

EPPO Data sheets on invasive alien plants
Fiches informatives sur les plantes exotiques envahissantes

13-18423 rev
WPPR Point 7.3

Baccharis halimifolia L.
Asteraceae – Groundsel Bush

Identity

Scientific name: *Baccharis halimifolia* Linnaeus

Synonym: *Baccharis cuneifolia* Moench

Taxonomic position: Dicotyledons, Asteraceae

Common names: Gewöhnlicher kreuzstrauch [DE], eastern baccharis, groundsel baccharis, groundsel bush, seepwillow [EN], tres Mariás [ES], baccharide à feuilles d'halime, séneçon en arbre [FR]

EPPO code: BACHA

Phytosanitary categorization: EPPO A2 List

Geographical distribution

Native range:

North America: Canada (Nova Scotia), Mexico (Mexico, Nuevo Leon, San Luis Potosi, Tamaulipas, Veracruz; Flora of North America Website), the USA (Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Louisiana, Maryland, Massachusetts, Mississippi, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Texas, Virginia, West Virginia; Flora of North America Website).

Carribean: Bahamas (Correl & Correl, 1982), Cuba (USDA-ARS Website; Weber, 2003),

Note: In Canada, *B. halimifolia* reaches its northern limit range and it is considered as an extremely rare Atlantic coastal plain species, occurring only in Tusket River estuary and its vicinity. Official conservation programmes are being implemented in this area (Nova Scotia Website, Species at Risk Conservation Fund 2009 Approved Projects).

Introduced Range:

Note: in New Zealand, according to Webb *et al.* (1988), the species was recorded as locally established on Banks Peninsula (Canterbury) only: Evans Pass, Lyttelton, Victoria Park and Barrys Bay (Lynne Huggins, Department of Conservation, New Zealand, pers. comm., 2012).

Asia: Georgia, in Abkhazia, on the eastern coast of the Black Sea (Westman *et al.*, 1975; Kikodze *et al.*, 2010).

EPPO Region: Belgium (Verloove, 2008), France (Thellung, 1916; Muller, 2004), Italy (Zanetti, 1997; Arrigoni & Viegi, 2011), Spain (Allorge, 1941), and the UK (Clement & Foster, 1994).

Note: the species had been recorded in the Netherlands but is not known to be present anymore in this country (van Valkenburg *et al.*, 2013). The plant is also recorded as planted in the Atatürk arboretum in Istanbul, but has so far not been recorded in the wild (Ibreliler Website, www.ibreliler.com).

History of introduction and spread

In Australia, the plant was first introduced for ornamental purposes around 1900 in Queensland. By 1930 it was considered invasive, spreading to neighboring areas, and is now recorded in New South Wales (Sims-Chilton & Panetta, 2011).

The first record of *B. halimifolia* in the EPPO region dates back to 1683 in France, where it was introduced for ornamental reasons (Fournier, 1936). There are indications of its cultivation in several botanical gardens, for instance, in Paris in 1796 (Jardin des Plantes) or in Montpellier in 1824 (AME & CBNMP, 2003). During the 19th century, the cultivation of *B. halimifolia* as an ornamental plant was recommended in several horticultural books (Duhamel du Monceau, 1800; Dupuis & Hérincq, 1884). The plant was particularly used for its tolerance to salinity, both in soil and in wind spray. It is also widely used as an ornamental plant on roadsides and roundabouts in coastal areas, and is also used on canal shores for stabilization, and more rarely for small game.

In Spain, *B. halimifolia* was reported for the first time by Allorge (1941) in the Basque Country (from Lekeitio to Deba). The Gobierno Vasco (2011) noted that although the species did not seem to be available in nurseries in the Basque country; *B. halimifolia* was nevertheless found in gardens in Asturias (González Costales, 2007). The species is suspected to have invaded some natural areas in the Spanish Basque country through natural spread by wind from the French Basque Country (Estela Beteta, Gobierno Vasco, pers. comm., 2012).

In Belgium, the plant was mentioned for the first time as introduced in 1924. It is thought to have been introduced intentionally in coastal dunes as a windbreak (Verloove, 2011). This plant is now recorded to be used in soil bioengineering systems to stabilize tidal shorelines because of its ability to root from a dormant, unrooted cutting (Invasive Species in Belgium Website).

There are only two records of *B. halimifolia* in the UK, where the plant is known to occur since 1942 (Clement & Foster, 1994). The introduction of the species has been reported more recently in Italy in the Veneto region (Zanetti, 1997; Pizzo & Buffa, 2009; Minelli, 2009) and in the Tuscany region (Coaro, 1987; Arrigoni & Viegi, 2011), in both cases in coastal areas.

Morphology

Plant type

B. halimifolia is a branching shrub or small tree growing up to 4 m high.

Description

B. halimifolia's trunk can reach 16 cm in diameter. Its leaves are alternate, pale green, thick; those of the stem and lower branches are obovate to elliptic or oblanceolate, 2-7 cm long and 1-5 cm wide; those of the branchlets are smaller, cuneate at the base, several-toothed above the middle. *B. halimifolia* is dioecious. Flowers are small, female ones are whitish, male ones are greenish. Flower heads are situated in terminal or axillary clusters of 1 to 5. Achenes are 1-2 mm long, pappus is bright-white, 6-8 mm long (Weber, 2003; Muller, 2004). See Figures 1, 2, 3, 4 & 5 in Appendix 1 for pictures.

Biology and ecology

General

B. halimifolia is generally an evergreen, but in the cooler parts of its native range, it is deciduous (Sims-Chilton & Panetta, 2011). *B. halimifolia* grows fast, up to 30 to 40 cm per year (Herrera & Campos, 2010). Shrubs are mature within 2 years and flower every year (Panetta, 1979b). The species reproduces mainly by seeds, but can also reproduce vegetatively by sprouting from the base, following disturbance (Westman *et al.*, 1975). *B. halimifolia* flowers at the end of the summer (August to October in France) and is wind-pollinated. Seeds are produced from October to November (in France). They are abundant, estimations range between 10 000 (Auld, 1970) to 1 500 000 per year for a healthy adult plant growing in full sunlight (Westman *et al.*, 1975) and are dispersed by wind, potentially over long distances, as well as by water. Seeds germinate easily (usually in 1 to 2 weeks) if sufficient soil moisture is available (Westman *et al.*, 1975). The seed bank is expected to persist at least 2 years (Panetta, 1979a).

Habitats

In its native range, *B. halimifolia* occurs in open sandy places, wet fields, marshes, beaches, disturbed sites, roadsides, old fields, from 0 to 100 metres above sea level (Sundberg & Bogler, 2006). It is considered as a common species in upland fringes of coastal saline marshes and back dune habitats (Cronquist, 1980). It is also capable of establishing in disturbed habitats such as fallow fields and hedgerows, as well as inland saline soils (Krischik & Denno 1990).

In Australia, *B. halimifolia* established within a wide variety of plant communities, from dry *Eucalyptus* forests to native tea-tree (*Melaleuca quinquenervia*) swamps (Westman *et al.*, 1975). It is particularly suited to moist gullies, salt marsh areas and wetlands. It also grows on high, cleared slopes (Anonymous, 2007a). As in its native range, *B. halimifolia* is also found in disturbed habitats, including cleared unused land, cleared slopes (Anonymous, 2007a), tropical pastures, irrigation channels and coastal canals (Westman *et al.*, 1975) or exotic pine plantations, e.g. *Pinus elliottii* (Panetta, 1979a, b).

On the Atlantic coast of Europe, *B. halimifolia* is known to escape from cultivation (private gardens, hedges and roundabouts) and to establish first in artificial habitats: along roadsides, along canals, in agricultural, industrial or on old saltworks wastelands (Le Moigne & Magnanon, 2009). From these habitats, it invades coastal wetlands such as saltmarshes, moist and wet dune slack, water-fringing reedbeds, meadows and open woodlands (Muller, 2004) and humid prairies (Zendoia *et al.*, 2006). Although preferentially in wetlands, it is also found in drier habitats such as heathlands with *Ulex europaeus* or in the upper beach area (Anonymous, 2007b). It also invades cliffs (Campos *et al.*, 2004).

The main habitats in which *B. halimifolia* is known to occur in the EPPO region according to the EUNIS habitat classification is provided in the EPPO PRA Record for *Baccharis halimifolia*.

Environmental requirements

B. halimifolia can be found on a wide range of soil types. It grows most typically in moist soils with high organic content (Sims-Chilton & Panetta, 2011). However, in Spain, *B. halimifolia* was also associated with high elevations and coarse sand (Onaindia *et al.*, 2001, cited in Sims-Chilton & Panetta, 2011). The plant is observed on soils with pH values ranging

from 3.6 to 9 (Westman *et al.*, 1975). In both its native and exotic ranges, it is often found in soil covered by water with salinity ranging from 0 to 3.6‰ (Westman *et al.*, 1975).

In its native area, *B. halimifolia* is found from Florida, which has a humid subtropical to tropical climate, to areas such as Massachusetts, which has snowfall in winter (USDA-ARS Website). It covers five plant hardiness zones from 9 to 6 with mean annual minimum temperatures of -17.8°C/-23.3°C in the latter zone (Erwin, 2009). It is frost tolerant, and can withstand temperatures as low as -15°C (Huxley, 1992 in Muller, 2004). Westman *et al.* (1975) found that optimal germination occurs between 15-20°C with cold pre-treatment at 5°C. This shows the temperate to subtropical range of the species.

Uses and benefits

The species is reported to be used as a food supplement for its medicinal value and as a cleanser favoring weight loss (Fédération des Conservatoires Botaniques Nationaux, undated).

Pathways for movement

Natural dispersal

B. halimifolia seeds are very small, their mass is approximately 0.11 mg (Panetta, 1977) and they are crowned by a pappus and are therefore readily dispersed by wind (Boldt, 1987) but also by water (Panetta, 1977).

Movement in trade

The plant is used as an ornamental and amenity plant due to its tolerance to salinity. 'Ornamental' and 'amenity' are defined according to Lambdon *et al.* (2008):

- Ornamental species are cultivated on a small scale (especially in private gardens).
- Amenity species are cultivated on a large to moderate scale in public places for landscaping purposes (e.g., for soil stabilization or aesthetic enhancement).

Trade for ornamental purposes can occur both via the internet and by direct retail at the nursery. The plant is widely available in garden centres and nurseries in Europe.

Impacts

Effects on plants

In its native range, *B. halimifolia* is considered a weed as it invades overgrazed rangeland in the Southern United States (Nesom, 2006). In Australia, *B. halimifolia* is a pest of pastures, where thick stands can inhibit the movement of stock and reduce the productivity of grazed areas (Ensbey, 2001). Nevertheless, there are currently no records of impacts on pastures in the EPPO region.

Environmental and social impact

B. halimifolia can outcompete other plants. It forms dense monospecific stands that are persistent as each shrub can live up to 25 years, and can have detrimental impacts on native populations and communities. Once established, the shrub blocks the light to other species, modifying micro-climatic conditions, leading to a regression of herbaceous species (Muller, 2004). Studies conducted at the habitat scale demonstrate that *B. halimifolia* significantly reduces the species richness (Pierre, 2012; Fried *et al.*, 2013). Invasion by *B. halimifolia* also

a marked change in the structure and physiognomy of the invaded community (Campos *et al.*, 2004). *B. halimifolia* can also cause physical modifications of habitats. As leaves and wood of *B. halimifolia* secrete an inflammable resin (Bean, 1981), dense thickets of *B. halimifolia* could increase fire frequency in invaded habitats (Muller, 2004). Lozano Valencia & Alagón Cardoso (1995) report modifications in productivity and in nutrient cycling, including changes in the rates of erosion and sedimentation of the affected estuaries. Such impacts are recorded to occur in threatened habitats listed on the Annex I of the EC *Habitats Directive* (Directive 92/43), in particular in France and in Spain (e.g. Atlantic salt meadows, Mediterranean salt meadows, Mediterranean and thermo-Atlantic halophilous scrubs, Embryonic shifting dunes, see the EPPO PRA record for *Baccharis halimifolia* for further details).

In addition, *B. halimifolia* may threaten rare or vulnerable species. In the Spanish Basque country, *B. halimifolia* is thought to have reduced the populations of *Matricaria maritima* (Campos *et al.*, 2004), which is included within the category ‘danger of extinction’ in the ‘Basque Catalogue of Threatened Species of the Wild and Marine Fauna and Flora’. Other estuarine species present in invaded rush marshes such as *Cochlearia aestuaria*, *Frankenia laevis*, *Limonium humile*, *Salicornia* spp. or *Sarcocornia perennis* are already endangered at the regional level in the Basque country (Uribe-Echebarría & Campos 2006). Galarza & Hidalgo (2005-2006) also report that the stands of *B. halimifolia* have an impact on bird populations associated with invaded habitats. The plant is considered to reduce the attractiveness and use of the habitats for nesting, roosting and feeding. *B. halimifolia* is then suspected to threaten *Acrocephalus arundinaceus* (Acrocephalidae, registered on the Annex 2 of the Bonn and the Bern Conventions) and *Emberiza schoeniclus* (Emberizidae, registered on the Annex 2 of the Bern Convention).

Concerning social and human health impacts, the establishment of *B. halimifolia* occurs in areas favorable to mosquitoes. Dense thickets of *B. halimifolia* protect mosquito larvae from insecticide treatments and impede access for mosquito control (Bouterin & Canonge, 1999 in Muller, 2004). *B. halimifolia* is also reported to cause hay fever-type allergies (Moss, 1967, cited in Panetta 1979b; De Loach *et al.*, 1986) caused by airborne pollen and seed ‘fluff’ (Anonymous, 2007a). Moreover, its resin is considered to make *B. halimifolia* highly flammable. Its establishment in fallow lands may therefore increase the fire hazard and threaten security (on industrial sites for instance) (Muller, 2004; Invasive Species in Belgium Website). When established near salt marshes, *B. halimifolia* is detrimental to salt production as it forms a wind break and contaminates salt with seeds (David, 1999).

As the species is difficult to control, management costs are quite expensive. To give an indication, the manual pulling out of plants coupled with the use of herbicide over 298 ha cost 630 000 € in 2011 in the framework of the Basque country Life + project (LIFE project 08NAT/E/000055 Website).

Control

The first step in controlling *B. halimifolia* is the reduction of its use as an ornamental plant, in particular along roads.

Flooding with marine water could limit the spread of the species. Nevertheless, such a technique can only be considered in salt marshes (Muller, 2004).

Cutting and uprooting can locally control the plant, but these expensive measures have to be repeated several times because of the resprouting ability of the species, and its large seed bank. If plants are removed manually, the roots should be cut well below the soil surface to prevent resprouting. When uprooting is not possible, regularly cutting the shrubs before they

set seeds can stop the spread of the plant. Sheep grazing can reduce the spread of *B. halimifolia* locally, when there is a heavy pasture load (the species has a low palatability) (Muller 2004; Charpentier *et al.*, 2006).

Chemical control is providing satisfactory results with 2,4-D, dicamba plus MCPA, glyphosate, picloram plus 2,4-D, and triclopyr (Weber, 2003).

Control through fire has proven to be inefficient (Muller, 2004). Several biological control agents have been tested, but are not regarded as highly efficient.

Regulatory status

In Spain, *B. halimifolia* is registered on the Catalogue of Invasive Alien Species for which introduction, possession, trade and transport of the species listed is prohibited (Ministerio de agricultura, alimentación y medio ambiente, Boletín Oficial de Estado, 2011).

B. halimifolia has been declared an unwanted organism under the New Zealand Biosecurity Act 1993, which makes it illegal to knowingly release, spread, display or sell, breed, propagate or otherwise distribute plants or part thereof.

In Australia, the species is considered noxious and is regulated in Queensland and New South Wales (as well as in Northern Territory where it is not recorded as present) (Weeds Australia Database).

References

- Allorge P (1941) Essai de synthèse phytogéographique du Pays Basque. *Bulletin de la Société Botanique de France* **88**, 66.
- AME & CBNMP (2003) Plantes envahissantes de la région Méditerranéenne. AME, ARPE, 42 p.
- Anonymous (2007a) Fact sheet. Groundsel bush (*Baccharis halimifolia*). Biosecurity Queensland, Department of Primary Industries and Fisheries, Brisbane.
- Anonymous (2007b) La lutte contre les plantes envahissantes sur le site Gavres-Quiberon. Syndicat Mixte Gâvres – Quiberon.
- Arrigoni PV, Viegi L (2011) La flora vascolare esotica spontaneizzata della Toscana. Regione Toscana. Direzione generale Politiche territoriali, ambientali e per la mobilità Settore Tutela e valorizzazione delle risorse ambientali.
- Auld BA (1970) Groundsel bush, a dangerous woody weed of the far north coast. *The Agricultural Gazette of New South Wales* **81**, 32-34.
- Bean W (1981) Trees and Shrubs Hardy in Great Britain. John Murray, London 4 Vols and Supplement.
- Boldt PE (1987) Host specificity and laboratory rearing studies of *Megacyllene mellyi* (Coleoptera: Cerambycidae), a potential biological control agent of *Baccharis neglecta* Britt. (Asteraceae). *Proceedings of the Entomological Society of Washington* **89**, 665-672.
- Bouterin B & Canonge L (1999) Dynamique et évolution des peuplements de *Baccharis halimifolia*, délimitation de ses conditions écologiques (entre Fos-sur-mer et Port-Saint-Louis-du-Rhône). Rapport de stage de DEUST, Entente Interdépartementale pour la Démoustication & Université de Droit d'Economie et des Sciences de St Jérôme. Marseille, France.
- CABI (2012) Invasive Species Compendium.
- Campos JA, Herrera M, Biurrun I & Loidi J (2004) The role of alien plants in the natural coastal vegetation in central-northern Spain. *Biodiversity and Conservation* **13**, 2275-2293.
- Clements EJ & Foster MC (1994) Alien Plants of the British Isles: A Provisional Catalogue of Vascular Plants (Excluding Grasses). Botanical Society of the British Isles, UK.
- Coaro E (1987) Flora e vegetazione del Bosco dell'Ulivo (Parco di Migliarino, S. Rossore e Massaciuccoli). *Quaderni del Museo di Storia Naturale di Livorno*, 8, Suppl. 1, 1-45.
- Correll DS & Correll HB (1982) Flora of the Bahama Archipelago. Cramer J, FL-9490 Vaduz, Germany. 1692 pp.
- Charpentier A, Riou K, Thibault M (2006) Bilan de la campagne de contrôle de l'expansion du *Baccharis halimifolia* menée dans le parc naturel régional de Camargue (PNRC) en automne 2004 et 2005.
- Clements EJ & Foster MC (1994) Alien Plants of the British Isles: A Provisional Catalogue of Vascular Plants (Excluding Grasses). Botanical Society of the British Isles, UK.
- Cronquist A (1980) Vascular flora of the Southeastern United States. University of North Carolina Press, Chapel

- Hill, North Carolina.
- David C (1999) Etude du *Baccharis halimifolia* dans les marais salants de Guérande et du Mès. Note de synthèse du rapport de stage pour le Syndicat Intercommunal de la Côte d'Armor et de la presqu'île Guérandaise, Guérande, 41 pp.
- DeLoach CJ, Boldt PE, Cordo HA, Johnson HB, Cuda JP (1986) Weeds common to Mexican and U.S. rangelands: Proposals for biological control and ecological studies. pp. 49-67. In: Patton D.R. (Ed.). Proceedings of the Symposium on Management and Utilization of Arid Land Plants, Saltillo, Mexico, 18–22 February 1985, Rocky Mountain Forest and Range Experiment Station, Fort Collins.
- Duhamel du Monceau HL (1800) Traité des arbres et arbustes que l'on cultive en France. Seconde édition, considérablement augmentée ; [Tome premier]. 2 Edition. Didot ainé, Paris.
- Dupuis A & Hérincq F (1884) Horticulture. Végétaux d'ornements. Abel Pilon et Cie Editeurs, Paris, France.
- Ensbeij R (2001). Groundsel bush. NSW Agriculture, Grafton.
- Ervin GN (2009) Distribution, habitat characteristics, and new county-level records of *Baccharis halimifolia* L. on a portion of its present US range boundary. *Southeastern Naturalist* **8**, 293-304.
- Fédération des Conservatoires Botaniques Nationaux (undated) *Baccharis halimifolia*. 6 pp.
http://invmed.fr/sites/invmed.fr/files/pictures/Fiche%20-%20Baccharis-halimifolia_sr.pdf
- Flora of North America, Vol. 20, *Baccharis halimifolia*
http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=250066181
- Fournier P (1936) Les Quatre flore de France.
- Fried G, Laitung B, Pierre C, Chagué N, Panetta FD (2013) Community-level impact of invasive alien plants in Mediterranean habitats : relative importance of invaders and invaded communities characteristics. in prep.
- Global Biodiversity Information Facility, *Baccharis halimifolia*, <http://data.gbif.org/species/3129663/>
- Gobierno Vasco. Dirección de Biodiversidad y Participación Ambiental. Comisión Internacional de Seguimiento e Intercambio de Experiencias (2011) *Baccharis halimifolia*.
http://www.ingurumena.ejgv.euskadi.net/r49-life55c/es/contenidos/informacion/life_estuarios/es_life/adjuntos/14_conclusiones_com_internacional_life_estuarios.pdf
- González Costales JA (2007) Plantas alóctonas invasoras en el Principado de Asturias. Consejería de Medio Ambiente, Ordenación del Territorio e Infraestructuras y Obra Social "la Caixa". Oviedo.
- Herrera M & Campos JA (2010) Flora alóctona invasora en Bizkaia. Instituto para la Sostenibilidad de Bizkaia. 196 pp.
- Huxley A (1992) The New RHS Dictionary of Gardening. MacMillan/Stockton Press.
- Invasive Alien Species in Belgium Website, *Baccharis halimifolia* <http://ias.biodiversity.be/species/show/41>
- Kikodze D, Memiadze N, Kharazishvili D, Manvelidze Z, Mueller-Schaerer H (2010) The alien flora of Georgia. 36 pp.
- Krischik VA & Denno RF (1990) Patterns of growth, reproduction, defense, and herbivory in the dioecious shrub *Baccharis halimifolia* (Compositae). *Oecologia* **83**, 182-190.
- Lambdon PW, Pyšek P, Basnou C, Hejda M, Arianoutsou M, Essl F, Jarošík V, Pergl J, Winter M, Anastasiu P, Andriopoulou P, Bazo I, Brundu G, Celesti-Grapo L, Chassot P, Delipetou P, Josefsson M, Kark S, Klot S, Kokkari Y, Kühn I, Marchante H, Perglová I, Pino J, Vilà M, Ziko A, Roy D & Hulme P (2008) Alien flora of Europe: species diversity, temporal trends, geographical patterns and research needs. *Preslia* **80**, 101-149
- Lozano Valencia PJ & Alagón Cardoso I (1995) Estudio fitogeográfico y botánico de las Islas del Bidasoa. *Lurralde: investigación y espacio* **18**, 197-228.
- Ministerio de agricultura, alimentación y medio ambiente, Boletín Oficial de Estado, Lunes 12 de diciembre de 2011, Núm. 29, Sec. I., 25 pp
<http://www.boe.es/boe/dias/2011/12/12/pdfs/BOE-A-2011-19398.pdf>
- Le Moigne G & Magnanon S (2009) Le sénéçon en arbre (*Baccharis halimifolia*). Conservatoire Botanique National de Brest.
- LIFE project 08NAT/E/000055 Website: Restoration of habitats of Community interest in estuaries of the Basque Country.
<http://www.ingurumena.ejgv.euskadi.net/r49-life55/en/>
- Minelli A (2009) Lagoons, estuaries and deltas - Boundaries between the sea and rivers. Italian Ministry of the Environment and Territorial Protection. Museo Friulano di Storia Naturale, Udine, Italy.
- Moss, JE (1967) A flowering calendar of possible hay fever plants in Brisbane. *Medical Journal of Australia* **1**, 270-272.
- Muller S (2004) Plantes invasives en France Muséum national d'Histoire naturelle, Paris.
- Nesom G (2006) Groundsel Tree *Baccharis halimifolia* L. USDA NRCS.
- Nova Scotia Website, Species at Risk Conservation Fund 2009 Approved Projects
<http://novascotia.ca/natr/wildlife/conservationfund/2009projects.asp>

- Onaindia M, Albizu I & Amezaga I (2001) Effect of time on the natural regeneration of salt marsh. *Applied Vegetation Science* **4**, 247-256.
- Panetta FD (1977) The effect of shade upon seedling growth in groundsel bush (*Baccharis halimifolia* L.). *Australian Journal of Agricultural Research* **28**, 681-690.
- Panetta FD (1979a) The effects of vegetation development upon achene production in the woody weed, groundsel bush (*Baccharis halimifolia* L.). *Australian Journal of Agricultural Research* **30**, 1053-1065.
- Panetta FD (1979b) Germination and seed survival in the woody weed, groundsel bush (*Baccharis halimifolia* L.). *Australian Journal of Agricultural Research* **30**, 1067-1077.
- Pierre C (2012) Impact de huit plantes invasives sur des communautés végétales de la région méditerranéenne. AgroSup Dijon.
- Pizzo L & Buffa G (2009) Analisi dei processi d'invasione di piante esotiche nei paesaggi costieri sabbiosi del Veneto. 104th Congress of the Italian Botanical Society, Campobasso, Italy.
- Sims-Chilton NM & Panetta FD (2011) The biology of Australian weeds 58. *Baccharis halimifolia* L. *Plant Protection Quarterly* **26**, 114-123.
- Sundberg SD & Bogler DJ (2006) *Baccharis*. Pages 23-28 in F. o. N. A. E. c. e. 1993+, editor. *Flora of North America North of Mexico*, New York and Oxford.
- Thellung MA (1916) Quelques plantes adventices de France. *Le Monde des Plantes* **99**, 11-13.
- Uribe-Echebarria PM & Campos JA (2006) Flora vascular amenazada en la Comunidad Autónoma del País Vasco. Gobierno Vasco, Vitoria-Gasteiz.
- USDA-ARS Website, *Baccharis halimifolia*. Germplasm Resources Information Network - (GRIN) National Germplasm Resources Laboratory, Beltsville, Maryland.
<http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?6232>
- Van Valkenburg J, Duistermaat H & Meerman H (2013, submitted) *Baccharis halimifolia* L. in the Netherlands: what withholds Tree Groundsel?[In Dutch] *Gorteria* **36**
- Verloove F (2008) La flore urbaine de Dunkerque (Nord) : quelques xénophytes remarquables. *Le Monde des Plantes* **494**, 11-14.
- Verloove F (2011) *Baccharis halimifolia* L. Manual of the Alien Plants in Belgium
<http://alienplantsbelgium.be/content/baccharis-halimifolia-0>
- Webb CJ, Sykes WR & Garnock-Jones PJ (1988) *Flora of New Zealand*. Vol. IV. Naturalised Pteridophytes, Gymnosperms, Dicotyledons. Botany Division, D.S.I.R, Christchurch, New Zealand.
- Weber E (2003) *Invasive Plant Species of the World. A reference guide to environmental weeds*. CABI Publishing, Oxon.
- Weeds Australia Database <http://www.weeds.org.au/noxious.htm>.
- Westman WE, Panetta FD & Stanley TD (1975) Ecological studies on reproduction and establishment of the woody weed, groundsel bush (*Baccharis halimifolia* L.: Asteraceae). *Australian Journal of Agricultural Research* **26**, 855-870.
- Zanetti M (1997) *Atlante della Flora notevole della Pianura veneta orientale*. Ediciclo. Ed., Italy, ISBN 88-85327-75-3, 209 pp.
- Zendoia I, Oreja L, Garmendia J, Azpiroz M, Arbelaitz E, Urkizu A, Tamayo I & Aizpuru I (2006) *Cladium mariscus* formazioen kartografia, karakterizazioa eta kontserbazio-egoera. Aranzadi. 30 pp.

Appendix 1 : Pictures of *Baccharis halimifolia*



Figure 1: Male flowers of *B. halimifolia*.
© Guillaume Fried, Anses, FR.



Figure 2: Female inflorescence of *B. halimifolia*. © Guillaume Fried, Anses, FR.



Figure 3: *B. halimifolia* fruiting along a river course in the Domaine de la Palissade in Camargue (FR). © Sarah Brunel, EPPO



Figure 4: Seeds of *B. halimifolia*.
© Guillaume Fried, Anses, FR.



Figure 5: Leaves of *B. halimifolia*
© Guillaume Fried, Anses.