EPPO Datasheet: *Alternanthera philoxeroides*

Last updated: 2024-01-02

IDENTITY

Preferred name: *Alternanthera philoxeroides*
Authority: (von Martius) Grisebach
Taxonomic position: Plantae: Magnoliophyta: Angiospermae: Basal core eudicots: Caryophyllales: Amaranthaceae: Amaranthoideae
Other scientific names: *Achyranthes paludosa* Bunbury, *Achyranthes philoxeroides* (von Martius) Standley, *Alternanthera philoxerina* Suessenguth, *Bucholzia philoxeroides* von Martius, *Telanthera philoxeroides* (von Martius) Moquin-Tandon
Common names: alligator weed (US)
view more common names online...
EPPO Categorization: A2 list, Alert list (formerly)
view more categorizations online...
EU Categorization: IAS of Union concern
EPPO Code: ALRPH

more photos...

GEOGRAPHICAL DISTRIBUTION

History of introduction and spread

In the USA, *A. philoxeroides* has been recorded as present since 1897 (Zeigler, 1967; Kay & Haller, 1982). *A. philoxeroides* has been a significant weed in the USA since the 1960s (Spencer & Coulson, 1976; Buckingham, 1996) and has been introduced to 15 southern states (USDA, 2008).

*Alternanthera philoxeroide*s is present in Asia where it is widespread and problematic in some regions. In the hotter tropical regions; including Indonesia and Thailand, the plant does not grow with the vigour seen in more temperate regions (Julien *et al*., 1995). In Sri Lanka *A. philoxeroides* was identified in the western and southern provinces of the country in 1999 (Jayasinghe, 2008). *A. philoxeroides* was recorded as present in 2004 in central provinces in Sri Lanka at high altitudes (over 2500 m a.s.l.) (L. Gunasekera, pers. comm., 2015). *A. philoxeroides* is found throughout India, including Assam, Bihar, West Bengal, Tripura, Manipur, Andhra Pradesh, Karnataka, Maharashtra, Delhi and the state of Punjab (Pramod *et al.*, 2008). More recently, the plant has been recorded from Wular Lake (Kashmir, India) at an altitude of 1580 m a.s.l. (Masoodi & Khan, 2012). Here populations are expanding (Masoodi *et al.*, 2013).

In Australia *A. philoxeroides* was first observed in the 1940s near Newcastle, New South Wales (Hockley, 1974; Julien & Bourne, 1988). It has been observed in every state in Australia, but has now been eradicated from the Northern Territory and South Australia (Van Oosterhout, 2007). It is still present in New South Wales, where very dense monospecific stands occur (Van Oosterhout, 2007).

In New Zealand *A. philoxeroides* was first recorded in 1906 (Roberts & Sutherland, 1986) where it was recorded as *Telanthera philoxeroides*. It is recorded from Northland, north of Auckland, the Waikato Region and the Bay of Plenty and has been eradicated from four sites on the South Island (P. Champion, pers. comm.) (Bassett *et al.*, 2012a,b). New sites are regularly discovered on the North Island (P. Champion, pers. comm.).

The first record of *A. philoxeroides* in Europe was from France in 1971 (Dupont, 1984, 1989). The species has long been confined to the south-west of France between the middle of the Gironde Estuary and the middle course of the River Garonne. New populations were found in the same region on the Tarn River in the 2000s (Fried *et al.*, 2014). Frequently observed in this area, *A. philoxeroides* never forms dense populations and is not considered as invasive in this Atlantic region (Georges, 2004). In 2013, a new location was found near Sorgues (Provence) on the Ouveze

River, a tributary of the River Rhone, in the Mediterranean region (Fried *et al.*, 2014). In just 1 year, the plant expanded from 10 m^2 to over 1500–2000 m^2 (a stand of 3–4 m wide over 500 m long) at the interface between the river and the banks. The species is now considered as an invasive species in the French Mediterranean region. In Italy it was discovered in 2001 near Pisa, Tuscany (Garbari & Pedulla, 2001) where sizeable populations have been recorded from a canal close to Fosso Oncinetto, Madonna dell'Acqua. The plant is also recorded as invasive along the Arno River from Signa to Florence (Iamonico *et al.*, 2010; Iamonico & Pino, 2015) and in Lazio in Rome along the Tevere River and in the Circeo National Park in Borgo Grappa as a casual (Ceschin *et al.*, 2006). In Lazio the status of *A. philoxeroides* has been updated and it is now considered invasive (Iamonico & Iberite, 2014).

EPPO Region: France (mainland), Italy (mainland), Spain (mainland)
Asia: Bangladesh, China (Anhui, Beijing, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanghai, Sichuan, Yunnan, Zhejiang), India (Arunachal Pradesh, Assam, Bihar, Delhi, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Tamil Nadu, Uttar Pradesh, West Bengal), Indonesia (Java), Japan (Honshu, Kyushu, Ryukyu Archipelago), Lao People's Democratic Republic, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam
North America: Mexico, United States of America (Alabama, California, Florida, Georgia, Illinois, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, Tennessee, Texas, Virginia)
Central America and Caribbean: Honduras, Puerto Rico, Trinidad and Tobago
South America: Argentina, Bolivia, Brazil (Alagoas, Amazonas, Bahia, Ceara, Espirito Santo, Fernando de Noronha, Goias, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Para, Parana, Pernambuco, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, Sao Paulo), Colombia, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela
Oceania: Australia (New South Wales, Queensland, South Australia, Tasmania, Victoria, Western Australia), New Zealand

MORPHOLOGY

Plant type

Emergent aquatic perennial herb, amphibious or terrestrial.

Description

Alternanthera philoxeroides is an emergent stoloniferous perennial herb. The leaves are dark green, elliptic, glabrous and opposite, 3.5–7.1 cm long and 0.5–2 cm wide (Flora of North America Editorial Committee, 1993+). Mature aquatic plants have hollow stems up to 10 m long that form thick interwoven mats throughout the water body and emerge up to 20 cm out of the water when the plant flowers. Inflorescences are white, terminal and axillary, 1.4–1.7 cm in diameter, on a short stalk (Flora of North America Editorial Committee, 1993+). In the native range the species is known to set seed (Vogt, 1973). In much of the invasive range seed production is not observed (Van Oosterhout, 2007). However, the species has been recorded to set seed in China. Liu-qing *et al.* (2007) cite Zhang*et al.* (2004) (in Chinese) and detail that *A. philoxeroides* showed a 6.5% seed set in Zhengzhou City, Henan Province. Contamination of bonsai plant soil sourced from China and detected in the Netherlands (van Valkenburg, pers. comm., 2015) indicates that viable seed is produced in China. In North America, *A. philoxeroides* flowers from early spring into the summer months, whereas in Australia, the species flowers around mid-summer (Flora of North America Editorial Committee, 1993+; Queensland Government, 2015). *A. philoxeroides* can be confused with a number of semi-aquatic species within the EPPO region; in particular the closely related congeners including *Alternanthera caracasana* Kunth., *Alternanthera nodiflora* R.Br. and *Alternanthera sessilis* (L.) R.Br. ex DC.

BIOLOGY AND ECOLOGY

General

In Florida there are two biotypes present, each having a different morphology, namely (1) broad and (2) narrow stemmed leaved forms (Kay & Haller, 1982), probably similar to *A. philoxeroides* f. *philoxeroides* and *A. philoxeroides* f. *angustifolia* identified in the native range in Argentina (Sosa *et al.*, 2008). Additionally, the two biotypes present in Argentina differ in the number of chromosomes (Parsons & Cuthbertson, 1992). There is no information regarding different biotypes within the EPPO region.

Habitats

Although more suited to aquatic and riparian habitats, where the species forms dense mats in shallow slow-moving water bodies, *A. philoxeroides* is also a vigorous colonizer of terrestrial habitats where the extensive (up to 2 m) deep rhizome system can sustain the population throughout extended dry periods (Government of South Australia, 2010). Often, *A. philoxeroides* grows at the interface between the aquatic and terrestrial environment (Julien & Bourne, 1988). Spread is predominantly vegetative, from axillary buds at each node in the warm summer months. Julien & Bourne (1988) list a number of habitats which will sustain populations of the species, including, but not exclusive too, freshwater habitats, coastal areas, managed terrestrial habitats including cultivated/agricultural land, disturbed areas and urban habitats. In addition, natural and semi-natural habitats are prone to invasion, including forests, riverbanks and wetlands.

Environmental requirements

Optimum shoot emergence and growth is at a constant of 30°C. Growth is suppressed at temperatures below 7°C; however, the species can tolerate mean annual temperatures of between 10 and 20°C (Shen *et al.*, 2005). No shoot emergence was observed at a constant temperature below 5°C (Shen *et al.*, 2005). Liu-qing *et al.* (2007) showed that *A. philoxeroides* can be propagated following stratification of the stolon at 4°C for up to 72 h. The photosynthetic optimum of the species occurred between 30 and 37°C and light saturation at 1000 lmol photons $m^{-2}\ s^{-1}$ (Hussner, pers. comm., 2015). The species has been observed to grow at a pH of between 4.8 and 7.7 in water (Van Oosterhout, 2007). Some parts of the plant can survive in frost-prone areas: frost and ice kill exposed stems and leaves, though protected stems enable the species to persist to the next season. *A. philoxeroides* persists and grows well in copper contaminated waters (Wei & Zheng-Hua, 2012). There have been numerous studies showing that *A. philoxeroides* can change the chemical composition and alter nutrient cycling of water bodies (Bassett *et al.*, 2010, 2012a). *A. philoxeroides* can tolerate relatively high levels of salinity for a freshwater plant (10–30% that of sea water) (Global Invasive Species Database, 2010) and can adapt to low light conditions (≥12% of full light) (Weber, 2003).

Natural enemies

There are no known natural enemies for *A. philoxeroides* within the EPPO region. The leaf beetle *Agasicles hygrophila* Selman & Vogt. has been used successfully as a biological control agent against the species in Australia (aquatic habitats), New Zealand, the USA and Thailand (CABI, 2015).

Uses and benefits

There are no known uses or benefits for *A. philoxeroides.*

PATHWAYS FOR MOVEMENT

There is potential for *A. philoxeroides* to be misidentified and imported into the EPPO region under another name. Similar confusion between closely related species has been noted in Sri Lanka by Jayasinghe (2008). *A. philoxeroides* has a very similar appearance to other species native to South America in the same family (Amaranthaceae) named as mukunuwenna or sessile joyweed (*Alternanthera sessilis*). *A. sessilis* is a leafy vegetable and that is popular in Sri Lankan diet. There was some confusion among the Sri Lankan community over *A. sessilis* and *A. philoxeroides* growing in Australia and Sri Lanka. Sri Lankan communities in Australia were cultivating and unknowingly using *A. philoxeroides* as a vegetable for over 25–30 years until it was identified in several gardens in Australia (L. Gunasekera, pers. comm., 2015). As a result of a public awareness campaign, and provision of a replacement vegetable plant, *Alternanthera denticulata* R. Br., the majority of Sri Lankans in Australia now recognize the difference between the species (L. Gunasekera, pers. comm., 2015).

Alternanthera philoxeroides seed has been found as a contaminant in bird seed originating from outside the EU. During a 2014 survey of contaminants from bonsai plants from China, seedlings of *A. philoxeroides* were found at 2 different importers (van Valkenburg, pers. comm., 2015). *A. philoxeroides* has been recorded entering Australia, New Zealand (Hockley, 1974) and the USA (Carley & Brown, 2006) via ship ballast water. However, it is more probable that the species entered Australia in ship cargo (Julien & Bourne, 1988)

IMPACTS

Effects on plants

To date there has been no research on the impact of *A. philoxeroides* on individual native plant species or native plant communities, or impacts on higher trophic levels in the EPPO region. Where studies have been conducted, with other aquatic weeds forming similar dense stands and coming from the same subtropical region, for example (Stiers *et al.*, 2011), a negative impact on abundance of both plants and macroinvertebrates has been shown.

In China, *A. philoxeroides* has been shown to decrease the stability of the plant community and, over time, permanently displace native species (Guo & Wang, 2009). In India, Chatterjee & Dewanji (2014) showed that *A. philoxeroides* reduced macrophyte species richness by up to 30% when the infestation was high. In New Zealand, Bassett *et al.* (2012a) showed that an increasing cover of *A. philoxeroides* decreased the cover of native plant species, resulting in loss of native species in the long-term. Throughout the plant's invasive range, studies have shown that *A. philoxeroides* alters the composition of native plant communities (Bassett *et al.*, 2012a; Schooler, 2012). The latter study also questions the possible effect of biotic resistance, with the presence of some species that would be particularly effective competitors against *A. philoxeroides* and would therefore reduce its impact.

Environmental and social impact

Alternanthera philoxeroides has been shown to alter macrophyte decomposition rates in north New Zealand lakes (Bassett *et al.*, 2006). *A. philoxeroides* decomposed significantly faster than native plant species – which may potentially act to alter the ecosystem processes of the invaded community – aiding the colonization of additional invasive plant species (Bassett *et al.*, 2006) or perpetuating conditions suitable for *A. philoxeroides*. Dense populations can result in decreased dissolved oxygen below the plant canopy (Quimby & Kay, 1976). Cultural services can be degraded by the infestation of scenic waterbodies by *A. philoxeroides*. In China the plant has had serious impacts in famous scenic areas (Commonwealth of Australia, 2012).

Where *A. philoxeroides* invades agricultural land, the species has been shown to reduce yields for a number of crop species including rice (45%), wheat (36%), sweet potato (63%), lettuce (47%) and corn (19%) (Shen *et al.*, 2005; Van Oosterhout, 2007). Impacts on agriculture have been recorded throughout the invasive range including North Carolina, USA, where *A. philoxeroides* was infesting over 4000 ha of agriculture land (Van Oosterhout, 2007). Additionally the species is reported to invade orchards, tea plantations and berry fields and cause losses of soybean, cotton and peanuts (Commonwealth of Australia, 2012). The species also presents a risk for the vegetable industry valued at AUD 150 million annually in the Hawkesbury– Nepean catchment (http://weeds.dpi.nsw.gov.au/Weeds/Details/7#TOC). In Sri Lanka *A. philoxeroides* can compete with vegetable crops, particularly carrots (L. Gunasekera, pers. comm., 2015).

Cattle and horses will graze *A. philoxeroides* in terrestrial pasture land, although photosensitivity and skin lesions have been associated with feeding on this species – sometimes resulting in the death of cattle (Van Oosterhout, 2007). In Australia, *A. philoxeroides* successfully outcompetes pasture species such as clover (*Trifolium* spp.) and *Pennisetum clandestinum* Hochst. Ex Chiov., degrading pasture lands in terrestrial habitats (Julien & Bourne, 1988). *Alternanthera philoxeroides* has been shown to increase breeding grounds for snails and mosquitoes in Asia, which can have impacts on livestock, food production and human health (Global Invasive Species Database, 2010; EPPO, 2012)

CONTROL

In the introduced range, *A. philoxeroides* is managed using both conventional (manual, mechanical and chemical control) and biological control (Sainty *et al*., 1998; Clements *et al*., 2014). Manual control, i.e. the physical removal of the plant, is both time-consuming and expensive. All fragments of the plant need to be removed to avoid any regeneration of the population. Further complications can arise for manual control in terrestrial habitats as the species has been recorded as having 10 times more biomass belowground than aboveground. Schooler *et al.* (2008) recorded a dry root biomass of 7.3 kg m^{-2} when the population had been established for over 20 years.

Physical control is an approach to be used where chemical control is not deemed feasible, for example due to the sensitivity of the habitat (Clements *et al.*, 2014). In a study to evaluate the effectiveness of chemical and physical control methods on an early stage infestation, Clements (2014) showed that 75% of the population could be removed physically with minimal follow-up treatments required to address any re-growth. Chemical application, specifically glyphosate (applied at 3 times the manufacturer's recommendations) and metsulfuron-methyl, was effective at controlling populations after 2 years. The effectiveness of herbicides for management of *A. philoxeroides*. has been reviewed by Dugdale & Champion (2012).

Integration of control methods has also been shown to be effective against *A. philoxeroides*. A combination of chemical application with physical removal during follow-up surveys showed success in controlling *A. philoxeroides* in the Coolabah Reserve, New South Wales, Australia (Van Oosterhout, 2007).

Biological control using natural enemies from the plant's native range (classical biological control) has been effective in controlling the species in some countries. In Florida, *A. philoxeroides* has been suppressed below an ecologically and economically damaging threshold, and although the species is still present in 80% of public waters the low levels do not warrant additional control practices. In Australia, biological control has proved effective in reducing the spread of aquatic populations in regions with mild to warm winters; however, control of terrestrial populations using biocontrol methods has not been successful.

REGULATORY STATUS

In the European Union, *A. philoxeroides* is included in the Regulation (EU) on Invasive Alien Species since 2017. The species is listed as a species of Union concern and measures to prevent its entry and impact are applied.

In Australia *A. philoxeroides* is a Weed of National Significance and a declared noxious weed in all states (Australian Government, 2003). In all states and territories, government departments are obliged by law to control and/or eradicate the species. In New Zealand, *A. philoxeroides* is listed as an unwanted organism under the

Biosecurity Act (1993). The plant is included on the National Pest Plant Accord List. This bans the sale, propagation and distribution of *A. philoxeroides* throughout New Zealand.

In the USA, *A. philoxeroides* has varying classifications at a federal, government or state level; in Alabama it is Class C (noxious weed) plant, in Arizona a prohibited noxious weed, in California an A list plant (noxious weed), in Florida a prohibited aquatic plant, Class 1, in South Carolina and invasive aquatic plant (plant pest) and in Texas a noxious plant (USDA, 2008).

PHYTOSANITARY MEASURES

EPPO (2015) recommends the following phytosanitary measures:

Plants for planting: Prohibition of import into and within the EPPO region and within the countries of plants labelled as *Alternanthera philoxeroides* and all other synonyms and misapplied names in use, as well as subspecies.

Contaminant of plants for planting: PC AND plants have been produced in a pest free area (PFA) Or Plants for planting have been produced in a pest free place of production/production site (official inspections + monitoring and control methods).

Grain: Grain has been produced in a pest-free area (PRA) Or Pest-free place of production/production site (official inspections + monitoring and control methods) Or Cleaning and treatment of grain lot to remove *Alternanthera philoxeroides* seeds.

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