# TREES FOR LIFE IN OCEANIA

## CONSERVATION AND UTILISATION OF GENETIC DIVERSITY

Edited by

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# *Acacia torulosa*

**Family:** Mimosaceae
**Botanical name:** *Acacia torulosa* Benth. In *J. Proc. Linn. Soc. Bot.* 3: 139 (1859).

The specific epithet is derived from the Latin *torulus*, a little bulge, and *osus*, abounding in, referring to the abundant pods, which are strongly constricted between the seeds.
**Common names:** torulosa wattle, deep gold wattle, thancoupie (English); torulosa (Niger)

## Summary of attributes and why diversity matters

*Acacia torulosa* is a fast-growing shrub or small tree adapted to a wide range of well-drained sites in tropical hot subhumid and hot semi-arid climatic zones. It is drought tolerant, nitrogen-fixing and noted for prolific biomass production. This makes it useful for agroforestry farming systems as a windbreak and a source of fuelwood, edible seed for human and animal food, mulch production, small roundwood (posts and poles) and building timber. It is also useful for land reclamation and ornamental purposes.

Provenance variation in growth and survival of *A. torulosa* indicates that a range of provenances should be screened when testing the species. For example, provenance selections in Niger have produced two tree types that have been domesticated for commercial use in the Sahelian zone of West Africa. A branched seed-producing type is being developed for use in agroforestry farming systems while a tall-growing type is better suited for roundwood and timber production.

## Description

***Habit*** small spreading shrub or tree of 2–8 m but may reach 15 m with a wide crown; new shoots resinous, angular and yellowish. ***Bark*** rough, grey, fibrous, flaky when old. ***Phyllodes*** hairless, straight or curved, 5–20 cm long, 4–18 mm wide, yellowish green; nerves longitudinal, numerous, very close together (8–14/mm) with 1–3 nerves more prominent than the rest. ***Inflorescences*** cylindrical spikes 1–4 cm long, in axillary pairs. ***Flowers*** dull yellow, peduncles 1–9 mm long. ***Pods*** moniliform, 8.5–20.0 cm long, 5–7 mm wide, longitudinally wrinkled and yellow-brown. ***Seed*** longitudinal in the pod, 4.5–7.7 mm long, 3–5 mm wide, shiny dark brown with pale cream aril.

Pods and seed (Photo: P. Cunningham)

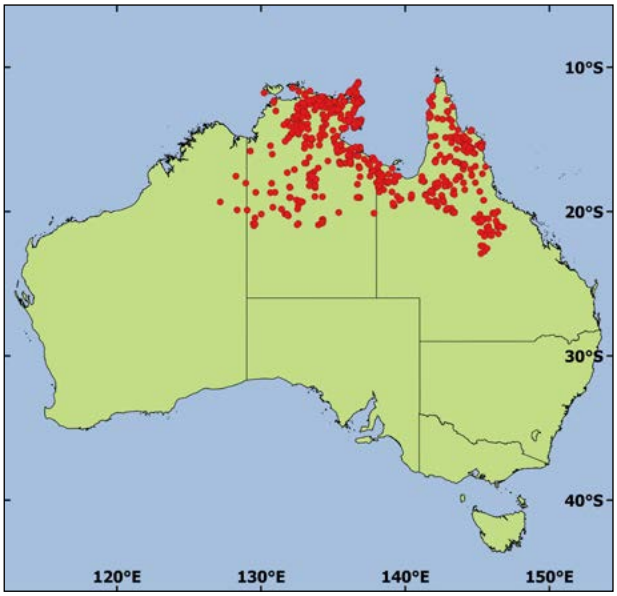
Flower spikes and phyllodes (Photo: P. Cunningham)

## Distribution

*Acacia torulosa* is a naturally occurring tree species of northern Australia where the main distribution is in the lowlands of the north of the Northern Territory and Cape York Peninsula, Queensland. There are also isolated occurrences in the Kimberley region of Western Australia.

This species has been very widely trialled outside Australia, including in countries in Asia, Africa, the Americas and Oceania.

Although mostly distributed in the hot humid zone (700–1,150 mm MAR), there are large areas in hot semi-arid zones where it can be found in locations with 225–275 mm MAR and an 8-month dry season.




Rainfall occurs mainly in summer. Altitudinal range is 0–350 m asl. The area is mostly frost free but 1–2 light frosts may occur annually in elevated inland localities. *Acacia torulosa* is recorded from plains, stony hills, ridges of steep slopes, beach dunes and stream banks. Soils are usually well drained and include deep sands, rocky skeletals, silts and loams. They are typically acidic and of low fertility, but may be alkaline (e.g. the species has performed well on raised coral terrace soils of pH 7.5 in Indonesia) or slightly saline in some places.

## Uses

*Acacia torulosa* is a fast-growing, nitrogen-fixing shrub or small tree suitable for cultivation on a wide range of sites in tropical, hot subhumid and hot semi-arid climatic zones. In Niger, two distinct types of *A. torulosa* have been domesticated for commercial use in the Sahelian zone of West Africa: a tall-growing form and a highly branched and well-adapted spreading form.

**Wood**—dark brown, tough and strong with an air-dry density of 720 kg/m$^3$. Indigenous Australians used the species to make spears, spearheads and pegs for spear-throwers. The tall-growing form can reach a height of 6 m with a stem diameter of ≤15 cm at 1 m above ground level after 4 years of growth at Maradi, Niger. In the Upper East region of Ghana (850 mm MAR), trees of this type have reached 6 m in 2 years. The tall-growing form can also be used in agroforestry farming systems but may be better suited to plantation production for building timber, fence posts, poles and farm tool handles.

**Non-wood**—*A. torulosa* has been recommended as an ornamental for gardens and amenity areas and for mine-site rehabilitation in northern Australia and its seed was used as food by Indigenous Australians during famine. The gum was also eaten.

In Niger, the highly branched spreading form has been developed for multipurpose use in agroforestry farming systems with alley cropping. This type provides good windbreaks and produces good-quality fuelwood and edible seed for human and animal consumption. Trees can be pruned to 1.0–1.3 m every second year to provide firewood and reduce competition with annual crops. The coppicing regrowth also enhances seed production and produces large quantities of mulch, which, together with nitrogen fixation, stabilise the soil and enhance fertility. Local Fulani herders have used one highly branched *A. torulosa* type for arrow shafts.

Three-year-old *A. torulosa* trees have produced 2–12 kg seed/tree in Maradi (450 mm MAR). The nutritious seed has high value as human food and has been treated in the same way as *A. colei* seed for this purpose. *Acacia torulosa* flour has been incorporated into local diets as a 25% mix with local grains such as millet, sorghum and wheat. The seed also has high potential for export to the international gourmet food market for use in a range of foods, including a syrup for ice-cream.

Compared with *A. colei*, which has been used in Maradi as a protein supplement in local foods for over a decade, *A. torulosa* has less bran and yields 64% flour compared with 67% for *A. colei*. The lighter coloured *A. torulosa* flour does not have the beany flavour that often affects *A. colei* flour, is easier to work as the bran sifts more readily and, in general, has a better texture for cooking. *Acacia torulosa* seed has a higher amino acid content (20.8%) than *A. colei* (14.6%), but both are low

Single bole form used for timber; Danja, Niger (Photo: P. Cunningham)

Food dishes from *A. torulosa* seed; Niger (Photo: P. Cunningham)

Multistemmed shrub form; Niger (Photo: P. Cunningham)

in methionine. Seed harvest, thrashing and cleaning are more rapid and easier for the larger seeded *A. torulosa* compared with *A. colei*.

## Diversity and its importance

There have been 37 provenances of *A. torulosa* collected from their natural distribution in northern Australia by CSIRO's Australian Tree Seed Centre. The Maradi Integrated Development Project managed by Serving In Mission (SIM) International from 1998 to 2010 tested 15 of these diverse provenances and identified five main classes of tree types, including two types with high potential for production of different end products in different climatic zones.

Type 1 trees—tall growing, few stems, low seed production, >6 m at 4 years of age—have been domesticated for pole production in the 450–500 mm MAR regions of the Sahel with lateritic and sandy loam soils. This type is also under development in the Upper East region of Ghana. Type 2 trees—medium growing, multistemmed, high wood/seed production, 4–5 m tall at 4 years—have been developed for multipurpose use in agroforestry farming systems and are adapted to 350–550 mm MAR regions in the Sahel. The Type 2 trees (provenances from Elliot, Newcastle Waters and the Tanami Desert in the Northern Territory) are proving to have the greatest potential with good adaptability. They also flower and give good seed production at Maradi from the second year and longevity under good management and pruning has exceeded 12 years.

Tree form; Cadell River, Northern Territory, Australia (Photo: CSIRO)

Further research to determine the flowering biology, seed production and suitability for human food is needed to support the domestication of adapted *A. torulosa* provenances and selections. Further field trials need to be established to determine the adaptability and suitability of Type 2 *A. torulosa* selections and provenances in agroforestry farming systems in wider areas of the Sahel, including those in the 250–300 mm MAR belt.

## Conservation of genetic resources (including threats and needs)

*Acacia torulosa*, like *A. colei*, is relatively common throughout its wide natural distribution and there are few threats to its genetic resources. Many populations occur in relatively remote regions where the main land use is rangeland cattle stations. It is also a naturally resilient species and populations usually thrive following site disturbance. Ex situ conservation measures are also implicit in the testing and selection work that is being carried out in the Sahelian zone of West Africa based on the extensive *A. torulosa* seed collections safely stored and documented at CSIRO's Australian Tree Seed Centre in Canberra, Australia.

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