



## Bellyache bush (*Jatropha gossypifolia*)

Also known as cotton-leaf physic nut. Alternate spelling *Jatropha gossypifolia*.



Bellyache bush flowers are red/purple with a yellow centre. Photo: Northern Territory of Australia.

### Key points

- Bellyache bush is found across the wet/dry tropics of Queensland, the Northern Territory and Western Australia.
- The spread of bellyache bush can cause significant loss of productive grazing land.
- Most parts of the plant are toxic to humans and animals.
- Bellyache bush forms monocultures in the beds and banks of temporary waterways, floodplains, open woodland and grassland.
- Preventing spread is the most cost-effective way of managing bellyache bush.
- Control requires an integrated management approach, including the use of herbicides, machinery, fire, pasture management and the planned timing of control works.

### The problem

Bellyache bush is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic, environmental and social impacts.

Bellyache bush forms dense thickets, particularly in riparian areas, such as river banks. It invades beds and

banks of ephemeral watercourses, floodplains, open woodland and grassland. Productive river frontages are often most at risk of invasion. It also takes over productive grazing land, reduces biodiversity and restricts access for activities such as mustering and recreation.

Most parts of the plant are also highly toxic to both animals and humans with significant stock losses attributed to this weed.

Bellyache bush is an opportunistic weed that thrives on both natural and man-made disturbance.

### The weed

Bellyache bush is widespread in its native range from Mexico to southern Brazil. It has been introduced as an ornamental and medicinal plant in many tropical countries across Australia, Africa, Asia, and North and South America.

Bellyache bush was first introduced into northern Australia in the late 1800s as a hardy garden ornamental, capable of growing well in poor soil and with little water. By the 1920s it had escaped and naturalised, probably due to dumping of plants and cuttings as well as flood born seeds and fragments.

Bellyache bush is an upright, multi-stemmed perennial shrub with a shallow root system. Individual plants have a life span of more than 10 years and can grow up to four metres, although most plants average between two and three metres high. It is deciduous in winter with new leaves generally produced with the onset of the wet season.

The branches, stems and leaves are covered with tiny, sticky hairs. Bellyache bush leaves are alternate and have three to five lobes with very finely toothed margins.



Dense bellyache bush forms monocultures and reduces biodiversity. Photo: Northern Territory of Australia.

Leaves have three to five lobes. Photo: Northern Territory of Australia.

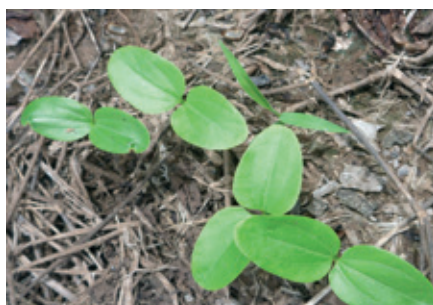
The leaf colour depends on biotype (a group of plants having the same genetic constitution) and the age of the leaf, but ranges from green to bronze, red or purple.

The small flowers are red or purple on the outside of the petals with a yellow centre. Fruit capsules are round to oblong, usually containing three seeds. The hard capsules are bright green when immature, pale green or tan and woody at maturity. The fresh brown seeds have a fleshy, lighter coloured outgrowth on one end (caruncle).

## How to identify bellyache bush

Key identification features of bellyache bush include:

- erect shrub can grow to four metres in height
- shallow, fleshy and tuberous root system
- seedlings comprise a single stem with three or four single lobed leaves sprouting from the top
- palm-shaped mature leaves with three to five oval segments



Newly emerged bellyache bush seedlings. Photo: Northern Territory of Australia.

- mature leaves vary from bright green to purplish red depending on biotype
- stems, leaf stalks and leaf margins covered with coarse, sticky, gland tipped, brown hairs
- thick stems which exude a sticky sap when damaged
- small red flowers with yellow centres in small clusters in the upper part of the plant
- smooth, green, oval fruit about the size of a cherry, and
- seed pods with three to four seeds.

## How it spreads

Bellyache bush plants are prolific seed producers with one adult plant producing up to 12,000 seeds each year depending on environmental conditions, biotype and the density of the infestation. Seed capsules open explosively on ripening, catapulting seeds up to 13 metres from the adult plant. Research indicates that most seed will expire within four years although some may last ten years or more under dry conditions. Seedling density can be very high, up to 400 per square metre.

Bellyache bush will also regenerate vegetatively from stem cuttings or from whole removed plants. As many infestations are found in riparian areas, the most significant long-distance dispersal mechanism is water, particularly during floods.

Seeds may also be accidentally transported as a contaminant of soil and sand or on vehicles and machinery.

## What to do about it

### Prevent spread

Stopping the spread of bellyache bush into clean areas should be a management priority. By identifying the most likely means of spread to and within a property, the risk of new infestations can be minimised.

Ensure that all roads and tracks on your land are free of bellyache bush. Clean any vehicles, weed control equipment and machinery that have been in bellyache bush infested areas. Avoid moving contaminated material, particularly soil or sand, into areas free of bellyache bush.

Early detection and control of new infestations is vital. Riparian areas should be checked after floods, looking for weeds when conducting routine management activities and being on the lookout for outlying plants are all essential activities with immediate follow-up treatment of any plants found.



Fruit is bright green, turning brown when mature. Bellyache bush flowers are red or purple with a yellow centre. Photo: Northern Territory of Australia.



Pulled plants can reshoot.  
Photo: Northern Territory of Australia.

## Chemical control

Herbicides are useful in the management of bellyache bush but follow-up control is vital. Chemicals are most effective through the active growth season. If a heavy infestation is sprayed then ignored, it can worsen the problem.

Foliar spraying, if applied when plants are actively growing, can kill 95 to 100 per cent of bellyache bush plants. Trials have shown that four consecutive years of foliar spraying have controlled established infestations. Selective herbicides allow grass to remain and compete with bellyache bush seedlings. Registered, selective herbicides for on-ground application are metsulfuron-methyl and fluroxypyr.

Aerial spraying may be an effective option for large, dense infestations, in areas of limited access and rugged terrain and in areas with minimal tree cover. Massive recruitment of bellyache bush seedlings may occur after aerial spraying and follow up control must be planned.

This method may require a vegetation management permit as there is the possibility of off-target damage.

An off-label permit will be required, as no herbicides are registered for aerial spraying of bellyache bush.

Basal bark spraying covers the full circumference of the stem from ground level to 20 cm (higher on larger plants). The cut stump method is where the bellyache bush stem is cut horizontally as close to the ground as possible and herbicide then applied immediately (within 15 seconds). Both these methods are labour intensive

but highly selective and effective for small infestations or where plants are too large to be pulled out by hand. Registration of herbicides varies across states for basal bark and cut stump applications. You should check the product label and seek advice from your local weeds officer.

## Mechanical control

Mechanical control may be suitable for large, dense infestations. The biomass of infestations will be reduced by mechanical control and access improved for the necessary follow up control of the resultant seedling recruitment.

Stick raking can result in greater than 90 per cent mortality of bellyache bush with mostly smaller plants surviving. As it bares the soil surface however, it can result in massive recruitment of seedlings.

Slashing can kill up to 100 per cent of mature plants but is restricted to flat, open woodland and must cut the plants as close to the ground as possible. Heavy duty mulchers are more robust than slashers and can handle some woody debris on the ground. They may also reduce shooting from cut plants. Both slashing and mulching should be undertaken when the plants are actively growing, during or soon after the wet season.

## Manual removal is effective for small areas

Due to its shallow root system, small bellyache bush plants can be easily removed by hand and larger ones dug out. However pulled or dug plants can stay alive and regrow many months later so should be burnt or placed where they are not in contact with

the ground. As plants hung in trees have been recorded to flower and set seed 130 days later, the stems should be snapped to increase stem moisture loss and allow greater access for secondary pests and diseases.

Cutting plants close to the ground with a brush-cutter or hand tools during the growing season may be useful for relatively small infestations, environmentally sensitive areas or where vehicle and machinery access is difficult. Reshooting may occur.

## Fire

Bellyache bush is sensitive to fire with young plants more susceptible than mature plants. Bellyache bush plants generally will blister but not burn so a grass fuel load is required to allow the fire to reach sufficient intensity to kill plants. The seeds are susceptible to fire but not all seeds in the soil will be killed. The up-front costs of using fire as a management tool may be minimal when compared to other techniques, however loss of pasture and subsequent high seedling recruitment must be considered. Handheld burners or flamers have proven effective for bellyache bush control where chemical or mechanical control is not appropriate. Flaming for 10 seconds around the base of each plant has been shown to kill 92 per cent of treated plants but care must be taken with this method during dry times.

## Biological control

Bellyache bush has been a target for biological control in Australia since 1996. The only agent so far released is the seed-feeding jewel bug *Agonosoma trilineatum*.



Monitoring site in the Northern Territory before treatment in February 2010.  
Photo: Northern Territory of Australia.

Three months after foliar spraying. Follow up required as germination of seedlings likely with onset of moist conditions.  
Photo: Northern Territory of Australia.



Fire can be an effective management tool particularly with young plants and a grass fuel load. However, follow up treatment is essential.  
Photo: Northern Territory of Australia.

Thousands of these insects were released across Queensland and the Northern Territory between 2003 and 2007. To date, the jewel bug is not known to have established in the field. Host-testing of a rust disease is currently in progress and it is the last remaining agent to be tested of those currently known.

## Pasture management and competition

Bellyache bush thrives in disturbed areas and is often a symptom of poor land condition.

Good pasture management, both native and improved, is vital to limit the spread of bellyache bush into clean areas and also to minimise the risk of reinvasion of controlled areas.

Maintaining a competitive pasture will reduce the number of bellyache bush seedlings that emerge, contribute to higher seedling mortality and delay the onset of seed production.

## Integrated control methods

No single treatment method will be effective in all situations or for both initial treatment and follow-up.

A combination of several methods may provide the best strategy depending on factors such as size and density of the infestation, accessibility, presence of non-target species, time of year, cost, resources available and any permit requirements.

Possible integrated control methods that have proven successful are:

- repeat foliar applications and maintenance of a competitive pasture
- initial stick-racking followed by other mechanical or herbicide applications
- slashing or mulching repeatedly or follow-up with spot spraying, and
- incorporation of burning as either an initial or follow-up technique

## Weed control contacts

Contact the weed control authority in your state for up to date information on pesticides and legislation.

	Department	Phone	Website
<b>National</b>	Australian Pesticides and Veterinary Medicines Authority	02 6210 4701	<a href="http://www.apvma.gov.au">www.apvma.gov.au</a>
<b>ACT</b>	Department of the Environment and Sustainable Development	13 22 81	<a href="http://www.environment.act.gov.au">www.environment.act.gov.au</a>
<b>NSW</b>	Department of Primary Industries	1800 680 244	<a href="http://www.dpi.nsw.gov.au">www.dpi.nsw.gov.au</a>
<b>NT</b>	Department of Natural Resources, Environment, the Arts and Sport	08 8999 4567	<a href="http://www.nt.gov.au">www.nt.gov.au</a>
<b>Qld</b>	Department of Agriculture, Fisheries and Forestry	13 25 23	<a href="http://www.dpi.qld.gov.au">www.dpi.qld.gov.au</a>
<b>SA</b>	Department of Primary Industries and Regions SA	08 8303 9620	<a href="http://www.pir.sa.gov.au">www.pir.sa.gov.au</a>
<b>Tas</b>	Dept of Primary Industries, Parks, Water and Environment	1300 368 550	<a href="http://www.dpipwe.tas.gov.au">www.dpipwe.tas.gov.au</a>
<b>Vic</b>	Department of Primary Industries	13 61 86	<a href="http://www.dpi.vic.gov.au">www.dpi.vic.gov.au</a>
<b>WA</b>	Department of Agriculture and Food	08 9368 3333	<a href="http://www.agric.wa.gov.au">www.agric.wa.gov.au</a>

## Where it grows

Bellyache bush is now widespread across northern Australia, especially along watercourses and associated floodplains.

In Queensland, bellyache bush is found in the Burdekin, Fitzroy, Walsh, Palmer, Flinders, Leichhardt and Gregory River catchments, as well as the headwaters of Lake Eyre Basin. Scattered infestations are also found in central Queensland.

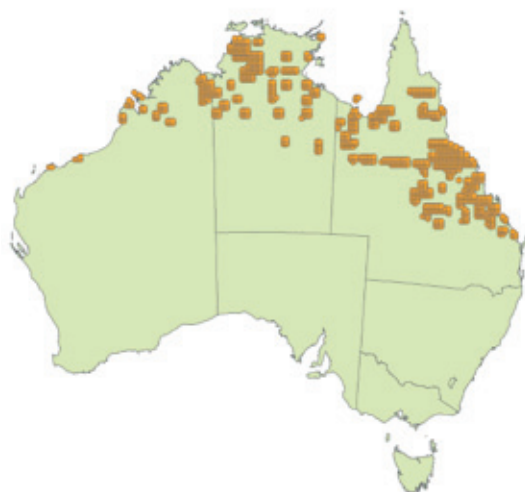
In the Northern Territory, bellyache bush is most prevalent in the Daly, McArthur, Roper and Victoria River catchments, the Gulf region and the Barkly Tableland. Smaller infestations are also found in several coastal monsoonal areas, including the Darwin region.

Widespread populations exist in the east Kimberley in Western Australia, with large infestations in the Lake Argyle catchment and Halls Creek area. Smaller infestations occur in the west Kimberley around Derby and Broome and on the Fitzroy River. It also occurs in the Pilbara towns of Karratha and Port Hedland.

## Potential distribution

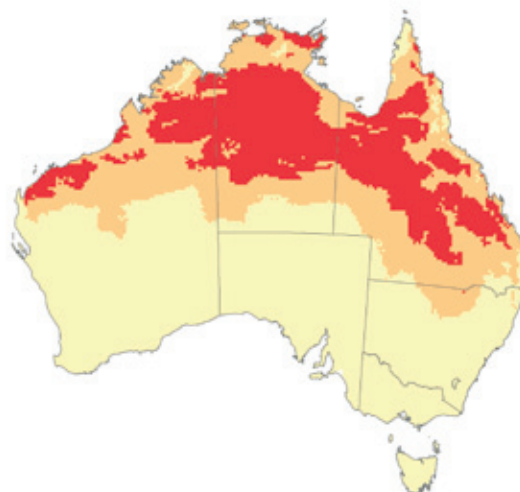
Bellyache bush has an extensive potential range in Australia; including all of the savanna woodlands of the wet-dry tropical climate of northern Australia in Queensland, Northern Territory and Western Australia. It is likely to be most abundant on sandy loams associated with creeks and rivers, but will establish and grow in most soil types including rocky cliffs. Most infestations occur in areas receiving between 400 and 1200 mm of rainfall. Bellyache bush has the potential to flower and fruit year-round, although seed production peaks in the late wet season in most locations.

Map 1: Current distribution of bellyache bush in Australia



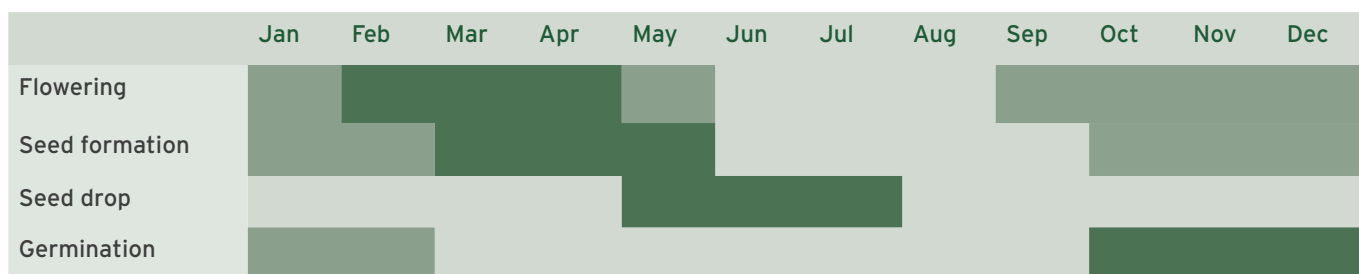
- Present and past reported occurrence
- No reported occurrence

Map 2: Potential distribution of bellyache bush in Australia



- Low climate match
- Moderate climate match
- High climate match

## Growth calendar



- General pattern of growth
- Growth pattern in suitable conditions

## Legislation

Bellyache bush is a declared noxious weed in Queensland, the Northern Territory and Western Australia with it being an offence to keep, move or sell it. In the Northern Territory, there are legislated zones in which all landholders are required to eradicate any bellyache bush. In the remainder of the Northern Territory, the northern half of Western Australia and Queensland, landholders are legally obliged to control this plant (i.e. prevent spread into unaffected areas). Check with your local council or state or territory government agency about the latest requirements for bellyache bush control.

## Acknowledgements

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*Maps:* Data provided by state and territory weed management agencies. Production by Chris Auricht. Potential distribution CLIMATCH modelling by ABARES.

Key reference: *Bellyache Bush (Jatropha gossypifolia) Management Manual*, Queensland Department of Employment, Economic Development and Innovation (2009).



Bellyache bush growing on the cliffs near the Argyle Dam wall. Photo: Northern Territory of Australia.

## Case study: Argyle Dam, Ord River WA

Ord Land and Water (OLW), a Landcare organisation based in Kununurra, Western Australia has been working since April 2008 on a multi-weed control project including bellyache bush. The project covers approximately nine hectares in the hilltop area surrounding Argyle Village and the riparian and adjacent vegetation on the reserve along the banks of the Ord River below Argyle Dam. The cliffs and steep slopes between the Argyle Village and the river banks also have some pockets of bellyache bush. The major concern has been the threat to the Lake Kununurra Ramsar site.

Bellyache bush was first observed in this area in 1994, thought to have originated as garden escapees. The infestation varies from dense thickets to scattered plants depending on the topography, with the biggest plants reaching over two metres. Access is difficult throughout the infestation, particularly below the dam wall. Foliar spraying, basal bark and a small amount of hand pulling of the bellyache bush plants, and other weeds species, is being done using garlon and diesel or starane.

Treatment and follow up of patches is being conducted using a staged approach allowing access and treatment to the nearby area. Grass has come back in some areas, reducing the number of seedlings that come back.

Dick Pasfield, OLW Coordinator says the biggest lesson learned during the project is the need for continual monitoring and spraying during the wet season. 'If you knock off over the wet, the seedling growth gets away and you are almost back to the beginning.'

Problems that OLW staff have faced include heat exhaustion, boat only access, snakes, crocodiles, unstable surfaces, out of season rainfall in 2010, the wet season itself, steep locations on the side of a cliff, other weeds and a lack of funding.

'After three and a half years work at a cost of \$44,000, there is still a fair storage of seed in the ground, but we will maintain the current program including monitoring all the time to ensure we keep ahead of the weed.' Dick said.