IPHA Health-Promoting Plants Series

# *Pittosporum angustifolia* Lodd. Family: Pittosporaceae

***Pittosporum*** – from the Greek meaning pitch seed, referring to the sticky seeds

***angustifolium*** - from the Latin meaning narrow leaf

## Common names: Weeping Pittosporum, gumby gumby.

Photos by Andrew Pengelly

## Description: Gumby gumby is a small tree to a height of 8m, bearing long narrow leaves with a weeping habit. Leaves are alternately arranged, glabrous, with entire margins and pointed ends. Fragrant yellow flowers grow in the leaf axils, either solitary or in small clusters. The fruit is a dehiscent smooth capsule up to 18mm in length, which opens in to two valves bearing bright red- or orange-coloured seeds upon ripening.

## Distribution: Widespread in all mainland states, mostly inland or along the Great Dividing Range. In South Australia it is more concentrated along and adjacent to the coastline. Another hotspot for distribution is the Alice Springs region of the Northern Territory.

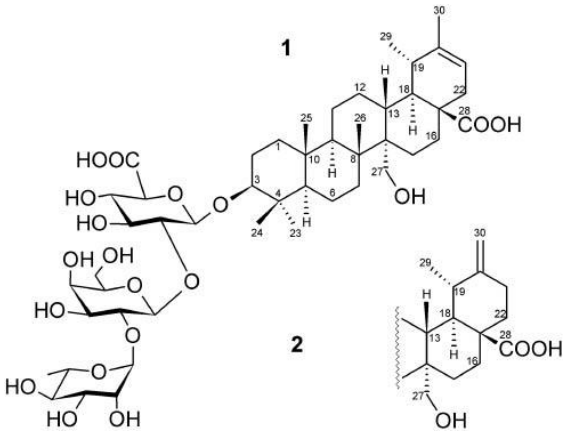
## Edibility: Gum exuding from branches is edible. Seeds, bark, leaves and twigs that have been dried and powdered do not represent traditional food, however they have been marketed as food supplements or nutraceuticals.

**Nutrients:** Proximate analysis of wild and cultivated "whole branch" *P. angustifolium* was conducted by Phan et al. (2020). Whole branch consisted of leaves and stems to a diameter of 5mm. Both samples contained over 40% of fibre by dry weight, while the cultivated sample contained 31% carbohydrate compared to 26% for the wild sample. Protein content was also higher for the cultivated sample (10.6% vs 7.2%), while total fat content was higher for the wild sample (4.6% vs 3.4%). *P. angustifolium* samples, both from cultivated and wild sources, are a good source of the macro-minerals calcium, magnesium and potassium. They have significantly more of the minerals than the common dietary sources spinach, green tea and bay leaves. In addition, leaf and whole branch samples provided useful levels of vitamins C, B2, B5, B6 and folate, with the cultivated samples being the most productive. These findings indicate the leaf and twig powders, when taken at the recommended dose of 10g, are a good source of fibre and energy, macro-minerals and vitamins, and a moderate source of protein and fat.

In separate investigations, leaves and twigs were found to contain the essential fatty acids linoleic and α-linolenic acids. Leaves contain a higher proportion of α-linolenic acids, while linoleic acid is the major EFA in the twigs (Sadgrove & Jones, 2016). Leaves of gumby gumby are also high in the carbocyclic sugar, inositol, sometimes referred to (incorrectly) as vitamin B8. Inositol does however provide therapeutic functions, with reported anti-atherogenic, anti-oxidative, anti-inflammatory and anticancer properties (Mani et al., 2024).

**Phytochemistry:** Several analytical studies have been conducted on this species, and the most significant compounds found to be of medicinal interest are triterpenoid saponins, flavonoids, phenolic acids and essential oils (Table 1).

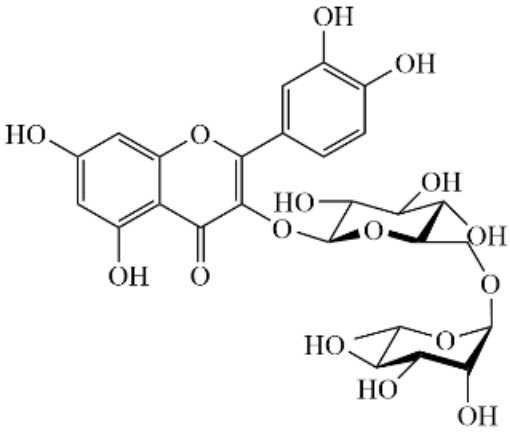
*P. angustifolium* leaves and seeds are a rich source of triterpenoid saponins. When added to water (a little shaking helps), they foam up to provide natural soap. These saponins are derived from pentacyclic triterpene aglycones with barrigenol, oleanolic acid or taraxastane backbones.



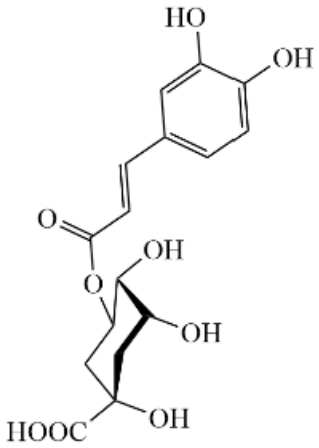

Taraxastane-type triterpenoid saponins pittangretosides L (1) and $C_1$ (2).
Images from Bäcker et l, 2015.

In terms of phenolics, a study by Phan et al (2020) showed samples collected from a South Australian plant sample had a very high total phenolic count (>4000 GAE/100 g DW) compared to several Queensland samples, which were in the range of 730-1350 GAE/100 g DW. Higher total phenolic counts reflect greater antioxidant capacity, and this was confirmed by the DPPH test which indicated that the South Australian sample had a significantly higher oxygen radical scavenging capacity compared to Queensland samples. This study also quantified the total of condensed tannins present, and not surprisingly the South Australian grown sample contained the highest levels. Individual tannins were not characterised. However, several hydroxycinnamic acids (phenolic derivatives) have been identified. These include chlorogenic, *p*-coumaric, and caffeic acids.

Flavonoids are polyphenolic compounds that occur as plant pigments. Flavonoids identified from *P. angustifolium* leaves are glycosides of the flavonol quercetin - rutin, isoquercitrin and quercetin-3-glucoside.




Rutin a flavonol glycoside




Chlorogenic acid

The issue of phytochemical variability in *P. angustifolium* extracts and essential oils and the implications with respect to traditional uses is discussed in two research reports by Sadgrove and Jones (2013 and 2016). With respect to essential oil composition there is also geographically defined variability, and variation between leaves and fruit. The leaves had higher quantities of esters and sesquiterpene alcohols compared to the fruit. In general, essential oil composition for *P. angustifolium* leaves and fruit is dominated by alkanes, mono- and sesqui- terpene compounds. Further details on individual constituents are shown in Table 1. Yields of essential oils also displayed significant variation in Sadgrove and Jones's investigations, with yields from coastal South Australia samples producing 13 times the yield of those from SE Queensland.

Table 1. Classes of phytochemicals from *P. angustifolium*

| **Class** | **Sub-class** | **Main constituents** |
|---|---|---|
| Phenolics | Flavonoids | Quercetin-3-glucoside<br>isoquercetin<br>rutin |
| | Condensed tannins | Not defined |
| | Phenolic acids | *p*-coumaric acid<br>chlorogenic acid<br>caffeic acid<br>dicaffeolquinic acid<br>ferulic acid |
| Triterpenoids | Triterpenoid glycosides (saponins) | Pittangretosides A-Z phillyregenin (a dihydroxylactone), R1-barrigenol, 27 – desoxyphillyrigenin (3fl - hydroxytaraxastan - 28, 20fl - olide), 23 -hydroxyphillyrigenin (3fl, 23, 27- trihydroxytaraxastan - 28,20fl - olide), dihydropriverogenin A, 16 – desoxybarringtogenol C barringtogenol C |
| Essential oils | Alkanes | undecane<br>Tridecane |
| | Alcohols | 1-Dodecanol<br>1-Hexadecanol |
| | Monoterpenes | Limonene |

| | | |
|---|---|---|
| | | Bornyl acetate |
| | | α, β-pinene |
| | Sesquiterpenes | Caryophyllene |
| | | Humulene |
| | | Bicyclogermacrene |
| | Esters | acetic acid decyl ester |

## Medicinal uses

### Traditional uses: There is significant variation in the use of gumby gumby by Aboriginal people across the continent, which may reflect differences in traditional medicine practices, geography-based phytochemical variation or both. Leaf, stem, bark and/or fruit decoctions are taken internally for treating coughs, colds, cramps and for skin disorders such as eczema, inflammatory conditions including arthritis as well as for treatment of infections. These preparations may also be applied topically for skin conditions and to relieve itching. Compresses from warmed leaves are applied to the breasts to promote lactation. Perhaps the most significant customary use is for treatment of various cancers, a treatment that has been revived in the current century.

While gumby gumby products are readily available, there is little therapeutic information to accompany them, for example on labels, since the species is not listed on the Australian Register of Therapeutic Goods.

## Biomedical research:

#### Antimicrobial

Antiviral activity for *P. angustifolium* extracts was demonstrated by the inhibition of 25% of Ross River virus in one study. In addition, pentacyclic triterpenoids which are abundant in this plant have shown inhibition of HIV and herpes viruses. These findings lend support for the traditional use for treating viral conditions such as colds.

Reports of antibacterial and antifungal actions are inconsistent, partly due to different solvents and extraction techniques, methodology used for antimicrobial testing, and the variation between plant parts used and their geographical source. Vesuol & Cock (2011) determined that gram -ve bacteria were more susceptible to *P. angustifolium* extracts compared to gram +ve bacteria, using the disc diffusion assay. Inhibition of a resistant strain of the fungi *Aspergillus niger* was demonstrated, however the growth of *Candida albicans* was not inhibited. These findings were contradicted to some extent by Phan et al.'s 2020 study, which found strong inhibition of *C. albicans* by water and methanolic extracts, but little or no inhibition of the bacteria *S. aureus* or *E. coli*.

Sadgrove & Jones (2013) used a variety of extraction methods to test antimicrobial activity of leaf and fruit extracts against a small panel of human pathogens, including *Staphlyococcus*, *Bacillus*, *Pseudomonas* bacteria and *Candida albicans*. Moderate to high rates of inhibition were demonstrated, correlating with the extraction process used and the solvent selection.

#### Antitumor, cytotoxic

Gumby gumby has been promoted as a cancer remedy across the Internet, it is widely used as a customary medicine for that purpose by Aboriginal people. While there is no clinical evidence of anticancer properties other than anecdotal, there is some evidence from in vitro studies there could be a role for the plant as a supportive remedy for cancer patients. In one example *P. angustifolium* was found to be the most potent extract compared to other plant extracts tested against HeLa (immortalized cancer) cells (Mani et al, 2022)

Bäcker and coworkers have conducted several investigations into the antiproliferative and cytotoxic properties of triterpenoid saponins extracted from the *P. angustifolium* plant. They determined that

acylated triterpenoid saponins with oleanone backbone are cytotoxic against human breast cancer, human urinary bladder carcinoma, and human glioblastoma cell lines. The type of sugar linkage also appears to influence cytotoxicity. Further to this, several acylated saponins were found to inhibit human DNA-topoisomerase I, an enzyme that modulates DNA replication and transcription (Bäcker et al. 2013, 2015, 2016).

More recently Mani et al. (2024) fractionated (a purification method) a 90% methanolic extract of *P. angustifolium* leaves. Fraction 1, which upon analysis contained chlorogenic acid among other compounds, was found to be very effective in reducing cell viability in the tested cancer cell lines. There was a high selective index, indicating that while cancer cells were killed, normal cells showed a good survival rate. Further fractionation failed to demonstrate cytotoxic effects on cancer cells, leading the authors to consider the likelihood of synergistic effects between two or more compounds. Chlorogenic and other hydroxycinnamic acids have demonstrated cytotoxic properties in separate studies (Hernandes et al, 2020).

Other
Apart from some findings of antioxidant activity, there is scant information from biomedical research, other than from the antimicrobial and anticancer research referred to above. Antioxidant effects do not indicate any specific therapeutic benefits, however since oxidation can play a role in inflammation and cancer, it is always preferable to have a regular supply of plant-derived antioxidants, these are usually provided in a balanced diet.

Sadgrove and Jones (2013) have rationalised the traditional use of gumby gumby for promoting lactation, observing that two essential oil components from the leaf and fruit, acetic acid decyl ester and 1-dodecanol, are structurally similar to volatile chemosemiotic compounds involved in mother–infant recognition.

As noted elsewhere, some of the phytochemical and antimicrobial studies indicate significant geographical differences, in particular plants sourced from South Australia appear to contain much higher levels of phytochemicals compared to samples from other states. Why this would be the case is not clear, and further research into this phenomenon should be undertaken. Phytochemical variability is clearly linked to therapeutic potency, which in turn may account for differences in traditional medicinal uses across Australia.

## Safety:

Little attention has been paid to safety issues with respect to *P. angustifolium.* In one report, extracts were subjected to an *Artemia franciscana* bioassay, the results of which showed very low toxicity for any of the extracted tested (Vesoul & Cock, 2011).

## Other species:

There are 150 species of Pittosporum worldwide, and 11 species in Australia, 9 of which are endemic. *P. undulatum,* sometimes referred to as mock orange or native daphne due to the sweet-smelling blossoms, is found along the coast and Great Dividing Range from Tasmania to Central Queensland. It has a reputation for becoming weedy, and has become a naturalised garden escape species in areas around Adelaide and Perth. There is little information regarding traditional uses for this species. An analytical study conducted on essential oil from of *P. undulatum* revealed different profiles to *P. angustifolium.* Monoterpenes including limonene, sabinene were dominant in both leaves and fruit, while leaves were also rich in sesquiterpenes such as bicyclogermacrene. Some antimicrobial activity was observed against *Staphylococcus epidermidis* and *Candida albicans.*

## Cultivation:

*P. angustifolium* is drought- and frost-resistant. It can survive in areas with very low rainfall and fertility, with a potential life-span of over a hundred years. Gumby gumby will grow in both clay and sandy soils. Slow growing, it is suitable for backyards, and when grown in clumps can make a good informal hedge. The trees respond well to light pruning, and harvested leaves can be used for making tea. Young trees sometimes need supporting with a stake or two, and protection from herbivores.

Propagation is by seed or cuttings, though cuttings are slow to take root. Seeds have a sticky coating which should be removed before sowing. One method is to place seeds in a jar with wet sand and agitate until the coating is removed. They are best sown in spring or early summer. Germination usually occurs within 4-14 weeks. Be careful not to overwater, as they are prone to damping off disease.

## Role in agroecology:

While gumby gumby can grow in coastal locations, from an agroecological perspective it will be more rewarding in drier, inland regions. Remnant bushland in which it grows should have high conservation value. An attractive shade tree, it contributes to medicinal sovereignty in many Aboriginal communities. Kevin McPherson ("Macgumby") from the Mackay region of Queensland, continues the tradition of his grandmother, a Barada woman, who kept the plant close by to administer medicinal treatments to her community for generations (https://macgumby.square.site/).

While the tree is too small for producing timber, its' wood is useful for making small tools such as axe handles. The leaves make good cattle fodder, and the weeping habit makes it easier for grazing animals to access the leaves without denuding the trees. The trees also attract birds, insects including bees, and lizards.

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