

1.0 Organism description

Scientific name

Brachiaria subquadripara (Trin.) Hitch., Poaceae.

Common names

Armgrass millet, cori grass, green summer grass, tropical signalgrass (PIER)

Synonyms (USDA, PIER, Hanelt & IPK 2001, Wipff & Thompson 2000)

Brachiaria distachya (L.) Stapf

Urochloa distachya (L.) T.Q. Nguyen

Urochloa subquadripara (Trin.) R.D. Webster

Panicum distachyon L. Mant

Panicum subquadriparum (Trin.)

Digitaria distachya (L.) Pers

- Note: some sources differentiate *B. subquadripara*/*U. subquadripara* from *B. distachya*/*U. distachya* (Wipff & Thompson 2000) while others group them together (USDA, PIER). For the purposes of this risk assessment *B. subquadripara* /*U. subquadripara* and *B. distachya*/*U. distachya* are treated as one entity.

Cultivars, strains, or variants

- Flora of China describes two varieties - *Brachiaria subquadripara* var. *subquadripara* and *B. subquadripara* var. *miliiformis*. The former said to occur in a wider range of habitats and distributed through tropical Asia and the Pacific Islands. *B. subquadripara* var. *miliiformis* restricted to China, India, Malaysia and Sri Lanka (Flora of China).

Previously recorded in New Zealand

No (Ministry of Agriculture and Forestry, Landcare Research).

2.0 Summary

- Fast growing annual or perennial grass 30-60cm high. Mat forming from creeping, stoloniferous runners (at least 1m long), rooting from lower nodes.
- Mostly tropical/sub-tropical distribution in Asia, Africa, Australasia, Pacific, North America, Central America and South America, but also grows in arid central areas of Australia.
- Tolerates a wide range of habitats and environmental conditions.

- A minor weed of cultivation in Asia, reportedly an aquatic weed in Brazil, and a weed of turf grass in Florida. No history of environmental impact overseas.
- In New Zealand it is likely to be restricted to coastal and lowland localities in the northern North Island but may extend throughout the North Island and to the top of the South Island. It is possible, but unlikely, that it could also establish in hot, dry parts of New Zealand such as the central South Island.
- Habitat in New Zealand likely to be cultivated land, waste places, open forests, lawns, pasture, roadsides, grasslands, sandhills, disturbed wetlands, swamp edges and creeks in coastal and lowland localities.
- Its relatively slow maturation means that it is only likely to be a minor problem in cropping industries. Potentially also a minor threat to pastoral agriculture if it proved to be invasive in pasture. However, this is unlikely as it does not appear to be particularly competitive in New Zealand conditions. Impacts, if any, would probably be restricted to warmer regions.
- Environmental impacts are uncertain but it could be a low level threat to disturbed wetlands, riparian habitats and dune systems.

3.0 Basic biology and ecology

3.1 Overseas distribution

- Tropical/sub-tropical Asia, Africa, Australia, Pacific, North America, Central America and South America. Arid central areas of Australia (PIER, Clayton et al. 2006).
- Asia (tropical and sub-tropical); native to India, Pakistan, Sri Lanka, Japan, Philippines, Cambodia, China (Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Jiangxi, Taiwan and Yunan), Indonesia, Japan, Malaysia, Taiwan, Myanmar, Thailand and Vietnam (PIER, Flora of China).
- Pacific (tropical); listed as introduced and often invasive on many Pacific Islands including American Samoa, Cook Islands, Micronesia, Fiji, Guam, Hawaii, Tongarua Islands, Nauru, New Caledonia, Niue, Palau, Western Samoa, Papua New Guinea, Solomon Islands, Tokelau Islands, Tonga and Vanuatu (PIER).
- Australia (tropical/sub-tropical/arid); native. Found in all states except Victoria. Widely distributed through northern and north eastern areas to northern New South Wales. Also in central and south Australia to about Lake Eyre (AVH, Flora of Australia).
- Indian Ocean (tropical); Mauritius (PIER).

- North America (sub-tropical/humid-continental); introduced to Florida, Georgia and Maryland (USDA).
- New World (tropical/sub-tropical); Puerto Rico, Mexico, Central America and Brazil (USDA, Wipff & Thompson 2000, Clayton et al. 2006).
- Africa (tropical); west tropical, west-central tropical, east tropical (Clayton et al. 2006).

3.2 Ecology/habitat

- Fast growing annual or perennial grass 30-60cm high. Mat forming from creeping, stoloniferous runners, rooting from lower nodes (Clayton et al. 2006, PIER, Whistler 1995).
- In glasshouse conditions in New Zealand it grew quickly but was relatively slow to reproductive maturity (James pers. comm.). Its niche in New Zealand is probably similar to kikuyu (*Pennisetum clandestinum*), with which it is unlikely to compete.
- Appears to tolerate a range of habitats. Common in waste places, cultivated land, open forests, lawns, pasture and roadsides from the seashore to 800m in the Pacific Islands and Australia (Whistler 1995, PIER, Ghazanfar et al. 2001). Additional habitats in Australia are humid woodlands, coastal grasslands, sandhills, swamp edges, along creeks and seasonally inundated watercourses and in river channels (Flora of Australia, ANHSIR).
- Adapted to a wide variety of fertility, humidity and light conditions (Toutain 1986) and soil types - often in sandy soils and sandy alluvium but also recorded in heavier clay soils (ANHSIR).
- Propagation by seed, also vegetative spread from stolons (Whistler 1995).
- Seed germination does not require light and is optimal at pH 5-6 and a temperature of 25° C. Germination at 15° C was < 20%. Shoots emerge from soil depths of 0-7cm, with maximum germination on the soil surface (Teuton et al. 2004¹).
- No information found on dormancy or seed bank properties.
- Cultivated as a palatable forage grass in Australia and tropical Asia (Wipff & Thompson 2000, Hanelt & IPK 2001).
- Drought tolerant (Wipff & Thompson 2000) and adapted to poor soils (Hanelt & IPK 2001).

- Noted to have potential as a soil-binder in coastal sand dunes (Hanelt & IPK 2001, USDA).

4.0 Likelihood of establishment and spread

4.1 Environmental tolerances overseas and comparison with New Zealand

4.1.1 Environmental tolerances overseas

- Mostly Old World and New World tropical or sub-tropical climates with associated high humidity and warm temperatures. Also widespread in arid, central Australia and reaches humid-continental North America.
- Australia (tropical/sub-tropical); the climate of northern Australia is characterised by hot humid summers and hot to mild winters. In this broad region, mean daily minimum temperature ranges from 12-24° C, average annual rainfall is 800-3200mm, rain days (>1mm) number 50-150 days per year, frost days range from 0-10 per year and humidity is 60-90% (Bureau of Meteorology).
- Australia (arid); climate through most of central Australia is classed as hot dry summer/cold winter, with mean daily minimum temperature ranging from 9-15°C, average annual rainfall 0-300mm, 10-30 rain days (>1mm) per year, 30-50% humidity and 10-50 days of frost per annum (Bureau of Meteorology).

4.1.2 Comparison with New Zealand

- New Zealand; the closest match to its sub-tropical environment overseas are the warmer regions of Northland, Auckland and coastal Bay of Plenty where average annual rainfall (1200-1500mm), rain days >1mm per day per year (111-137 days) and humidity (78-86%) are comparable, although mean daily minimum temperatures (10-11.8° C) are lower, and ground frosts more frequent (1-42 days per year) (NIWA).
- Note that the Australian and North American distribution suggests *B. subquadripara* tolerates both arid and humid-continental climates. Therefore it has the potential to extend throughout the North Island and to the top of the South Island. It is also possible, but unlikely, that it could establish in hot, dry parts of New Zealand such as the central South Island.

4.2 History of spread in other countries

- First recorded in Fiji in 1927 (Whistler 1995). Now throughout the Pacific and listed as invasive in many places (PIER).

- Naturalised and invasive in Hawaii with recent extensions to its range there (Lorence et al. 1995).
- Introduced and naturalised on Christmas Island (Flora of Australia).
- Introduced to tropical Africa (Clayton et al. 2006) but no information found to show that it has spread beyond to more temperate regions.

4.3 Natural dispersal mechanisms and human assisted means of spread

4.3.1 Natural dispersal mechanisms

- Seed dispersed by birds and bats in Fiji (Ghazanfar et al. 2001). No other references specific to dispersal found.
- Probably also dispersed by wind/gravity, animal (internal/external) and possibly water.

4.3.2 Human dispersal mechanisms

- Human mediated dispersal likely in contaminated machinery, produce, soil or stock feed.

4.4 Distribution of potential habitat in New Zealand

- Cultivated land, waste places, open forests, lawns, pasture, roadsides, grasslands, sandhills, disturbed wetlands, swamp edges and creeks in coastal and lowland localities primarily in the northern North Island but possibly extending to cooler areas of the South Island, including hot, dry central areas.

4.5 Constraints to spread and predicted rate of spread in New Zealand

4.5.1 Predicted rate of spread

- Moderate to fast rate of spread by natural seed dispersal from local infestations, particularly if bird dispersed here as it is elsewhere.
- Could form widespread populations quickly via human assisted dispersal in contaminated produce and machinery.
- Slow to moderate rate of vegetative spread (via stoloniferous habit) from local infestations.

4.5.2 Constraints to spread

- Probably limited by climate but this is uncertain given the range of habitats and environments it is known from overseas.
- No references found on biological controls or constraints to spread overseas.
- The foliage is palatable to mammalian browsers (Hanelt & IPK 2001).

5.0 Consequences

5.1 Overseas impacts

5.1.1 Economic impacts

- Cited as a weed of vegetables and lawns (Waterhouse 1997). Widespread and important only in Tonga and American Samoa; important in Fiji and Western Samoa; and unimportant in Cook Islands, Guam, New Caledonia, Solomon Islands, Tokelau Islands and Vanuatu (Waterhouse 1997). Also referred to as a weed in canefields, maize and coffee (PIER, ANHSIR, Lorence et al. 1995). The direct impact on crop plants is reduced growth and yield through competition for light, water and nutrients.
- A dominant weed in the turf grass industry in Florida. Problematic due to a lack of control options (Teuton et al. 2004¹). Its presence increases production costs and lowers turf grass quality (Teuton et al. 2004²).
- *B. subquadripara*, along with *B. mutica*, is an aquatic weed in Brazil where its fast growth and slow decomposition increases sedimentation in waterways, reservoirs and hydroelectric power dams (Costa et al. 2006, Cavenaghi et al. 2005, Negrisoli et al. 2006).

5.1.2 Environmental impacts

- No references found describing *B. subquadripara* as an environmental weed.

5.1.3 Other impacts

- As a weed of lawns and turf *B. subquadripara* has impacts on amenity values.

5.2 Potential impacts in New Zealand

5.2.1 Economic

- Its relatively slow maturation means that it is likely to be only a minor problem in cropping industries. Potentially also a minor threat to pastoral agriculture if it proved to be invasive in pasture. However, this is unlikely as it does not appear to be particularly competitive in New Zealand conditions. Impacts, if any, would probably be restricted to warmer regions.
- As in Brazil, its growth in waterways could cause problems in reservoirs and for hydro-electric schemes. However, this potential impact is unlikely (even in northern New Zealand) as its growth is likely to be considerably slower than in Brazil.

5.2.2 Environmental

- *B. subquadripara* could be a low level threat in disturbed wetlands, riparian habitats and dune systems. Its establishment could jeopardise the naturalness of these habitats, displace native species, or threaten local populations of rare or endangered species.
- Control measures (herbicide use/manual weeding) could further disturb natural environments, kill non-target species and may affect water quality.

5.2.3 Other impacts

- Could displace, or compete with, native dune plants such as pingao (*Desmoschoenus spiralis*), a plant of cultural significance to Maori.
- As a weed of lawns and turf it may impact on amenity values.
- Probably a nuisance weed in home gardens.

6.0 Control techniques

- An acceptable range of controls are available, although control of *B. subquadripara* in water-ways may require specialised chemicals or manual control. Underlined names are herbicides known to be available in New Zealand.

- Flame weeding and mechanical/manual control in aquatic environments (Marchi et al. 2005).
- In Florida, pre-emergence herbicide field trials using benefin + oryzalin, imazapic, and oryzalin provided >75% control 8 weeks after application. In greenhouse trials on immature *B. subquadripata*, post-emergence herbicides Asulam and CGA 362622 provided >89% control while Imazaquin gave >98% control. However, in field trials on mature signalgrass (>20cm stolons) none of the 20 herbicide treatments applied post-emergence provided acceptable control (Teuton et al. 2004²).
- MON 13200 (thiazopyr) applied pre-emergent provided commercially acceptable control of a range of annual and perennial grass weeds (including *B. subquadripata*) in sugar cane in Australia, with good crop safety (Somerville 1993).
- In Brazil, glyphosate at 3360 and 4320g a.e./ha applied post-emergence showed excellent control while glyphosate at 2400g a.e./ha was only satisfactory. Diquat was inefficient in controlling *B. subquadripata* (Carbonari et al. 2003).

7.0 Uncertainty summary

- Potential New Zealand distribution is uncertain. Likely to be limited by climate but its overseas distribution suggests it grows in tropical and arid conditions, and to some extent, also tolerates temperate climates.
- Preferred habitat in New Zealand is uncertain. Noted to grow in watercourses in Australia, and in Brazil is a problematic aquatic weed. However it is also said to be drought tolerant and adapted to poor, sandy soils - with potential for erosion control in coastal dunes.
- These uncertainties feed back into uncertainty regarding the risk *B. subquadripata* poses economically and environmentally to specific habitats and industries in New Zealand.

8.0 References

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