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Stylosanthes scabra - environmental weed risk assessment 2022

Department of Primary Industries and Regional Development, Western Australia

Department of
Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Environmental weed risk assessment

Shrubby stylo (*Stylosanthes scabra*)

Family: Fabaceae

Common name: Shrubby stylo

Cultivars: Include Fitzroy, Seca, Siran

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Species summary:

Shrubby stylo (*Stylosanthes scabra*) is a shrubby, perennial legume, erect to suberect, with strong, woody stems, usually densely hairy and viscid, making them sticky under hot, dry conditions. It is a widespread and variable species, originating from South America and the Caribbean (Sousa Costa and Ferreira 1984) with two ecotypes identified reflecting their distribution. It is an erect shrub (0.3 – 2m high) which may be more prostrate under grazing.

Shrubby stylo is extremely drought hardy but can occur in areas with rainfall from 350 to 2,600mm per annum. In cultivation it is usually grown in areas with an annual rainfall between 600 and 2,000mm (Cook et al. 2005). It is moderately shade tolerant. Shrubby stylo is well adapted to infertile, acid, friable or hard-setting, coarse and medium-textured soils; but not finer-textured, less acid soils, and is unsuited to heavy clays (Cook et al. 2005).

Shrubby stylo was introduced and has been commercialised in Australia since the early 1970's (Stace and Edye 1984). It is usually used to increase the nutritive value of perennial native or sown pastures but may be used for cut and carry in some countries (Cook et al. 2005).

S. scabra is widely naturalised across northern Australia (Figure 1). In northern WA, shrubby stylo has been oversown into native pastures in some areas and is naturalised in the north Kimberley (Hussey et al. 2007), and in the west Kimberley, albeit usually at a very low density. Florabase (Western Australian Herbarium (1998–) gives the current distribution in Western Australia as IBRA regions: Central Kimberley, Dampierland, Northern Kimberley and Victoria Bonaparte.

S. scabra was assessed by the Pacific Island Ecosystems at Risk (PIER) as a low weed risk to the environment with a score of 1 (PIER 2018).

Figure 1. The distribution of shrubby stylo (*Stylosanthes scabra*) in Australia from the Australasian Virtual Herbarium (https://avh.ala.org.au/)

1. Does the species have a documented environmental weed history?

a) Is an environmental weed in Australia

b) Is an environmental weed overseas

c) Species not known to be an environmental weed but there are environmental weed species in the genus

d) Genus has no known environmental weeds

Shrubby stylo (*Stylosanthes scabra*) is regarded as an environmental weed in Queensland, the Northern Territory and northern Western Australia (Biosecurity Queensland 2021). Lonsdale (1994) noted 34 accessions of shrubby stylo in Australia and its presence on two of the four weed lists examined. Biosecurity Queensland (2021) report shrubby stylo naturalised overseas in Hawaii and widely in northern Australia (northern and eastern Queensland), northern parts of the Northern Territory (Short 1998), and in northern Western Australia. Batianoff and Butler (2002) in their assessment of invasive naturalized plants in south-east Queensland, record *S. scabra* as a cultivation escape, naturalised and an environmental weed. Groves and Hosking (1997) in a report on recent incursions of weeds to Australia report *S. scabra* as a weed. Keighery and Longman (2004) report *S. scabra* as an environmental weed and naturalised in the north Kimberley, central Kimberley and Dampierland IBRA regions.

Swarbrick (1983) report *S. scabra* as a medium weed of gardens, lawns, parks and amenity areas in coastal Queensland and the top end of the NT.

2. What is the ability of the species to successfully establish and compete with other plants, especially amongst intact native vegetation?

a) High - species can establish and displace intact native vegetation

b) Moderate - species can establish amongst intact native vegetation, but may not displace the native vegetation

c) Low - species can only establish where there is little or no competition or in areas where the native vegetation is in poor condition or has been disturbed

d) Very low - species can only successfully establish in vegetation which has been highly disturbed (e.g. roadsides, degraded or cleared areas)

e) Don’t know

Biosecurity Queensland (2021) report shrubby stylo a weed of open woodlands, grasslands, floodplains, levee banks, roadsides, disturbed sites, waste areas and crops in tropical and sub-tropical regions. It is naturalised in parts of three northern Australian states (WA, NT and Qld).

Shrubby stylo can be successfully oversown into grazed native pastures (Gardener 1984; Mott et al. 1989), so it can establish among native vegetation but is unlikely to displace the native vegetation. The seedlings are reported as very slow growing, but the plants can develop a strong, deep tap root to 4m. Once established this can contribute to the persistence of the plants amongst other vegetation. The plants can survive fire or defoliation, regrowing from low growing crowns or root tissue below the soil surface or by regeneration from the seedbank (Cook et al. 2005).

Shrubby stylo mainly spreads through grazing animals, however in a study in north Queensland only 1.5% of the seed excreted in the grassland grew into established plants despite most seeds being viable. Varying the amount of grass had little effect on establishment (Gardener 1993).

3. Grazing tolerance and palatability

a) Very high - Unpalatable (or toxic), rarely grazed

b) High - Will persist under heavy continuous grazing due to plant structure (like rhizomatous grasses) or has limited palatability

c) Moderate - Tolerant of grazing as, usually, only young growth (annuals) or young re-growth (perennials) is grazed, for example after fire or early in wet season; or plants are occasionally browsed

d) Low - Readily grazed during the wet season with some preferential grazing, during the dry season some plants are grazed while others are left ungrazed

e) Very low - Comparatively good feed quality and preferentially grazed at all growth stages; or has low tolerance to grazing and plants are easily killed. Plant numbers decline over successive years if overgrazed.

f) Don’t know

Shrubby stylo provides nutritious feed but has low to moderate palatability and as a result in a mixed pasture the grasses are usually preferentially grazed, particularly early in the growing season. Once established regrowth from buds along the hard and woody stems can replace grazed leaves. Under managed grazing shrubby stylo should be continuously but lightly grazed, however under extensive rangeland conditions animals tend to ignore the shrubby stylos until late in the growing season (Cook et al. 2005).

4. What is the species’ ability to persist as a long-term sward or stand without management?

a) Plant numbers increase substantially with successive reproductive cycles to form a near monoculture over a significant area

b) Plant numbers remain at a steady level, persisting as a significant component of a mixed sward/stand

c) Plant numbers decline slowly over successive years so that it becomes a minor component of the vegetation

d) Plant numbers decline rapidly over successive years so that only occasional plants can be found

e) Don’t know

Shrubby stylo is a short-lived perennial shrub, so long-term persistence relies on recruitment from seed. Seedling growth is slow, but once established the perennial plants can persist for

several years under managed grazing (Jones et al. 2000). However, several studies have found that where there are long dry seasons plant numbers decline until regeneration from the soil seed bank. Observations from areas in the Kimberley where shrubby stylo is naturalised are that it is a minor component of the vegetation, usually <1%.

5. Is the plant likely to spread or rapidly colonise a site?

a) High risk – plants with a history of spreading rapidly with many plants successfully establishing under favourable conditions >200m from the sown area within 5 years for herbaceous perennials or 10 years for woody perennials

b) Medium risk – some plants will spread outside the planted area and successfully establish under favourable conditions >100m from the sown area within 5 years for herbaceous perennials or 10 years for woody perennials

c) Low – No or minimal spread of sown species. Outside the planted area a few plants will spread and successfully establish within 100m of the planted area under favourable conditions within 5 years for herbaceous perennials or 10 years for woody perennials

d) No spread of sown species more than 10m outside the planted area within 5 years for herbaceous perennials or 10 years for woody perennials

e) Don't know

The seedlings are reported to be slow growing, so plants are slow to establish. However, once established the plants can develop a strong, deep taproot to 4m (Cook 2007). Individual plants live 3-5 years and rely on recruitment from seed to persist in the long-term. The main colonisation by this species is from dispersal by grazing animals ingesting and spreading hard-seed. Only a low proportion of the excreted seed is likely to develop into established plants (Gardener 1993), however the hard-seed can remain in the soil for several years until suitable conditions occur for germination.

6. Will the species establish and reproduce in low-nutrient Australian soils without the addition of fertiliser or inoculant?

a) Establishment, growth and seed production uninhibited in low-nutrient soils

b) Establishment, growth and seed production reduced in low-nutrient soils

c) Establishment, growth and seed production severely diminished in low-nutrient soils

d) Establishment, growth and reproduction not likely in low-nutrient soils without soil additives

e) Don't know

Cook (2007) reports that shrubby stylo is well adapted to infertile, acid, friable or hard-setting, sandy surfaced soil and will flower and produce seed on infertile soils. It is adapted to soils low in available soil phosphorus but both stylo plants and the animals grazing them will respond to additional phosphorus fertiliser on very infertile soils (Cook et al. 2005; Gilbert et al. 1989). In a study in the north Kimberley on three different soils there was a large increase in productivity with applied phosphorus compared with the control (no P) which had low productivity (Holm and D'Antuono 1990).

Shrubby stylo nodulates readily with a wide spectrum of rhizobium strains, so inoculation is not essential.

7.1 How likely is long-distance dispersal (>100m) by flying animals (birds, bats)?

a) Common

b) Occasional

c) Unlikely

d) Don't know

Seeds are small and have no adaptions to attract birds or bats. No information found on bird feeding or dispersal.

7.2 How likely is long-distance dispersal (>100m) by stock, native and/or feral animals?

a) Common

b) Occasional

c) Unlikely

d) Don't know

Dispersal by grazing animals is the main dispersal mechanism. Shrubby stylo seed has a high proportion of hard-seed which survives ingestion and passage through the rumen (Gardener et al. 1993). In a study of Gardener (1993) found ingestion of shrubby stylo seed by cattle and that digestion had little effect on the hard seed passing through the gut.

> "Seed content in the cattle faeces reached a peak at the end of the wet season and accounted for 8% of seed production. Only 1.5% of the seed excreted in the grassland grew into established plants despite most seeds being viable. Varying the amount of grass had little effect on establishment. The two short-lived herbaceous species, *S. guianensis* and *S. hamata*, were more efficient colonizers (i.e. produced more seedlings per unit biomass) than the more perennial shrubby types of *S. scabra* and *S. viscosa*" (Gardener 1993).

The hairy and/or hooked pod segments can also be dispersed by adhering to animal hair or fur (Cook et al. 2005).

7.3 How likely is long-distance dispersal (>100m) by water?

a) Common

b) Occasional

c) Unlikely

d) Don't know

The seeds are small and held in hairy pods. There are no adaptations specifically for dispersal by water and the plants are waterlogging intolerant. However, the plants grow on flood plains and levee banks and produce a high proportion of hard seed which could remain viable after water movement.

7.4 How likely is long-distance dispersal (>100 m) by wind?

a) Common

b) Occasional

c) Unlikely

d) Don't know

The seeds are small and held in hairy pods. They could be occasionally blown short distances on the soil surface, but have no adaptations specifically for wind dispersal.

8.1 How likely is long-distance dispersal (>100m) accidentally by people and vehicles?

a) Common

b) Occasional

c) Unlikely

d) Don't know

This may happen occasionally, but no evidence that a significant factor.

8.2 How likely is long-distance dispersal (>100 m) as fodder or accidentally in contaminated produce?

a) Common

b) Occasional

c) Unlikely

d) Don't know

Shrubby stylo is usually over-sown into native pastures and would rarely be cut for fodder under Australian conditions (Cook et al. 2005). Shrubby stylos are not suitable for making hay because of a high content of stem material, which is not eaten by livestock (Cameron 2013).

9.1 What is the species' minimum generation time?

a) ≤1 year

b) 2-3 years

c) >3 years or never

d) Don't know

The main restriction to germination is hard seededness, which may be as high as 70-90% in freshly harvested seed. Natural breakdown of hard seededness is brought about by exposure to soil surface temperatures of 50-55ºC (Cook et al. 2005). Seed lots are usually treated (scarified) before planting to increase germination percentage at planting.

In an experiment in north Queensland (average rainfall 865mm) the sown *S. scabra* did not flower in the first year, but did produce seed from year 2 onwards (Gardener 1993).

9.2 What is the species' average seed set in a favourable season?

a) Prolific seed production high (e.g. >1000 m^{-2}/year for woody species, >5000 m^{-2}/year for herbaceous species)

b) Moderate – low seed production

c) None (or seed is sterile)

d) Don't know

Shrubby stylo seeds are small (less than 2mm long), kidney shaped and light brown in colour. There are about 450 000 seeds-in pod/kg or 700 000 dehulled seeds/kg (Cook 2007). With commercial seed crops, the seed yield varies with accession and environmental conditions from 100-700kg/ha (Cook et al. 2005). A more realistic maximum value for shrubby stylo are the average values in north Queensland in a sown grazing experiment (Average annual rainfall 865mm) where seed yields averaged 67-78 kg/ha over six years, which equates to 3,000 to 3,500 seeds/m^2 (Gardener 1993).

9.3 What is the species' seed persistence in the soil seedbank?

a) >5 years

b) 2-5 years

c) <2 years

d) Don't know

Hard seededness may be as high as 70-90% in freshly harvested seed. Natural breakdown of hard seededness is brought about by exposure to soil surface temperatures of 50-55ºC in the late dry season to early wet season, or fire (Cook et al. 2005). In a seed biology study across three sites in northern Australia there was less than 10% hard-seed remaining after one year as more than 80% of the hard-seed softened in the first year (McKeon and Mott 1984).

> "*S. scabra* and *S. viscosa*, seed softened quickly, the soil seed bank remained small and short-lived, and long-term stability depended on the survival of perennating plants" (Mott et al. 1989).

9.4 Can the species' reproduce vegetatively?

a) Yes – rapid vegetative reproduction

b) Yes – slow

c) No

d) Don't know

Plants can regrow rapidly from the low-set crown or in some situations from root tissue below the soil surface after fire or other removal of above ground plant growth (Cook et al. 2005). However, they do not spread or form new plants vegetatively.

Section 2: Impacts

1. Could the species reduce the biodiversity value of a natural ecosystem, either by reducing the amount of biodiversity present (diversity and abundance of native species), or degrading the visual appearance?

a) The species could significantly reduce biodiversity such that areas infested become low priorities for nature conservation and/or nature-based tourism

b) The species could have some effect on biodiversity and reduce its value for conservation and/or tourism

c) The species would have marginal effects on biodiversity but is visually obvious and could degrade the natural appearance of the landscape

d) The species would not affect biodiversity or the appearance of natural ecosystems

e) Don't know

In an area ungrazed by ruminants, shrubby stylo is unlikely to have a competitive advantage and as such is likely to remain as a minor component of the native vegetation. For example, at the former 'Pindan Research site' near Derby which was sown to cleared, improved pastures of *Cenchrus* species with shrubby stylo as a companion legume but then abandoned in the late 1980s, shrubby stylo is now a minor component (<1%) of the vegetation (G. Moore personal communication).

Shrubby stylo has established unmanaged self-sustaining populations (i.e. naturalised) in three northern Australian states (Biosecurity Queensland 2021).

2. Does the species have a history of, or potential to reduce the establishment of other plant species?

a) The species can significantly inhibit the establishment of other plants (e.g. regenerating native vegetation) by preventing germination and/or killing seedlings, and/or the species forms a monoculture over a large area

b) The species can inhibit the establishment of other plants and can become dominant.

c) The species can cause some minor displacement by inhibiting establishment, but will not become dominant.

d) The species does not inhibit the establishment of other plants.

e) Don't know

The seedlings are reported as very slow growing once established the perennial shrubby stylo can produce seed with a high level of hard seed. This provides a soil seed bank from which new plants can establish over several years when suitable conditions arise (Cook et al. 2005).

Shrubby stylo only becomes dominant in sown perennial grass-stylo pastures where the paddocks are consistently over-grazed early in the wet season when the perennial grasses are preferentially grazed, leading to a loss of the perennial grass component and stylo dominance (Cook 2007). This situation is very unlikely to occur in native vegetation.

3. Could the species alter the structure of any native ecosystems at risk of invasion from this species by adding a new strata level?

a) Will add a new strata level, and could reach medium to high density

b) Will add a new strata level, but at low density

c) Will not add a new strata level

d) Don't know

As a perennial shrub (up to 2m), but often limited in height by grazing (Cook 2007), shrubby stylo is unlikely to provide a new strata within the rangelands of northern WA.

4. Could or does the species restrict the physical movement of people, animals, and/or water?

a) Species infestations could become impenetrable throughout the year, preventing the physical movement of people, animals and/or water

b) Species infestations could significantly slow the physical movement of people, animals and/or water throughout the year

c) Species infestations could slow the physical movement of people, animals and/or water at certain times of the year or provide a minor obstruction throughout the year.

d) Species infestations have no effect on physical movement

e) Don't know

Shrubby stylo may grow to 2m in height but is usually less than 1m and sometimes prostrate (5–10cm) under heavy grazing (Cook 2007). It is unlikely to restrict the movement of people, animals or water in the rangeland environment.

5. Does the species have, or show the potential to modify the existing behaviour and alter the fire regime?

a) High - major effect on frequency and/or fire intensity. May greatly increasing the dry season fuel load

b) Moderate effect on frequency or fire intensity

c) Minor or no effect

d) Don't know

Dry matter production is moderate when compared with many other species and moderately grazed, so the species is unlikely to have an impact on fire regimes.

Once established, stands of shrubby stylo can survive fire, either by regrowing from low growing crowns or root tissue down below the soil surface or from regeneration from the seedbank as hard-seed in the soil is softened by fire (Cook et al. 2005).

6.1 Is the species toxic to animals, have spines or burrs, or host other pests or diseases that could impact on native fauna and flora?

a) Yes – plant poisonous or other adverse factors present

b) No – plant is not poisonous, does not produce burrs or spines or harbour pests or diseases

There is no record of toxicity to livestock (Cook et al. 2005) and it does not produce burrs or spines or harbour diseases.

6.2 Could the species provide food and shelter for pest animals?

a) Yes – could provide more shelter or greater nutritional value than the native vegetation

b) No – could provide similar or less shelter or nutritional value than the native vegetation

c) Don't know

There is no evidence that shrubby stylo provides more shelter and where naturalised the low density and plant habit would suggest this is unlikely, but as a legume that readily nodulates

with the background rhizobia the feed quality and especially the crude protein is higher than many native shrubs and grasses.

7.1 Does the species have, or show the potential to have, a major effect on nutrient levels in intact native vegetation?

a) Will significantly increase soil nutrient levels

b) Will significantly decrease soil nutrient levels

c) Will have minimal effect on soil nutrient levels

d) Don't know

Shrubby stylo is a leguminous shrub which will readily nodulate with the background rhizobia, but in intact native vegetation the plant density is likely to be low and as a minor component of the vegetation will have minimal effects on soil nutrient levels.

7.2 Could the species reduce water quality or cause silting of waterways?

a) Could significantly reduce water quality or cause silting or alteration of flow of waterways

b) May have some effect on water quality or silting of waterways in some ecosystems

c) Minor or no effect on water quality

d) Don't know

Although shrubby stylo is found in northern Western Australia in levees adjacent to major rivers, flood prone areas and well-watered cultivated grounds (Spooner 2005) it is not tolerant of flooding and is unlikely to reduce water quality or cause silting of waterways.

7.3 Does the species have, or show the potential to have, a major effect on the soil water table below intact native vegetation?

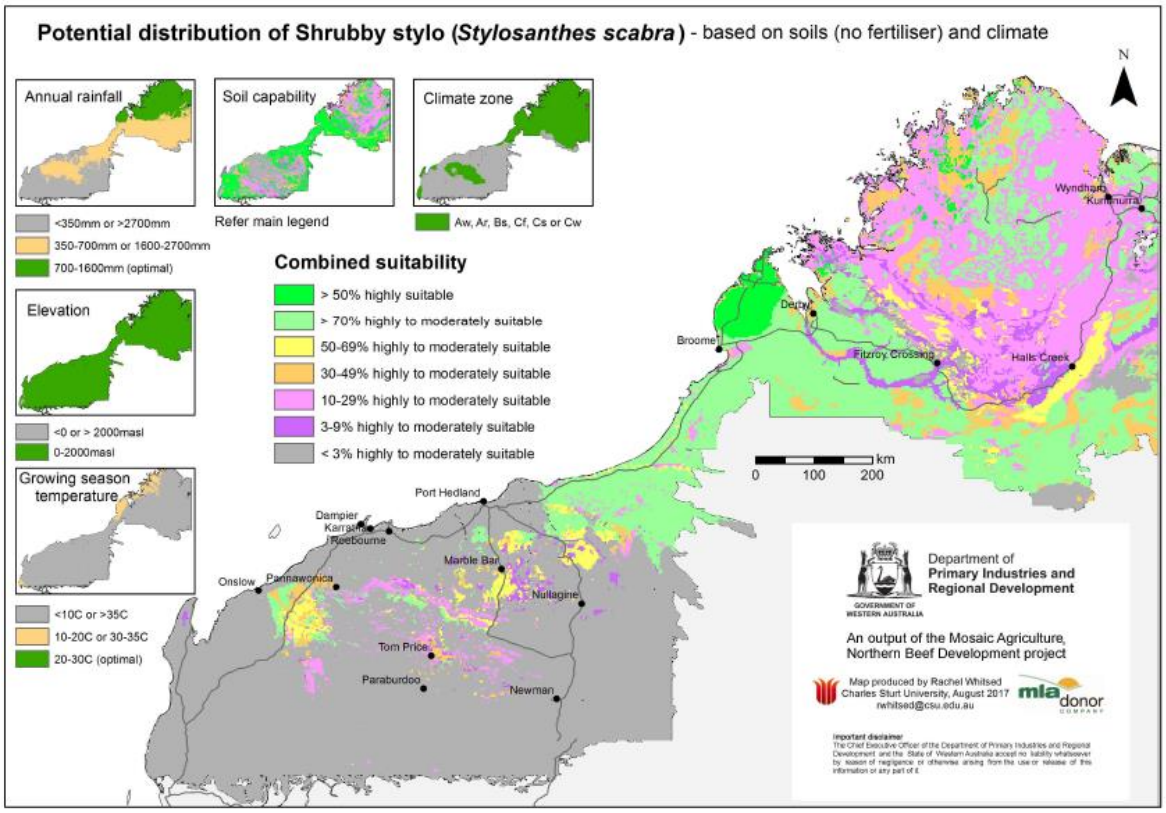
a) Will significantly lower the water table and/or reduce groundwater recharge to the water table.

b) Will have little or no impact on hydrology

c) Don't know

Shrubby stylo can develop a deep tap root to 4m. This, with the lateral root network gives the plant access to subsoil moisture, aids establishment and contributes to its drought tolerance. However, no information was found that the plant density in intact native vegetation would reach a level where the watertable would be significantly affected.

Potential distribution



Region	Area of suitable soils and climate	Potential distribution score
Kimberley	16.1Mha	8.0
Pilbara	3.3Mha	6.0
Gascoyne – Goldfields	0	0.5
South-west land division	0	0.5

Overall weed risk assessment

The overall weed risk assessment (WRA) is calculated from Equation 1.

Equation1: Invasiveness (0-10) x Impacts (0-10) x Potential Distribution (0-10) = Weed risk score (0-1000)

Adjusted Invasiveness score = 5.7, Adjusted Impacts score = 1.5

Region	WRA calculation*	Overall score	WRA rating
Kimberley	5.7 x 1.5 x 8.0	**68.4**	**Medium**
Pilbara (>350mm AAR)	5.7 x 1.5 x 6.0	**51.3**	**Medium**
Pilbara (<350mm AAR)	5.7 x 1.5 x 0.5	**2.9**	**Negligible-low**
Gascoyne – Goldfields	5.7 x 1.5 x 0.5	**2.9**	**Negligible-low**
South-west land division	5.7 x 1.5 x 0.5	**2.9**	**Negligible-low**

***** Invasiveness (0-10) x Impacts (0-10) x Potential Distribution (0-10) = Weed risk score (0-1000)

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Important disclaimer