

Weed risk assessment



Dutchman's pipe

Aristolochia elegans

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August 2009

Note: this version is a preliminary draft and information is still being collected for this species. Technical comments on this draft are being sought and are most welcome.



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Front cover: flower of *Aristolochia elegans*.

Photo: Sheldon Navie.

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Summary

Aristolochia elegans is a perennial climbing vine grown for its distinctive pipe-shaped flowers. A native of Brazil, *A. elegans* has escaped cultivation and naturalised in a number of tropical and subtropical regions including Florida, South Africa, Hawaii, and several other Pacific Islands. In Australia, *A. elegans* has naturalised in parts of Queensland and northern New South Wales. *A. elegans* favours moist, fertile soils and will grow vigorously and smother supporting vegetation given suitable conditions. Habitats most at risk in Queensland are rainforest, creek and river banks or vine forest in tropical and subtropical regions. Small, scattered populations have also been found in eucalypt woodland and dry rainforest. It is commonly associated with other weed infestations and disturbance. *A. elegans* is also a threat to the vulnerable Richmond Birdwing butterfly (*Ornithoptera richmondia*) that mistakenly lays its eggs on the leaves of *A. elegans*, which are toxic to the larvae. In Queensland, *A. elegans* is declared a 'Class 3' weed, meaning its sale and supply is prohibited and removal may be required if it is present in environmentally significant areas.

Introduction

Identity and taxonomy

- Taxa:** *Aristolochia elegans* Mast.
- Genus:** *Arisolochia*
- Family:** Aristolochiaceae (birthwort family)
- Synonyms:** *Aristolochia littoralis* Parodi (PIER, 2006)
- Common names:** Dutchman's pipe, calico-flower, elegant Dutchman's pipe, Maori (Cook Islands): mokorā, Tongan: fue paipa holani, Brazil: jarrinha-pintada, pelican flower.

Taxonomy

Aristolochia elegans belongs to the Aristolochiaceae family of which there are approximately 450 species. Most are evergreen climbers from moist temperate woodlands and moist subtropical regions in both hemispheres. There are also some perennial herbs and shrubs (Starr et al., 2003). The name is derived from the Greek *aristos* meaning best, and *lochia* meaning delivery, because derivatives from these plants were used to assist child birth (Starr et al., 2003).

Description

Aristolochia elegans is a perennial climbing vine with large pipe-shaped flowers that are shaped like a traditional Dutchman's pipe. The plant is distinguished by broad heart-shaped leaves, each with a distinctive curved leaf base. *A. elegans* can grow from 3 m to 4.5 m high on supporting vegetation. Leaves grow 3–10 cm long, 3–12 cm wide on a 5 cm stalk (Kleinschmidt and Johnson, 1977; Weeds Australia, undated). Leaves are arranged alternately along a climbing stem (McClymont, 2002).

The plant has slender woody stems that twine in tight coils around other plants, fences, wires or other supporting structures (Langland et al., 2004). On young vines, stems are slightly channeled and corky, while larger vines are covered with fissured corky or spongy brown bark (McClymont, 2002). The leaf stalk is twisted with a stipule-like small leaf at the base (see Figure 8) (Weeds Australia, undated). Damaged stems exude a strong acetone-like smell (nail polish remover) (McClymont, 2002).



Figure 1. *A. elegans* flower vine and flower (Photo: Sheldon Navie).



Figure 2. Heart-shaped leaves of *A. elegans* (Photo: Sheldon Navie).

The yellow-green flowers are pipe-shaped, flared at the base, expanding out to a petal-like calyx that is mottled purple, brown and white on the inside, about 7.5 cm long and 10 cm wide (Kleinschmidt and Johnson, 1977; CRC for Australian Weeds Management, 2008). Single flowers are borne on leaf axils, with flowers located among the foliage.



Figure 3. Purple and white mottled flower of *A. elegans* (Photo: Sheldon Navie).



Figure 4. Pipe-shaped flower of *A. elegans* (Photo: Sheldon Navie).

The fruit is an oblong dehiscent capsule (structure that splits apart to release its contents) 4–6 cm long and 2.5 cm wide with six ribs. When brown and still on the vine, the capsules split along the ribs to release numerous flat, brown, tear-drop shaped seeds 6–7 mm in length (Hyde and Wurston, 2009; Sands and Scott, 1998; Weeds Australia, undated).



Figure 5. Fruit of *Aristolochia elegans* (Photo: Sheldon Navie).



Figure 6. Winged seeds and dehiscent capsule of *A. elegans* (Photo: Sheldon Navie).



Figure 7. Stems (with seed pods) of *A. elegans* twining around supporting plants (Photo: Sheldon Navie).



Figure 8. The leaf stalk is twisted with a stipule-like small leaf at the base (Photo: Sheldon Navie).

Reproduction and dispersal

Flowers appear in summer and have a strongly aromatic scent that has been likened to carrion. Flies, attracted by the scent, enter and become trapped in the inner part of the hair-covered perianth tube and wander within the utricle of the flower, depositing pollen on the stigmas. The anthers then dehisce to release more pollen on the fly. The guard hairs eventually wither and release the fly (Hall and Brown, 1993).

Average germination rate of seeds is estimated to be more than 50 per cent (Hall and Brown, 1993).

Origin and distribution

Aristolochia elegans is likely to have originated in Brazil (Hall and Brown, 1993) but other authors and databases list additional countries of origin. According to PIER (2006) native range of *A. elegans* extends from Brazil, Argentina to Antigua and Barbuda, South America. It is also reported as native in Bolivia, Columbia, Ecuador, Paraguay and Peru (GRIN, 2009).

An aggressive woody climber, *A. elegans* has been widely cultivated throughout the tropics and has naturalised in parts of northern and central Florida (Langeland et al., 2004), several Pacific Islands, Australia, Christmas Island and South Africa (Foxcroft, 2008; PIER, 2006, Starr et al., 2003). In Africa it has also been recorded in Malawi, Mozambique and Zimbabwe (Stannard, 1997), but the extent to which it has naturalised in these countries is unclear.

In Hawaii *A. elegans* has naturalised on Kauai, O'ahu, Maui (Wagner, 1999). On O'ahu, *A. elegans* has naturalised (sparingly) in the Pearl Harbour area (Starr et al., 2001–2).

A. littoralis (*A. elegans*) is listed as a threat in Australia, Tahiti Island (PIER, 2006). It is also present in Tonga, present in Guam and Taha'a Island (PIER, 2006).

Ecology and preferred habitats

A. elegans prefers moist, well-drained soils and grows in full sun to part shaded areas (Scheper 2003, Stannard 1997). *Aristolochia elegans* is a rapidly growing vine that can be cultivated by seed or from cuttings (Csurshes and Edwards, 1998). It is 'winter hardy' but does not tolerate dry soil. Seedling plants are often found near mature vines (Scheper, 2003).

Globally, *Aristolochia elegans* has been recorded as a naturalised escapee in tropical and subtropical regions along forest edges and in riverine fringes, particularly in disturbed areas (Stannard, 1997). In Australia, *A. elegans* has been recorded growing around the edges or in disturbed gaps of rainforest remnants, and along creeks or moist gullies (McClymont, 2002). Records from the Queensland herbarium indicate that *A. elegans* grows in sandy, alluvial soils, basalt-derived soils, black or red clay loams, and in stoney dark brown loams and lithosols.

An aggressive and vigorous climber, *A. elegans* scrambles over small shrubs and trees, smothering vegetation. It is commonly associated with other weed infestations and disturbance. Like other exotic vines, *A. elegans* can weigh down native vegetation and result in collapse under the weight of biomass it produces and provide an opportunity for other invasive plants to establish (Starr et al., 1993).



Figure 9. *A. elegans* scrambles over small shrubs and trees (Photo: Sheldon Navie).

History of Australian introduction

A. elegans was likely to have been introduced into Australia in the late nineteenth century, the earliest record being 1897 (Randall 2009, pers comm). Years in which the plant was first documented in each state's nursery trade are: New South Wales: 1897; South Australia: 1906; Victoria: 1995; Western Australia: 2002, and Queensland: 1932, although these figures may be decades behind the actual date of introduction (Randall 2009, pers comm).

History as a weed elsewhere

Aristolochia elegans is recorded as an invasive weed in Florida, the Pacific Islands of Kauai, Maui, Oahu (Hawaii), Mangaia (Cook Islands), Mangareva and Tahiti Islands (French Polynesia), New Caledonia, Tonga; in Queensland, and New South Wales, (Australia) and on Christmas Island (PIER, 2006).



Figure 10. Global distribution of *Aristolochia elegans* (Source: GBIF).

In Florida, *A. littoralis* (*A. elegans*) is classified as a 'Category II' pest plant, signifying that it has increased in abundance or frequency, but has not yet altered Florida's plant communities (Scheper, 2003). Though not prohibited from sale, government agencies and peak industry groups have urged growers, landscapers and retailers to phase out the production and sale of *A. littoralis* (Florida Department of Environmental Protection, 2001, cited in Scheper, 2003).

In Hawaii, *A. littoralis* (*A. elegans*) is known to escape cultivation and become sparingly naturalised on Kaua'i, O'ahu, and East Maui (Imada et al., 2000: 10, Starr et al., 2003: 25, Wagner et al., 1999 cited in Openheimer, 2006). More recent records document a significant range extension to include West Maui, where it climbs alien vegetation in secondary lowland forest (Openheimer, 2006).

A. littoralis (*A. elegans*) is an invasive or potentially invasive plant species present in and around the Pacific region and is listed as a 'Plant Risk to Pacific Ecosystems' under the Pacific Island Ecosystems at Risk (PIER) project. It is considered a potentially invasive species present on Mangaia (Cook Islands). PIER (2006) recommends that *A. elegans* be subject to inter-island quarantine to prevent its movement to other islands in the Cook Island group.

In New Caledonia *A. elegans* is listed as a 'moderate invader' (Meyer, 2000).

In South Africa *A. elegans* has escaped cultivation and naturalised in a number of sites in Kruger National Park (Foxcroft et al., 2008). It has also been recorded in Malawi, Mozambique and Zimbabwe (Stannard, 1997).

Distribution in Australia and Queensland

The Australian Virtual Herbarium has 93 records of *A. elegans* in all states except Tasmania. These include Canberra (15), New South Wales (7), Northern Territory (5), Queensland (55), South Australia (2), Victoria (7), and Western Australia (2).

A. elegans has naturalised in north-eastern New South Wales and in Queensland, mainly in high rainfall coastal areas including the Conondale Ranges, Coomera River catchment, the Mary River, around Cairns and in numerous state forests (Csurhes and Edwards, 1998).

The Queensland Herbarium has approximately 55 records of non-cultivated *A. elegans*. Figure 11 shows records extending from the south-east corner to the Wet Tropics.

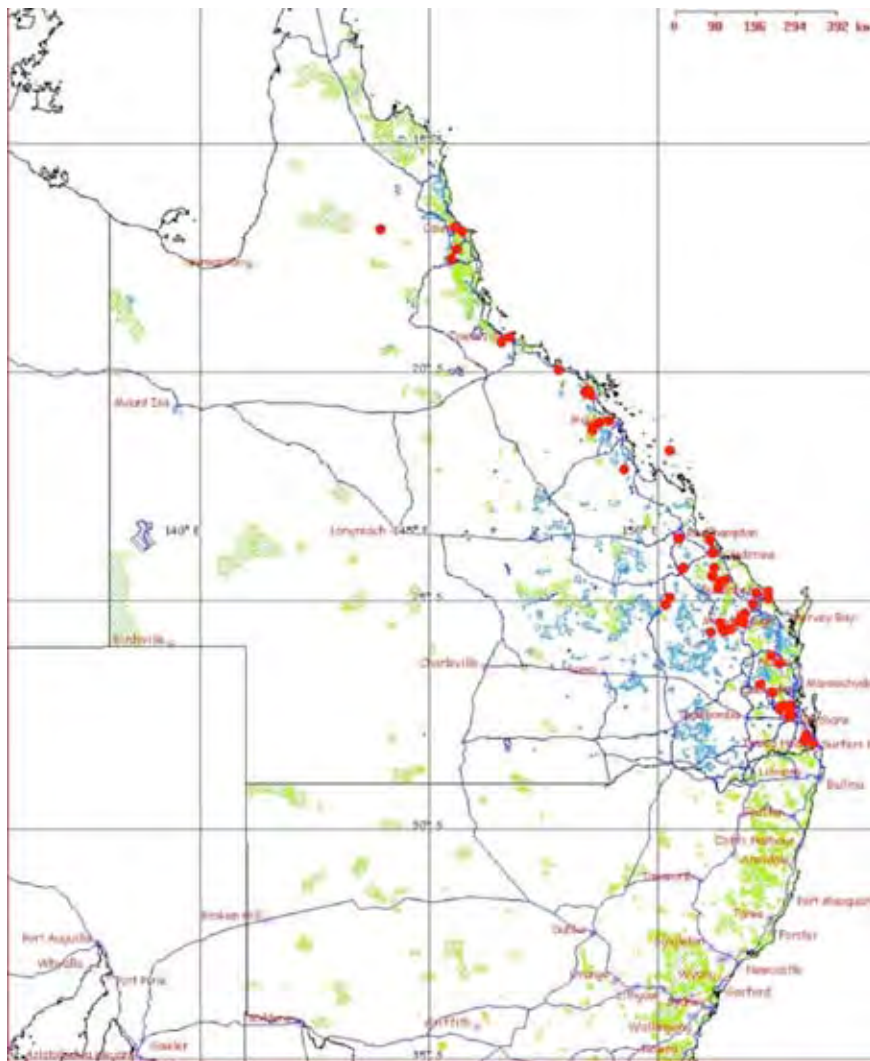


Figure 11. Records of non-cultivated *A. elegans* (Source: Queensland Herbarium).

Queensland Herbarium records document *Aristolochia elegans* growing along rivers, creeks and flood channels in sandy, alluvial soils, or basalt-derived soils amongst riparian forest, rainforest, or vine forest. These records also document *A. elegans* growing in *Casuarina cunninghamiana* (river she-oak) and *Eucalyptus tereticornis* (Queensland blue gum) forest, dry rainforest and occasionally in hilly terrain and ridge lines.

Uses

A. elegans has been widely cultivated as a garden ornamental in tropical and subtropical regions throughout the world (Starr et al., 2003). In cultivation it is also referred to as ‘Calico vine’ as the purple pattern on the flower resembles patterned calico fabric.

Derivatives of the genus *Aristolochia* are sometimes found in herbal preparations and have been used to treat various ailments, such as malaria as well as to moderate pain in childbirth. Many *Aristolochias* contain the alkaloid aristolochic acid and other components (Langeland et al., 2004; Scheper, 2003). Plants and herbal preparations containing aristolochic acids are associated with severe kidney damage and urinary tract cancer and ingestion of plants or these derivatives are to be avoided (Department of Health and Aging Therapeutic Goods Administration, 2007).

Impacts on the Richmond birdwing butterfly

Cultivation and naturalisation of *A. elegans* in south-east Queensland and northern New South Wales has contributed to further decline of the spectacular Richmond birdwing butterfly (*Ornithoptera richmondia*), which has disappeared from approximately one third of its range.

The Richmond Birdwing is listed as Vulnerable in Queensland due to loss of its larval food plant, *Pararistolochia praevenosa*, found in lowland rainforest, as a result of habitat fragmentation through land clearing (CRC for Australian Weed Management, undated). *A. elegans* resembles the larval food plant, *P. praevenosa* and Richmond birdwing butterflies lay their eggs on the leaves of *A. elegans*, which is poisonous to the caterpillars (Department of Primary Industries and Fisheries, 2007; New and Sands, 2002).

Fortunately, recovery programs by schools and community groups have focused on weed control and extensive plantings of *P. praevenosa* and have halted the contraction of the Richmond birdwing’s range (New and Sands, 2002; Russell, 2003; Sands et al., 1997).

Pest potential in Queensland

Considering the evidence presented in this risk assessment, it seems reasonable to predict that *A. elegans* has the potential to become a significant weed in certain habitats in Queensland, primarily riparian habitats and rainforest remnants in coastal south-east Queensland.

A. elegans is a weed in other countries in subtropical regions including Florida, South Africa, Hawaii, and other Pacific islands.

In Australia, *A. elegans* has naturalised in north-eastern New South Wales and in Queensland, mainly in high rainfall coastal areas including the Conondale Ranges, Coomera River catchment, Mary River, Cairns region, and in numerous state forests (Csurshes and Edwards, 1998). Queensland Herbarium records confirm the suitability of *A. elegans* in riparian zones along creek banks, and river banks in subtropical Queensland.

A national survey of naturalised invasive and potentially invasive garden plants (WWF, 2006) listed *A. elegans* as a naturalised ‘sleeper’ weed in Queensland and New South Wales. Though not declared in New South Wales, *A. elegans* is recognised as a significant environmental weed (NSW Department of Environment and Climate Change, undated).

In an assessment of invasive naturalised plants of south-east Queensland, *A. elegans* was identified as ‘generally invasive’ (escaping from cultivation and spreading to natural areas) to ‘highly invasive’ (forms monocultures) (Batianoff and Butler, 2002). *Aristolochia elegans* was reported as ‘common’ in *Araucaria cunninghamii* plantations in Brooyar State Forest, indicating a potential to spread and intensify infestations, displacing native understorey species (Parsons Binkerhoff, 2009).

The area of Australia where climate appears suitable for survival of *Aristolochia elegans* is predicted in Figure 12. This model was generated using ‘Climatch version 1.0’ climate-matching computer program and was based on global distribution data for the species (GBIF, undated) together with all Australian collection sites within 20 km of a meteorological station—the model only used temperature parameters and assumed that rainfall is unlikely to be a significant limiting factor to survival in permanent riparian areas).

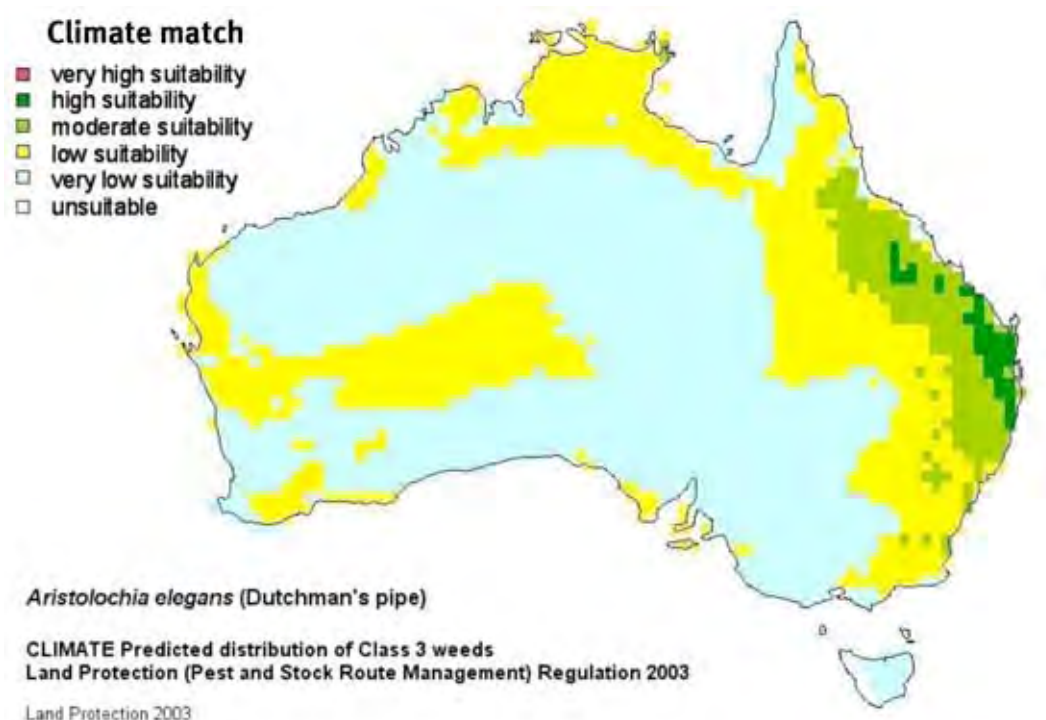


Figure 12. Areas of Australia where climate appears suitable for survival of *Aristolochia elegans* (this model was generated using a climate-matching computer program). Dark green areas appear most suitable for survival of this species.

The above model supports the conclusion that *A. elegans* is a moderate to high weed risk in subtropical Queensland.

Control

A. elegans may be difficult to control because of its effective dispersal mechanism (many winged seeds). Once established, numerous above and below ground stems and roots require multiple herbicide applications (Langeland et al., 2004). Existing plants should be removed before seeds are produced if possible. Plants should be basal barked (without cutting the vine) and applied with herbicide at the base of vines, as close to the root. Repeat applications of herbicide may be required to control regrowth or plants missed on initial application. Small seedlings may be hand pulled (Langeland et al., 2004; Starr et al., 2003).

Biological control

There is no known biological control for *A. elegans*.

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