur. vol. 1 (A–H), pp 1–1240, vol. 2 (I–Z), pp 1241–2444
- Burkill HM (1995) Useful plants of West Tropical Africa, vol. 3, Families J–L, 2nd edn. Royal Botanic Gardens, Kew, 857 pp
- Che CT, McPherson DD, Cordell GA, Fong HH (1986) Pulcherralpin, a new diterpene ester from *Caesalpinia pulcherrima*. *J Nat Prod* 49(4):561–569
- Chiang LC, Chiang W, Liu MC, Lin CC (2003) In vitro antiviral activities of *Caesalpinia pulcherrima* and its related flavonoids. *J Antimicrob Chemother* 52(2):194–198
- de Padua LS, Lugod GC, Pancho JV (1977–1983) Handbook on Philippine medicinal plants, 4 vols. Documentation and Information Section, Office of the Director of Research, University of the Philippines, Los Banos
- Facciola S (1990) Cornucopia. A source book of edible plants. Kampong Publications, Vista, 677 pp
- Foundation for Revitalisation of Local Health Traditions (2008) FRLHT database. <http://envis.frlht.org>
- Kumar A, Nirmala V (2004) Gastric antiulcer activity of the leaves of *Caesalpinia pulcherrima*. *Indian J Pharm Sci* 66(5):676–678
- Maheswara M, Siddaiah V, Venkata Rao C (2006) Two new homoisoflavonoids from *Caesalpinia pulcherrima*. *Chem Pharm Bull(Tokyo)* 54(8):1193–1195
- Omole JO (2003) The chemical composition of *Caesalpinia pulcherrima*. *Nigerian J Anim Prod* 30(1):15–19
- Pacific Island Ecosystems at Risk (PIER) (2004) *Caesalpinia pulcherrima* (L.) Sw., Caesalpiniaceae. http://www.hear.org/pier/species/caesalpinia_pulcherrima.htm
- Pongpangan S, Poobrasert S (1985) Edible and poisonous plants in Thai forests. Science Society of Thailand, Science Teachers Section, Bangkok, 206 pp
- Pranithanchai W, Karalai C, Ponglimanont C, Subhadhirasakul S, Chantrapromma K (2009) Cassane diterpenoids from the stem of *Caesalpinia pulcherrima*. *Phytochemistry* 70(2):300–304
- Promsawan N, Kittakoop P, Boonphong S, Nongkunsarn P (2003) Antitubercular cassane furanoditerpenoids from the roots of *Caesalpinia pulcherrima*. *Planta Med* 69(8):776–777
- Ragasa CY, Hofileña JG, Rideout JA (2002) New furanoid diterpenes from *Caesalpinia pulcherrima*. *J Nat Prod* 65(8):1107–1110
- Ragasa CY, Ganzon J, Hofileña J, Tamboong B, Rideout JA (2003) A new furanoid diterpene from *Caesalpinia pulcherrima*. *Chem Pharm Bull (Tokyo)* 51(10):1208–1210
- Rao YK, Fang SH, Tzeng YM (2005) Anti-inflammatory activities of flavonoids isolated from *Caesalpinia pulcherrima*. *J Ethnopharmacol* 100(3):249–253
- Roach JS, McLean S, Reynolds WF, Tinto WF (2003) Cassane diterpenoids of *Caesalpinia pulcherrima*. *J Nat Prod* 66(10):1378–1381
- Srinivas KV, Koteswara Rao Y, Mahender I, Das B, Rama Krishna KV, Kishore KH, Murty US (2003) Flavonoids from *Caesalpinia pulcherrima*. *Phytochemistry* 63(7):789–793
- Stone BC (1970) The flora of Guam. *Micronesica* 6:1–659
- Sudhakar M, Rao CV, Rao PM, Raju DB, Venkateswarlu Y (2006) Antimicrobial activity of *Caesalpinia pulcherrima*, *Euphorbia hirta* and *Asystasia gangeticum*. *Fitoterapia* 77(5):378–380

- Tanaka T (1976) Tanaka's cyclopaedia of edible plants of the world. Keigaku Publishing, Tokyo, 924 pp
- Uphof JCT (1968) Dictionary of economic plants, 2nd edn. (1st edn. 1959). Cramer, Lehre, 591 pp
- Utomo BI (2001) *Caesalpinia pulcherrima* (L.) Swartz. In: van Valkenburg JLCH, Bunyapraphatsara N (eds) Plant resources of South-East Asia No. 12(2). Medicinal and poisonous plants 2. Backhuys Publisher, Leiden, pp 128–129
- Yusuf AA, Mofio BM, Ahmed AB (2007) Nutrient contents of Pride of Barbados (*Caesalpinia pulcherrima* Linn.) seeds. Pak J Nutr 6(2):117–121