**Schinus terebinthifolius**

**System:** Terrestrial

<table>
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<th>Kingdom</th>
<th>Phylum</th>
<th>Class</th>
<th>Order</th>
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<tr>
<td>Plantae</td>
<td>Magnoliophyta</td>
<td>Magnoliopsida</td>
<td>Sapindales</td>
<td>Anacardiaceae</td>
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**Common name**

pimienta de Brasil (English, Puerto Rico), Christmas berry (English), Mexican pepper (English), Brazilian pepper tree (English), Brazilian pepper (English), Brazilian holly (English), Rosapfeffer (German), Florida holly (English), poivrier d'Amérique (French), faux poivrier (French), poivre du Brésil (French), poivre rose (French), enceint (French), warui (Fijian), poivre marron (French), naniohilo (Hawaiian), wilelaiki (Hawaiian), copal (Spanish), baie rose (French)

**Synonym**

**Similar species**

Native to Argentina, Paraguay and Brazil, Schinus terebinthifolius is a pioneer of disturbed sites, but is also successful in undisturbed natural environments. It is an aggressive evergreen shrub or small tree, 3-7 metres in height that grows in a variety of soil types and prefers partial sun. Schinus terebinthifolius produces shady habitats that repel other plant species and discourage colonisation by native fauna and alter the natural fire regime. Its fruit has a 'paralysing effect' on birds and even grazing animals when ingested. Schinus terebinthifolius seeds are dispersed by birds and mammals and it readily escapes from garden environments. It is planted as both an ornamental and shade tree and has many uses.

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**Species Description**

*Schinus terebinthifolius* is an evergreen shrub or small tree, 3-7 metres tall or more. The odd-pinnately compound leaves are alternately arranged on branches and range from 8 to 17cm in length. Each leaf is composed of usually 4 or 6, or sometimes more, rounded and often toothed lateral leaflets, arranged in pairs along a narrowly winged leaf axis, or rachis, and a single, terminal leaflet. When crushed, the leaves produce a pungent aroma that has been variously described, from "peppery" to "turpentine-like" (Ferriter 1997; Tomlinson, 1980).

The flowers are produced in showy, branched panicles, 2-11cm long, which arise from the axils of leaves near the ends of stems. In addition to flowers, the inflorescences also bear triangular to lanceolate, leaf-like bracts with ciliate margins. Both male and female flowers occur on stalks, or pedicels, 1mm long and essentially have the same structure: 5 small, green, triangular sepals with ciliate margins; 5 small, white, glabrous, ovate petals; 10 stamens concentrically arranged in 2 series of 5, the outer series being longer; a lobed disc at the base of the stamens; and a single-chambered, or unilocular, ovary with 3 short styles. However, in male flowers, the ovary, or pistillode, is non-functional, and in female flowers, the staminodes are sterile. On female trees, flowering is followed by the production of bright red, fleshy, spherical drupes, often referred to as "berries", each 5-6mm in diameter and containing a single seed (Ferriter 1997).
Notes
There are five varieties listed within the South American distribution: S. terebinthifolius var. terebinthifolius – from Venezuela to Argentina; S. terebinthifolius var. acutifolius – southern Brazil and Paraguay to Misiones, Argentina; S. terebinthifolius var. pohlianus (the most common variety of the species) – southern Brazil, Paraguay, and northern Argentina; S. terebinthifolius var. radicans – south central Brazil; and S. terebinthifolius var. rhoifolius – south central Brazil (Barkley, 1944; Barkley, 1957) in Cuda et al, 2006).

Lifecycle Stages
Flowering and fruiting phenomena in Brazilian pepper shows distinct periodicity. The main flowering period, September to October, is marked by the production of copious flowers from axillary inflorescences developing at the ends of leafy branches. A second flowering period (March-May) occurs in less than 10% of the population (Ewel et. al., 1982, in Ferriter 1997). Fruit production occurs during the winter (November to February), at which time the branches of female trees are heavily laden with red fruits while male trees remain barren. Ewel et. al. (1982) observed that ripe fruits are retained on a tree for up to 8 months (Ferriter 1997). The survivorship of naturally established seedlings is very high ranging from 66-100%. It is extremely rare to encounter such high survivorship in weedy species. The tenacity of its seedlings makes S. terebinthifolius an especially difficult species to compete with, as its seedlings seem to survive for a very long time in the dense shade of an older stand where they grow, although slowly, while in openings they grow very fast (Ewel et. al. 1982 in Ellers, 2001).

Uses
Schinus terebinthifolius has been used as a garden plant in many countries. It is planted as both an ornamental and shade tree. The bark serves as a source of tannins and the bright red berries and leaves are used in the making of Christmas Wreaths. The berries are also used as a spice called pink peppercorn. The wood of Brazilian pepper is used in construction, as stakes, posts, and railway sleepers. Virtually all parts of this tropical tree have been used for medicinal purposes throughout the tropics including its leaves, bark, fruit, seeds, resin and oleoresin or balsam. Brazilian peppertree is also considered an important nectar and pollen source by the bee industry in the United States and Hawaii (Cuda et al, 2006).

Habitat Description
Schinus terebinthifolius occurs in sub-tropical areas between latitudes 15° and 30° N and S in many countries (Hosking et al, 2003). It is a pioneer species and an aggressive invader of mesic and wet lowland environments (Smith, 1985). It is commonly found in disturbed sites, such as highway right-of-ways, canals, drained wetlands, and fallow fields and farmlands but is also successful in undisturbed natural environments including pinelands, hammocks, and mangroves (Woodall, 1982; Cuda et al, 2006). S. terebinthifolius prefers partial sun to full sun, grows in a variety of soil types (Woodall, 1982; Larocha, 1994a), and is known to be fairly tolerant to shade, high salinity, flooding, and fire (Ewel, 1979; Mylinter and Williamson, 1987; Doren et al, 1991) in Cuda et al, 2006).

Reproduction
Schinus terebinthifolius is largely a dioecious plant which means that the flowers are either male (staminate) or female (pistillate), and the sexes occur on male and female trees. However, a small number of trees have been observed producing bisexual (“complete”) flowers or having both unisexual flowers occurring on the same individual (Ferriter 1997). Flowering generally occurs in the fall, while a small fraction flower in the spring (Ellers, 2001). Although in some locations, such as certain locations in Florida, flowering can occur year-round. Numerous small, white flowers occur in dense axillary panicles near the end of branches. Flowers produce copious amounts of pollen and nectar, and are primarily insect pollinated (Ewel et al. 1982 in Cuda et al, 2006). They are pollinated by diurnal insects, including a number of dipterans (especially a syrphid fly, Palpada vinetorum), hymenopterans, and lepidopterans. A massive number of bright red fruits are typically produced on the plants from November to February. Although most seed dispersal occurs shortly thereafter, some trees retain their fruits until July or August. The fruits are eaten and dispersed primarily by mammals and birds although some dispersal occurs by gravity or water. For example, raccoons (Procyon lotor L.) and oppossums (Didelphus virginianus) consume fruits and contribute to seed dispersal. Although cattbirds (Dumantilla carolinensis) have been observed feeding on the fruits, robins (Turdus migratorius L.) are considered the most important avian seed dispersers. They consume large quantities of seed and spread them to habitats that Brazilian peppertree would never otherwise reach (Ewel et al. 1982 in Cuda et al, 2006). Like many hardwood species, Brazilian peppertree also is capable of resprouting from above-ground stems and crowns after damage from cutting, fire, or herbicide treatment. Resprouting also occurs from the roots with or without evidence of damage and often leads to the development of new daughter plants. Resprouting and suckering often is profuse and the growth rates of the sprouts are high, which contributes to the plant’s habit of forming dense clumps (Cuda et al, 2006).
General Impacts

Schinus terebinthifolius is an aggressive, rapidly colonizing invader of natural communities and disturbed habitats that shades out and displaces native vegetation, often forming dense monocultures that reduce the biological diversity of plants and animals in the invaded areas (Cuda et al., 2006; Donnelly & Walters, 2008; Ewe & Sternberg, 2003). It is known to displace native vegetation in Florida, California, Hawaii, Bermuda, the Bahamas, and Australia (Randall 2000; Hight et al., 2002; Habeck et al., 1994) in Cuda et al., 2006). It is one of the most widespread and problematic invasive plants in Florida where it has infested nearly 280,000 ha of all terrestrial ecosystems (Cuda et al., 2006). Vast monospecific stands of it pose a significant threat to the mangrove swamp communities of the Florida Everglades where it threatens rare federal and/or state listed native species such as the Beach Jacquemontia (Jacquemontia reclinata), the Beach Star, Remirea maritime (Cole 1998, D.F. Austin, pers. comm. in Cuda et al., 2006), and the nesting habitat of the gopher tortoise (Gopherus polyphemus) (EPPO Reporting Service, 2005; Doren and Jones 1997 in Cuda et al., 2006). In Hawaii, S. terebinthifolius is negatively impacting several threatened and endangered plant species, including the Haleakala silverword (Argyroxyphium sandwicense macrocephalum), liliwai (Acaena exigua), and the mahoe tree (Alectryon micrococcus) (Hight et al., 2002 in Cuda et al., 2006). In Bermuda it invades upland margins of mangrove swamps (Mark and Lonsdale 2002). In Malta it invades the Mediterranean maquis community, which consists of mixed species, including olive (Olea europaea), bay laurel (Laurus nobilis) and the garigue. In the Bahamas, it is found on remote islands, where it may alter habitats and interfere with nesting sites (Moyroud 2000). S. terebinthifolius is believed to have allelopathic properties which aid its displacement of native species (Morgan & Overholt, 2005; Hargraves, 2006). Aqueous extracts from it were found to negatively affect the growth of two native plants commonly found in south Florida's natural areas, Bromus alba and Rivina humilis (Morgan and Overholt 2005, in EPPO Reporting Service 2005).

Furthermore, S. terebinthifolius has been found to reduce the density and species diversity of native bird populations compared to uninvaded native pinelands and forest-edge habitats and the alter natural fire regimes because of its resultant increased shade (Cummut, 1989 in Cuda et al., 2006). Brazilian peppertree was shown to have species-specific impacts on microalgae at the land–sea interface, making the possibility of a cascade effect on primary productivity, biodiversity, and community structure likely (Hight et al., 2003). S. terebinthifolius is a relative of poison ivy and usually aggregates allergic skin reactions on contact (Florida Department of Environmental Protection). The high concentration of volatile and aromatic monoterpenes has been suggested to be the probable cause of respiratory problems associated with crushed fruits. Its highly toxic resin is found in its bark, leaves, and fruits (Lloyd et al., 1977). It contains active alkenyl phenols, e.g., urushiol, cardol, which can cause contact dermatitis and inflammation in sensitive individuals (Lampe and Fagerstrom 1968, Tomlinson 1980) in Cuda et al., 2006). Persons sitting beneath S. terebinthifolius trees exhibited flu-like symptoms, and sneezing, sinus congestion, chest pains and acute headache (Morton 1969 1978, in Ferriter 1997). The AMA Handbook of Poisonous and Injurious Plants (Lampe and McCann 1985) reports that the triterpenes found in the fruits can result in irritation of the throat, gastroenteritis, diarrhea, and vomiting in humans (Cuda et al., 2006). The ingested fruits have a ‘paralysing effect’ on birds and grazing animals such as horses are susceptible to its effects which can even prove fatal (Campello and Marsaudi 1974, in Ferriter 1997; Morton, 1978 in Cuda et al., 2006). Intoxication of migratory robins, one of the principal avian disseminators of Brazilian peppertree, is not uncommon (Blassingame, 1955 in Cuda et al., 2006).
Management Info

"A Risk Assessment of Schinus terebinthifolius for Hawaiian and other Pacific Islands was prepared by Dr. Curtis Daehler (UH Botany). The result is a score of 19 and a recommendation of: "Likely to cause significant ecological or economic harm in Hawai‘i and/or other parts of the world,"."

When developing a management strategy it is important to consider the following biological traits of S. terebinthifolius: Its seeds are generally not viable after five months following dispersal. Water availability, especially rapid changes in water level, determines to a great extent seedling success. Its lack of success in California has been attributed to the short period of sufficient soil moisture needed for germination and root establishment. Seedlings grow very slowly and can survive in dense shade, exhibiting vigorous growth if the canopy is cleared (growing at rates of .03 to .05 metres per year (Ferriter 1997). The creation of open habitat influences and increases the rate of spread of S. terebinthifolius. When S. terebinthifolius occurs in these open disturbed areas it provides a reservoir for the plant to spread to natural environments. This means that the restoration of disturbed ecosystems back to their natural state may control the spread of the weed to native ecosystems, as well as providing an opportunity to regain native environments. The plant is capable of resprouting from above-ground stems and root crowns and resprouting is also often profuse, with new growth originating from dormant and adventitious buds. The characteristics that make the Brazilian pepper plant a successful weed include (1) fast growth, (2) prolific seed production, (3) continuous shoot extension, (4) vigorous resprouting and (5) tolerance of a wide range of growing conditions (Ewel 1979, in Ferriter 1997).

Preventative measures: Prohibiting the sale of Schinus terebinthifolius in nursery trade is an important method of slowing its spread. Florida has established a state law prohibiting the sale, cultivation, and transportation of it passed by the Florida legislature in 1990 (Cuda et al, 2006).

Cooperation among public and private agencies as well as from neighboring states to reduce or prohibit its use as an ornamental and manage existing populations is highly recommended. (Doreau et al., 2001). The use of herbicides is the most commonly used and cost-effective method for controlling S. terebinthifolius. S. terebinthifolius is sensitive to foliar applications of imazapyr, to foliar and cut surface applications of triclopyr, dicamba and glyphosate, to basal bark applications of triclopyr, and to soil application of tebuthiuron and hexazinone. It is not sensitive to 2,4-D (Matooka et al 2003 in PIEC, 2010). Cut-stump treatment and basal bark treatment of triclopyr will effectively control it (Langland & Stocker, 2001 in Cuda et al, 2006). Foliar application of imazapyr and triclopyr is also effective and was found to achieve greater than 90% control. However, foliar application will effect non-target vegetation. Imazapyr has also been used in an application referred to as lacing which involves treating only half the foliage with a low volume back pack sprayer that has reportedly yielded 98% control (Phil Waller, BASF, pers. Comm. in Cuda et al, 2006). Basal soil applications of both hexazinone and tebuthiuron were also effective and resulted in 80-90% control (Laroche and Baker, 1994 in Cuda et al, 2006). Other treatments including basal bark application of a mixture of imazapyr and triclopyr are effective in an oil-based solution (BASF, 2005 in Cuda et al, 2001). Excellent control was reported with triclopyr ester/oil applied basal bark at 10% of product. triclopyr amine at 50% of product in water applied to cut surfaces, and imazapyr at 1% of product in water applied as foliar sprays (Matooka et al, 2003 in PIEC, 2010).

Karmex is recommended when the only objective is to kill S. terebinthifolius seedlings. It is, compared to Hyvar or Velpar, less easily leached, making shallow rooted plants, like seedlings, more susceptible than deeper rooted ones. However, on many south Florida sites, feeder roots of established desirable plants may also be very close to the surface and may be affected. Hyvar and Velpar may be as effective on seedlings as Karmex, but are recommended only where larger roots are involved. Where soil characteristics or root distributions preclude soil herbicides, Tordon is recommended as a foliar spray (Woodall 1982 in Ellers, 2001).

Biological: A variety of biological control agents have been investigated or released to control S. terebinthifolius. The most important include the Brazilian pepper thrush (Pseudophilornis porphyricollis), the Brazilian pepper leafhopper (Epsipnus utile), the Brazilian pepper sawfly (Heteropemphysa hubrichii), toyrmid wasp Megastigmus transvaalensis, and a variety of fungal pathogens ( Cleary, 2003; Wheeler et al, 2001 in Cuda et al, 2006). A few biological control agents from southern South America that been screened and released in Hawaii in the 1950s and 1960s include E. utile, Lithraeus arotatus, and Crasimorpha in fuscate. Of them two established but had little effect on Brazilian peppertree and its root system to prevent re-sprouting (Cuda et al., 2005)."

Additional biological control agents that may be useful for the control of Brazilian peppertree include: the torymid wasp Mesos, the torymid wasp Lithraeus atronotatus, and the sawfly Heteropemphysa hubrichii. Fungi Sphaeropsis terebinthifolii, Rhizoctonia solani and Chronodastereum purpureum are all known to infect S. terebinthifolius in different capacities and may also prove to be useful biological controls (Cuda et al, 2006).

Fungi Sphaeropsis terebinthifolii, Rhizoctonia solani and Chronodastereum purpureum are all known to infect S. terebinthifolius in different capacities and may also prove to be useful biological controls (Cuda et al, 2006). The fungi S. terebinthifolius includes soil removal, prescribed burning, and flooding. Soil removal can be effective for eliminating Brazilian pepperette and preventing its reestablishment but this method is labor intensive and costly. Prescribed burns have been used to control Brazilian peppertree with mixed results (Cuda et al, 2006). The seeds fail to germinate following exposure to fire but plants readily resprout from crown and roots (Randall, 200 in Cuda et al, 2006). Repeated fires at 3 to 7 year intervals were found to slow its invasion but did not completely prevent re-establishment (Doreau et al, 1991 in Cuda et al, 2006).

Hydro-leveling, a new technique, was tested in a mangrove forest restoration project in 2004. Hydro-leveling uses a high pressure stream of water to wash sediment from the soil and into the adjacent wetland and ditch. This was found to reduce but not eliminate adult S. terebinthifolius but did successfully eliminate seedlings. Native plants should be planted following hydro leveling to promote native recolonization (Smith et al, 2007).

Mechanical control: Once the Brazilian pepperette reaches heights of several feet, heavy equipment including bulldozers, front end loaders, and root rakes are necessary for the removal of it and its root system to prevent re-sprouting (Cuda et al, 2006; Ellers et al, 2001). Integrated management: An integrated, site specific management plan should be developed for the management of S. terebinthifolius following guidelines provided by (Cuda, 2006).

Cut-stump treatment with 50% Garlon 3A, 10% Garlon 4 or a basal bark application of 10% Garlon 4. Foliar application of Garlon 4, Garlon 3A, Roundup Pro, Roundup Super Concentrate, or Rodeo, according label directions may be used where appropriate. Glyphosate products are less effective when used alone in spring and early summer. Use Rodeo or cut stump application of 50% Arsenol where plants are growing in aquatic sites (Langland & Stocker, undated).

Additionally, Schinus terebinthifolius infestations may be detected with hyperspectral instrumentation or high resolution imagery by aerial observation to evaluate its infestation in inaccessible locations and aid in management program development (Lass & Prather, 2004; Pearlstine et al, 2005)."
FULL ACCOUNT FOR: *Schinus terebinthifolius*


** Compiler:** IUCN/SSC Invasive Species Specialist Group (ISSG)

** Review:** Under Revision

** Publication date:** 2011-02-23

** ALIEN RANGE **

| [1] TURKS AND CAICOS ISLANDS | [8] UNITED STATES |

** Red List assessed species 8: CR = 6; EN = 2:**

- Alectryon macrococcus CR
- Chamaesyce deppeana CR
- Chamaesyce herbstii CR
- Coffea myrtifolia EN
- Commidendrum robustum EN
- Labordia cyrtandrae CR
- Phyllostegia mollis CR
- Schiedea kaalae CR

** BIBLIOGRAPHY **

87 references found for *Schinus terebinthifolius*

** Management information **


GLOBAL INVASIVE SPECIES DATABASE
FULL ACCOUNT FOR: Schinus terebinthifolius


Summary: A study on the use of a screening system to assess proposed plant introductions to Hawaii or other Pacific Islands and to identify high-risk species used in horticulture and forestry which would greatly reduce future pest-plant problems and allow entry of most nonpests.


Summary: The EPPO Reporting Service is a monthly information report on events of phytosanitary concern. It focuses on new geographical records, new host plants, new pests (including invasive alien plants), pests to be added to the EPPO Alert List, detection and identification methods etc. The EPPO Reporting Service is published in English and French. Available from: http://archives.eppo.org/EPPOReporting/2005-Rse-0509.pdf [Accessed 28 November 2005]


Summary: Uses Clidemia hirta in Hawaii as an eradication case study. Clidemia is in the Melastomataceae and somewhat similar ecologically to miconia.


Mc Kay, Fernando; Oleiro, Marina; Cabrera Walsh, Guillermo; Gandolfo, Daniel; Cuda, James P.; Wheeler, Gregory S., 2009. Natural enemies of Brazilian Peppertree (Sapindales: Anacardiaceae) from Argentina: Their possible use for Biological Control in the USA. Florida Entomologist. 92(2). JUN 2009. 292-303.


Summary: Available from: http://www.fleppc.org/publications/Wildland%20Weeds/WW_Summer%202002.pdf [Accessed 9th February]

Molooka, P. 2000. Summaries of herbicide trials for pasture, range, and non-cropland weed control-1999. College of Tropical Agriculture and Human Resources of the University of Hawaii at Manoa.

Summary: Data published to assist applicators experimenting with herbicides for weed control.


Summary: The National Pest Plant Accord is a cooperative agreement between regional councils and government departments with biosecurity responsibilities. Under the accord, regional councils will undertake surveillance to prevent the commercial sale and/or distribution of an agreed list of pest plants.


Pacific Islands Ecosystems at Risk (PIER), 2010. Schinus terebinthifolius Raddi, Anacardiaceae

Pacific Islands Ecosystems at Risk (PIER), 2010. Risk Assessment Schinus terebinthifolius Raddi, Anacardiaceae


PIER (Pacific Island Ecosystems at Risk), 2002. Schinus terebinthifolius

Summary: Ecology, synonyms, common names, distributions (Pacific as well as global), management and impact information.


Summary: Eradication case study in Turning the tide: the eradication of invasive species.

Royal New Zealand Institute of Horticulture (RNZIH), 2005. Christmas berry Schinus terebinthifolius


Summary: Available from: http://library.fws.gov/CCPs/pelicanisland_draft.pdf [Accessed 9th February]


Summary: This database compiles information on alien species from British Overseas Territories.

Available from: http://www.jncc.gov.uk/page-3660 [Accessed 10 November 2009]


General information


Summary: Tableau synth?tique des plantes exotiques de Mayotte class?es en fonction de leur niveau d envahissement.


Summary: Available from: http://www.fcla.edu/FlaEnt/fe78p1.html [Accessed 9th February 2005]


Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.


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Cet article est le premier à proposer une hiérarchisation des plantes les plus envahissantes de La Réunion. 33 espèces de plantes ligneuses introduites à La Réunion, permet d'en identifier 132 comme envahissantes. Les bases d'une stratégie de lutte contre les plantes exotiques envahissantes sont également formulées.

Summary: Article focusing on the interaction between alien birds and plants describing many examples and the ecological feedback that takes place between an introduced bird and plants it unknowingly introduces as food.


Summary: L'inventaire de 318 espèces de plantes ligneuses introduites à La Réunion, permet d'en identifier 132 comme envahissantes dans l'archipel. Les bases d'une stratégie de lutte contre les plantes exotiques envahissantes sont également formulées.


Summary: Article de synthèse sur les espèces ligneuses envahissantes dans l'archipel néo-calédonien. FAO. 29 March 2010). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Summary: L'inventaire de 318 espèces de plantes ligneuses introduites à La Réunion, permet d'en identifier 132 comme envahissantes dans l'archipel. Les bases d'une stratégie de lutte contre les plantes exotiques envahissantes sont également formulées.