EPPO Datasheet: *Ageratina adenophora*

Last updated: 2024-01-02

IDENTITY

Preferred name: *Ageratina adenophora*
Authority: (Sprengel) King & Robinson
Taxonomic position: Plantae: Magnoliophyta: Angiospermae: Campanulids: Asterales: Asteraceae: Asteroideae
Other scientific names: *Eupatorium adenophorum* Sprengel, *Eupatorium glandulosum* Kunth
Common names: Crofton weed (AU), Mexican devil, pamakani (US), sticky eupatorium (US), sticky snakewort, white thoroughwort
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EPPO Categorization: A2 list
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EPPO Code: EUPAD



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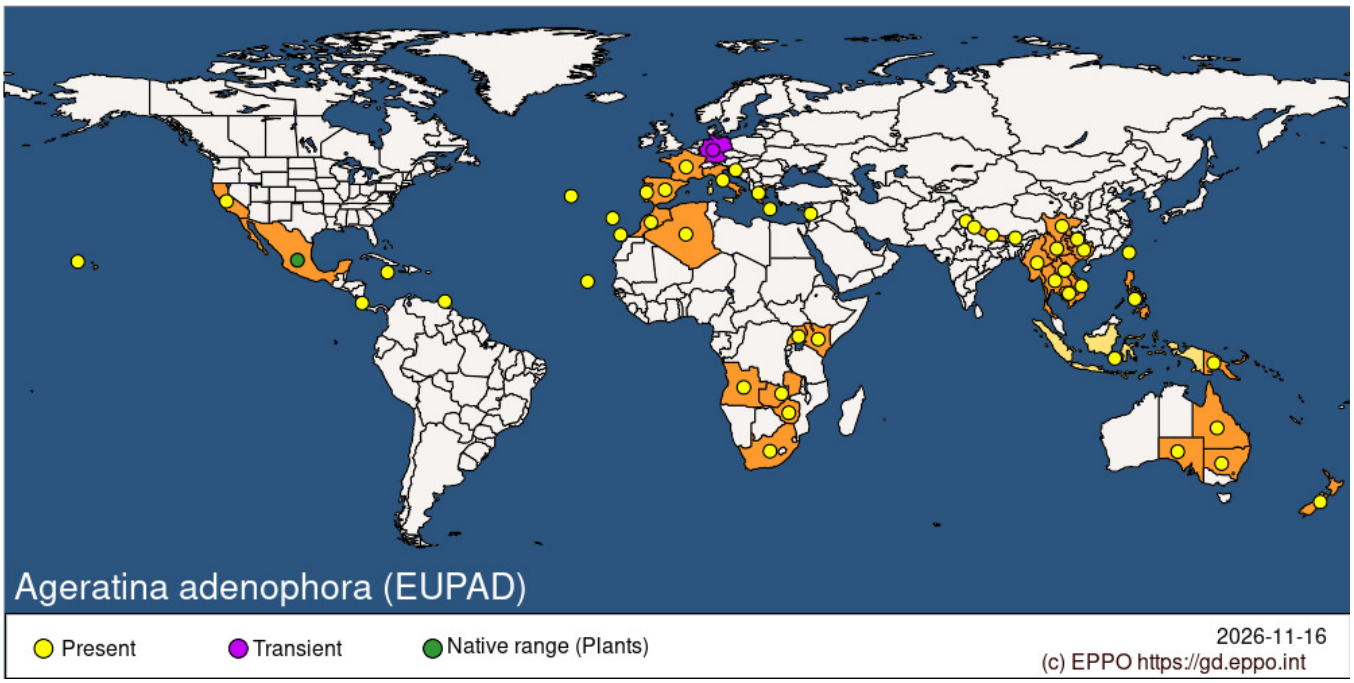
GEOGRAPHICAL DISTRIBUTION

History of introduction and spread

Ageratina adenophora is native to Mexico (EPPO, 2023a; POWO, 2023). It was first introduced outside of its native range as an ornamental plant to the United Kingdom in 1826 (Auld & Martin, 1975). Subsequently, it was recorded in Hawaii in 1860 (Muniappan *et al*., 2009), Australia in 1875 (Auld & Martin, 1975) and India in 1924 (Tripathi *et al*., 2012). *Ageratina adenophora* spread naturally to China from Myanmar in the 1940s (Dong *et al*., 2008; Wang & Wang, 2006). It was first recorded from New Zealand in 1931 (Webb, 1987), Nepal in 1952 (Tiwari *et al*., 2005) and South Africa in 1958 (Henderson, 2006).

In Algeria, *A. adenophora* was considered naturalized as early as in the 1870s (Battandier & Trabut, 1878). In France, it has been cultivated in botanical gardens since the 19th century. It is mentioned in the Villa Thuret garden (Antibes Juan-les-Pins, Sauvagio, 1899), the Monte Carlo garden (Jeannel, 1890), the Montpellier botanical garden (L'Indépendant: journal du Midi, 1848) and the Grenoble botanical garden (Verlot, 1857). It was also probably cultivated in private gardens as it is mentioned in horticultural books with advice on cultivation and maintenance (e.g. Dupuis & Hérincq, 1884). *Ageratina adenophora* was detected in Corsica in 1952 in Lupino near Bastia. More recent records around 2020 confirmed this expansion trend, with several new locations covering the area between Monaco and Nice (Cap-d'Ail, Beausoleil, Roquebrune-Cap-Martin, Eze, Beaulieusur-Mer, Saint-Jean-Cap-Ferrat, Nice). The species can now be found along the entire Riviera coastline between Nice and Menton (Provence-Alpes-Côte d'Azur region; Fried, 2023).

Alien Plants of Greece (2023) detail that *A. adenophora* is distributed in East Aegean Islands, Ionian Islands, Kiklades, Kriti and Karpatho. *Ageratina adenophora* is distributed in Azores archipelago (islands of São Miguel, Terceira, S. Jorge, Pico, Faial), and Madeira archipelago (islands of Madeira, Porto Santo and Desertas islands) Plantas invasoras em Portugal (2020). In Spain, *A. adenophora*, is known from Andalusia, where it was first mentioned near Malaga (Burton, 1979). It is naturalized and abundant along field ditches near Motril.More recently, it has been recorded near Huelva (Sánchez Gullón *et al*., 2006). *Ageratina adenophora* has also been found in Galicia. The first mention of it dates back to the end of the 1980s (Rodríguez-Oubiña & Ortiz, 1989) in the locality of Redondela (Pontevedra). Later, Gómez Vigide *et al.* (2005) mention its presence in Lourizán, in the same province.



EPPO Region: Algeria, Croatia, France (mainland), Germany, Greece (mainland, Kriti), Italy (mainland), Morocco, Portugal (mainland, Azores, Madeira), Spain (mainland, Islas Canárias)
Africa: Algeria, Angola, Cabo Verde, Kenya, Morocco, South Africa, Uganda, Zambia, Zimbabwe
Asia: Bhutan, Cambodia, China (Guangxi, Guizhou, Sichuan, Yunnan), India (Himachal Pradesh, Uttarakhand), Indonesia, Lao People's Democratic Republic, Lebanon, Myanmar, Nepal, Philippines, Taiwan, Thailand, Vietnam
North America: Mexico, United States of America (California, Hawaii)
Central America and Caribbean: Costa Rica, Jamaica, Trinidad and Tobago
Oceania: Australia (New South Wales, Queensland, South Australia), New Zealand, Papua New Guinea

MORPHOLOGY

Plant type

Erect perennial herb (hemicryptophyte) or (sub)shrub (nanophanerophyte).

Description

The following description of the morphology of *A. adenophora* was synthesized from the Flora of North America (Nesom, 1993+), Flora of Tropical East Africa (Beentje *et al*., 2005) and Flora of China (Wu & Raven, 1994).

Ageratina adenophora is a perennial herb or a (sub) shrub 30–220 cm high. The stem is erect, purplish when young, somewhat woody, with opposite branches. The stem is covered with short glandular hairs, becoming more densely pubescent towards the apex. The leaves are opposite with a petiole of 10–25 mm and triangular- ovate, or rhombic-ovate blades of (1.5–)2.5–7.5(-8) cm long and 1.5–3 cm wide; the base of the blade is truncate or slightly cordate. The synflorescences are terminal, somewhat leafy, up to 12 cm in diameter. The capitula are numerous, 40–50(72) flowered; they are borne on 5–12 mm long peduncles.

$2n = 3x = 51$. Individuals from introduced ranges (e.g. China) have higher plant height, stem diameter, leaf length, leaf width and leaf area in comparison with individuals from the native range (Feng *et al.*, 2009).

BIOLOGY AND ECOLOGY

General

There is no precise observation of the life cycle of the plant in the EPPO region (especially for the germination period), but the available evidence indicates that *A. adenophora* has a similar seasonal life cycle to that observed in Australia. In Australia, seeds germinate in the summer to the end of autumn, with peak germination (>80% viable seeds) at the end of summer to the beginning of autumn (Auld & Martin, 1975). Seedlings grow rapidly and are fully established within 8 weeks of germination. In the second year, and in older plants, new growth begins with the first heavy summer rains. The growth rate of seedlings and mature plants remains high during the summer but decreases during the cooler winter months. Buds appear in late winter and flowering takes place from late winter to summer. Seeds ripen between mid-spring to mid-summer, with the lower leaves of the plant falling off after the seeds have dropped.

In Mediterranean France, *A. adenophora* flowers early in spring (April) and seeds ripen from mid-May to later in the summer (Fried, 2023). In Southern Spain, flowering starts in March.

Throughout its invasive range, seed production of *A. adenophora* is high and it forms a large seed bank in the soil. Dense populations can produce up to 60 000 viable seeds m?2 (Muniappan *et al*., 2009). Seed viability varies with the depth the seed is buried and time. The species forms a persistent seed bank. Shen *et al.* (2011) showed that 90% of seed on the soil surface died. 40% of seeds were viable at depths of 5 and 10 cm after 2 years, and 20% of seeds germinated after 3 years. After 4 years, survival rates at 5 and 10 cm decreased to <10%. Similar observations were made in India (Yadav & Tripathi, 1982).

Habitats

In Mexico, *A. adenophora* occurs in diverse habitat types (Herbario Nacional de México MEXU, 2005). For example, some northern records (Las Cebollitas) are located in *Pinus*, *Quercus*, *Pseudotsuga*, *Picea*, and *Abies* mixed forest, on shallow stony soils; more central and close to the coast (La Guaynera) it was seen on rocky, oak covered slopes. Close to the area of the Reserva de la Biósfera de Serra Gorda, the records are located in a riparian habitat (*Platanus* gallery forest) and in an *Alnus* forest. In the area of Tehuacán, the records are located in xerophytic shrubland, in Chiapas in tropical sub-caducifolious forest and in tropical evergreen forest close to the El Triunfo Biosphere Reserve. There is also high variability in the altitudinal data; for example, one sample collected in the municipality of “Donato Guerra” reports an altitude of 2980 m a.s.l. (Herbario Nacional de México [MEXU], Plantas Vasculares); overall this online herbarium database reports a total number of about 100 records with an altitudinal range of 169–2980 m a.s.l.

In France, *A. adenophora* is most abundant on the banks of streams and in coastal wetland valleys (Fried, 2023, Figure 2). This is similar to the habitats where the species is found in Italy (Del Guacchio, 2013). In mainland Portugal, *A. adenophora* is established on “cliffs, banks of water lines and roads, including disturbed and agricultural areas” (Plantas invasoras em Portugal, 2020). It is also present in these habitats in the Azores, in addition to *Pittosporum* scrubland (non-native woodland dominated by *P. undulatum*) and ruderal habitats (Silva *et al*., 2008). In Maderia, *A. adenophora* is recorded in rocky shores, cliffs, thermo-Mediterranean scrubland, Madeira olive micro forest, Apollonias laurel forest (Mediterranean laurel forest), Ocotea laurel forest (temperate laurel forest), riparian laurel forest (*Sambucus* woodland, *Persea* laurel forest, *Salix* woodland), Cultivated and human-modified vegetation, urban areas, abandoned land, degraded natural habitats (Silva *et al.*, 2008). It is listed in riparian environments (artificial conduction systems, springs, and other wet enclaves and ponds), moist montane “forests” (heaths, hygrophytic tree thickets and mesophytic tree thickets), scrubland, urbanized areas, cultivated land and man-made green spaces (Catálogo Español de Especies Exóticas Invasoras, 2013).

Environmental requirements

Ageratina adenophora is highly ecologically adaptable: it can tolerate a wide range of biotic and abiotic conditions and has been shown to adapt to the habitats and areas where it has invaded.

In most of the area where *A. adenophora* is invasive, it grows in warm, moist, frost-free regions. Cold temperatures are reportedly not required for seed stratification (Wang *et al.*, 2012) and low temperature (5–10°C) has also been shown to limit germination (Li & Feng, 2009; Lu *et al*., 2006).

Lu *et al.* (2006) conducted laboratory and greenhouse studies to determine the effect of several environmental factors on seed germination and seedling emergence. Seed has been shown to germinate over a range of 10–30°C, with optimum germination at 25°C (Lu *et al*., 2006). High temperature markedly restricts germination and Lu *et al.* (2006) did not report any germination at 35°C.

In China, the known localities of *A. adenophora* range from 4.4 to 23.1°C for mean annual air temperature (Zhu *et al* ., 2007). In South Africa, *A. adenophora* appears to prefer temperatures in the range of 10–25°C and low temperature seasonality (Tererai & Wood, 2014).

Li *et al*. (2008) details that populations in China show different responses to low temperatures. Some populations can withstand low temperatures more than others where freezing injury was less in plants from Huangguoshu compared to other populations. Li *et al.* (2008) suggest that freezing-tolerant populations would have a greater chance to invade more north-eastern areas.

Marginal populations found at high elevations (~2500 m a.s.l.) in the Himalayas (India and Nepal, Datta *et al.*, 2017) and in Yunnan province (China) can experience freezing temperatures during the winter. One population in Lijiang Yunnan has been reported to experience the lowest temperature of ?10°C at elevations of 2600 m (Xie *et al.*, 2015). However, continuous exposure to sub-zero temperature damages the aerial parts of the plant and reduces the reproductive output drastically. Studies have indicated that epigenetic changes are responsible for conferring increased cold tolerance at high elevations (Xie *et al*., 2015).

In Italy, clones cultivated near Salerno show considerable drought resistance. Even when the aerial parts were senesced, when watered, the plants readily produced young shoots from the base of the stem or the rootstocks (Del Guacchio, 2013). However, plants did show drought stress after a week of no water.

Ageratina adenophora has some shade tolerance: in an experiment, Auld and Martin (1975) showed that seedlings display a degree of tolerance to shading to 10% daylight and they regard this as a useful attribute in the context of competition with other colonizing plants.

Uses and benefits

Historically, *A. adenophora* has been utilized as a garden ornamental species though nowadays it is less common.

PATHWAYS FOR MOVEMENT

In general, there is a lack of information on the pathways for movement of *A. adenophora* into the EPPO region.

There is no evidence that *A. adenophora* is currently utilized as a plant for planting for horticulture in the EPPO region. However, the pathway is cited throughout the literature (e.g. CALIPC, 2022; Wagner *et al.*, 1999). During the 1800s and early 1900s, the species was sold as an ornamental species and moved around the world for this purpose. Misidentification of *Ageratina* species may have resulted in inadvertent introductions. There is historic evidence that *A. adenophora* has been planted in botanical gardens, and in one case, more recent evidence from France (where the species was collected in Thailand and grown in the botanical garden in Nancy Herbarium CJBN-NCY NCY021903).

Although there is no evidence that *A. adenophora* has been intercepted as a contaminant of plants for planting, the seeds are light and can be moved by wind and therefore there is the potential for contamination of growing media attached to plants. Other potential pathways include soil and growing media, contaminant of seed, and grain. However, EPPO (2023b) considers these pathways to all have a very low likelihood for entry into the EPPO region.

In Hawaii, there is an association with *A. adenophora* and recreational tourism, it is found growing along trails for recreation that are only used by hikers. *Ageratina adenophora* seed may be a contaminant of travellers and their equipment (e.g. shoes, clothes and leisure equipment [tents, bags, etc.]). Seeds spread by wind can become attached to equipment and the small seeds can become incorporated into the tread of shoes. Travellers arriving from areas where the species is established with equipment that has not been properly cleaned, could potentially introduce the

species into habitats where the species could establish in the EPPO region.

Seed of *A. adenophora* may become a contaminant of machinery and equipment. However, there is probably very little movement of used machinery from the countries where the pest occurs into the EPPO region and if there is, it is probable that such equipment would undergo phytosanitary procedures such as decontamination (e.g. in the EU, machinery and vehicles imported from third countries other than Switzerland and which have been operated for agricultural or forestry purposes should be cleaned and free from soil and plant debris (Implementing Regulation (EU) 2019/2072); European Commission, 2019).

IMPACTS

Effects on plants

Where *A. adenophora* is invasive it can reduce the growth of native species by releasing allelopathic compounds (Darji *et al.*, 2023; Kaul & Bansal, 2002) which may also alter the soil microbial communities (Niu *et al.*, 2007).

Once *A. adenophora* invades an area, it can develop into a single predominant plant community in a short period of time by displacing native plant species and altering local nutritional cycles and hydrological conditions. *Ageratina adenophora* can reduce native plant species, particularly rare species, ultimately causing serious ecosystem degeneration and altering the local natural landscape (Wan *et al*., 2010).

Ageratina adenophora has been reported as having a negative impact on the composition and structure of understory communities and on *Pinus yunnanensis* seedling growth under pine stands in Yunnan, China (Fu *et al.*, 2018). Fu *et al*. (2018) showed that *A. adenophora* altered species and functional diversity by changing the species composition and abundance in the understory community because of its higher specific leaf area, leaf nitrogen concentration, and leaf phosphorus concentration compared with native species.

In Nepal, *A. adenophora* is locally known as the forest killer plant due to its negative impacts on the forest and Thapa *et al*. (2016) showed that seedlings of the indigenous tree species *Schima wallichii* had reduced root length and dry weight when grown with leaf litter of *A. adenophora*.

In areas of the EPPO region that are climatically suitable and have favourable micro-habitats for the optimal growth and reproduction of *A. adenophora*, there is the potential of competition with native species for resources (space, light and nutrients).

Along streams in the French Riviera (Provence-Alpes- Cote-d'Azur region, between Nice and Menton), *A. adenophora* forms dense monospecific stands in several wet ravines and valleys (Fried, 2023). It is likely to have negative impacts on native species which are characteristic of these habitats such as *Allium triquetrum, Carex pendula*, *Eupatorium cannabinum* subsp. *cannabinum, Hypericum androsaemum*, *Oloptum miliaceum*, *Parietaria judaica*, *Sambucus nigra, Samolus valerandi*, *Sanicula europaea* (Fried, 2023). In one site, it has been found co-occurring with *Symphytum bulbosum*, a nationally protected species (Conservatoire botanique national méditerranéen, 2023).

A number of papers document the presence and the potential or actual impacts of *A. adenophora* in the Macaronesian laurel forest, both in managed and unmanaged sites (e.g. Parada-Diaz *et al*., 2021). In Spain the presence of *A. adenophora* is particularly concerning in the National Park of Caldera de Taburiente, on the island of La Palma (Canary Islands), where it has been estimated that it has invaded 80% of the park's surface. It is located also in the Garajonay National Park, in La Gomera, where it invades the native pine forests (*Pinus canariensis*) and degraded Macaronesian laurel forest plants communities such as Myrico-Ericetum, Lauro- Perseetum, and Visneo-Arbutetum.

In Italy, Del Guacchio (2013) notes that in Campania, *A. adenophora* may compete against native species. In Sorrento several endemic species were observed to grow together with *A. adenophora*, and it is able to compete against these endemic plants which usually disappear in sites where the ecological conditions are favourable for alien competitors. *Ageratina adenophora* can outcompete *Helichrysum litoreum* and *Centaurea tenorei* growing in the same locations and depriving them of space and light.

Environmental and social impact

Zhihong *et al*. (2004) detail that for the Tianlin county (Guangxi, China) in infested areas yield losses of 18% in maize and 9% in rice have been reported per year. Zhihong *et al.* (2004) also detail that banana plants in infested plantations can have two to three fewer leaves and a reduction in height of 4–8% (potentially reducing yield).

In Australia, *A. adenophora* is an important agricultural weed, and although no economic studies of its importance have been undertaken, it has been reported to reduce crop yield (with no mention of the specific crop species; Parsons & Cuthbertson, 2001).

In Australia, it can reduce the value of bush land (Department of Primary Industries, Australia, 2022) and reduce animal carrying capacity and restrict livestock movement (Parsons & Cuthbertson, 2001).

Ageratina adenophora has a poisonous effect on domestic animals, such as horses and cattle (Ren *et al*., 2021). The plant is more toxic in its flowering stage compared to its juvenile stages (O'Sullivan, 1985). It is known to cause respiratory disease in horses and may result in death, if horses continue to feed upon it for prolonged periods (O'Sullivan, 1979). It causes the "blowing disease" in Hawaii and "Numinbah disease" or "Tollebudgera horse disease" in Australia. Symptoms such as coughing, difficulty in breathing, and violent blowing after exertion are the result of acute lung edema leading to haemorrhage (O'Sullivan, 1985). Verma *et al.* (1987) found that *A. adenophora* reduced digestive function and photosensitive reaction in cattle.

Xu *et al*. (2006) detail that *A. adenophora* and *Eupatorium odoratum* are the two main invasive alien species in China that threaten grassland ecosystem function. Wan *et al*. (2010) detail that *A. adenophora* has caused 989 million-yuan (133 million EUR) losses to livestock production and 2.6 billion yuan (338 million EUR) annual losses to the production of grassland in China. These high figures are supported by data that suggest that "each hectare of grassland invaded by this toxic species produces no more than 1 kg of grass and 78 000 kg of croftonweed" (Lu *et al.* , 2008). According to Sun *et al*. (2004) only 3 years after invading a natural pasture, the coverage of *A. adenophora* can reach 85–95% and reduce yield by 70–79%.

Economic losses in forests have been reported at 5% per year in China (Zhihong et al., 2004). *A. adenophora* has been shown to have a negative effect on the growth of *Pinus yunnanensis* seedling under pine stands (Fu *et al*., 2018). In Nepal, *A. adenophora* invades plantation forests (*Pinus roxburghii*, *P. wallichiana* and *P. patula*) regenerated by seed. When it is present with other invasive plants (*Chromolaena odorata*, *Lantana camara* and *Mikania micrantha*), there is a negative impact on forest regeneration and a cost for the management of the suite of invasive plants (Malla *et al*., 2021).

CONTROL

Control of *A. adenophora* is difficult, because of its extensive root system, its ability to grow from small root fragments and the number of seeds produced. It is most successful when multiple tactics are employed, such as the combination of preventive methods, chemical and mechanical control techniques.

A number of biological control agents have been released against *A. adenophora* worldwide with varying success (Poudel *et al*., 2019). *Procecidochares utilis* (Diptera), a gallfly was first introduced to Hawaii in 1945 and Madeira (Portugal) in 1962. A leaf spot fungus *Passalora ageratinae* (Mycosphaerellaceae) has been introduced into several countries and has established. The rust fungus *Baeodromus eupatorii* (Uredinales) is a native of Mexico and was released in Australia in 2014. *Xanthaciura connexionis* (Diptera) is native to Mexico and was released in Hawaii in 1955. Further research is needed in the EPPO region, particularly continental Europe to assess if any of the biological control agents are suitable for release. This research should include host range studies along with climate matching.

Mechanical control can be applied where the plant is accessible. This can include digging plants out. However, plants often grow on steep slopes making hand removal difficult. Cutting a plant may not control it, but over time it will reduce the seedbank and reduce the population.

A number of herbicides can be effective in controlling *A. adenophora*. Chemical control of *A. adenophora* can be

performed by spraying herbicides such as glyphosate, fluroxypyr, 2,4-D amine, picloram + 2,4-D, picloram + triclopyr, dicamba + MCPA and metsulfuron methyl (DiTomaso *et al.*, 2013; Parsons & Cuthbertson, 2001). They are most effective when the plant is in the vegetative stage and growing actively.

REGULATORY STATUS

In the EPPO region, *Ageratina adenophora* is included on the EPPO A2 list of pests recommended for regulation as a quarantine pest.

In addition, in Portugal, *A. adenophora* is listed as invasive species in the Decreto-Lei n° 92/2019, 10 July. In Spain *A. adenophora* is listed as invasive species in the Real Decreto 630/2013, de 2 de agosto. The Regulation also applies to the Canary Islands.

Outside of the EPPO region, *A. adenophora* is listed as a quarantine pest in China since 2021 (EPPO, 2023a,b). In the United States of America: *Ageratina adenophora* is listed as a Federal noxious weed in the United States and is thus prohibited from import or interstate commerce unless under permit. It is listed as a noxious weed by Alabama, Florida, Hawaii, Minnesota, North Carolina, and Vermont, as a prohibited weed in Massachusetts, and as a plant pest in South Carolina (USDA, NRCS, 2022). The species is a U.S. Federal noxious weed seed and is also a prohibited noxious weed seed in Hawaii (USDA AMS, 2022). In South Africa, *A. adenophora* is listed as a category 1b plant prohibited from planting or commerce (NEM:BA listing).

In Australia, *A. adenophora* is listed for New South Wales as a Class 4—a locally controlled weed. This means that the "growth and spread of this species must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed (in a large number of local authority areas)" (Australian Government, 2014). In Western Australia, the species is Prohibited—on the prohibited species list and not permitted entry into the state (Australian Government, 2014).

In New Caledonia it is listed as potentially invasive in the Code de l'environnement de la province nord: Article 261–1 relatif aux espèces envahissantes (Délibération no. 2012-236/BPN du 12 octobre 2012).

PHYTOSANITARY MEASURES

EPPO (2023b) recommends that *Ageratina adenophora* should be recommended for regulation as a quarantine pest and *Ageratina adenophora* should be banned for sale in the EPPO region. Plants for planting (horticulture) should be prohibited for import into the EPPO region.

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