EPPO data sheet on Invasive Plants

Senecio inaequidens

Identity
Scientific name: *Senecio inaequidens* De Candolle
Synonyms: *Senecio burchellii* De Candolle, Senecio
Taxonomic position: Asteraceae.
Common names: Narrow-leaved ragwort, South African ragwort (English), séneçon du Cap (French), schmalblättriges Greiskraut, schmalblättriges Kreuzkraut, südafrikanisches Greiskraut (German), senecione sudafricano (Italian).
EPPO code: SENIQ
Notes on taxonomy and nomenclature:
Senecio inaequidens DC. (Asteraceae) is a perennial plant originally growing in South Africa which was unintentionally and independently introduced into several sites in Europe from 1889 onwards.
The identity of the plant in Europe has long been in doubt; it has been called *S. harveianus* Mac Owan and quite erroneously *S. lautus* Solander ex Willd (Tutin *et al.*, 1976*).* In fact, *Senecio inaequidens* De Candolle, *Senecio madagascariensis* Poiret and *Senecio harveianus* Mac Owan are three *Senecio* species growing in South Africa frequently confused by the botanists.
Molecular studies have shown that South African *S. madagascariensis* was more closely related to South African *S. inaequidens* than to Madagascan *S. madagascariensis*. However chromosome counts revealed that individuals of *S. inaequidens* are tetraploids in Europe whereas Australian individuals of *S. madagascariensis*, which have a South African origin, are diploids. The tetraploid form is very aggressive (Lafuma *et al*., 2003). A comparison of some South African populations of the three species and a study on ploidy level was conducted. It showed that *S. inaequidens*, *S. madagascariensis* and *S. harveianus* are the same species and that polyploidisation of *S. inaequidens* occurred in South Africa and seeds introduced in Europe probably came from tetraploid populations of the Lesotho area (Lafuma *et al*., 2002).
Other species such as *S. paniculatus* (syn. *S. reclinatus*), *S. harveianus* (syn. *S. vimineus*), *S. douglasii* and *S. lautus* do not occur in Europe and have not spread outside their area of origin.
Phytosanitary categorization: EPPO A2 List of invasive alien plants

Morphology

Plant type
S. inaequidens is a perennial herbaceous or woody shrub, seed or vegetatively propagated.

Description
S. inaequidens is up to 100 cm tall, spherically shaped, rising from a shallow taproot (Hilliard, 1977). Stems are erect, more or less glabrous, often numerously branched from the woody base.
Leaves are alternate, bright green, simple, slightly thick, usually with clasping stems at the base (occasionally petiolate), becoming reduced in size from the base, very variable, from 3 to 14 cm long and 0.3 to 1 cm wide. Cauline leaves are mostly linear-lanceolate to elliptic-lanceolate, apex acute, margins denticulate to coarsely and irregularly-toothed, referring to its name "*inaequidens*" meaning "irregular tooth" in latin. Upper leaves are occasionally pinnately-lobed, shortly petiolate, subsessile or sessile.
Inflorescences are open, terminal or axillary, corymbose panicles, 80 to 100 per plant. Capitula ranges from 18 to up to 25 mm in diameter and are radiate. Involucral bracts are lanceolate (about

20), acute, more or less glabrous, keeled, 5(4-7) mm long, resinous. Calyculus bracts are few, acute, more or less glabrous, dark-tipped. Ray florets are (7-)13, female, ligule bright yellow, becoming revolute. Disc florets are numerous, perfect, tube bright yellow and have lobes with a median resinous line.
Achenes are 2-2.5 mm long, cylindrical, pubescent between ribs. Pappus is white, 2 to 3 times as long as achenes, readily detached. The genus name "*Senecio*" comes from "*senex*" and means "old man", referring to the white pappus.
Similarities to other species
S. inaequidens is unlikely to be confused with other *Senecio* spp. in its exotic range, though it looks like *S. lythroides*, indigenous of the Western Mediterranean area.

Biology and Ecology
S. inaequidens is a short-lived perennial, with a life span of 5-10 years (Brunel, 2003). In France, flowering occurs from April to January. *S. inaequidens* is visited by many types of insects, mainly Hymenoptera, Lepidoptera and Diptera (Ernst, 1998). It is an important food plant for wild insect species in its introduced range (Schmitz and Werner, 2001) and may be a nectar source for honey bees. *S. inaequidens* is considered self-compatible by Ernst (1998), but self-incompatible by Harland (1955), and thus this plant may be another example of a successful self-incompatible colonizer like *S. squalidus* and *S. jacobaea*.
Reproduction is primarily by achenes produced from June to January (in France). Vegetative propagation also occurs by the rooting of stems that touch the ground (Ernst, 1998). Individual *S. inaequidens* plants vary greatly in the numbers of achenes that they produce. On average, 10 000 seeds are produced per plant and per year. Achenes may remain viable for at least 2 years when stored dry (Ernst, 1998). They are mainly dispersed by wind over large distances. They can also be dispersed by birds and mammals. Massive germination occurs all year long, the highest rates being spring and autumn.

A chromosome number of 2n= 40 is reported for *S. inaequidens* in Europe (Chichiricco *et al.*, 1979), and Hunziker *et al*. (1989) reported 2n=20 for *S. madagascariensis* in Argentina (see notes on taxonomy and nomenclature). Natural hybrids have not yet been reported though were possible experimentally (Harland, 1954, 1955).

Habitat
S. inaequidens colonizes open and disturbed lands: wastelands, fallows, railway tracks and roadsides, crops (mainly vineyards), burnt land and pastures. It is also found in natural environments such as dunes and cliffs in littoral areas, and temporary ponds in France (Brunel, 2003).

Environmental requirements
S. inaequidens is ubiquist as it is found from plains to mountains (it is observed from coastal areas up to 1900 m altitude). *S. inaequidens* can grow under temperate and Mediterranean climates. It is opportunistic but however has the ability to colonize a wide range of habitats. Reseedings germinate better in compact soils, but the plant can survive under most soil moisture conditions. Mean annual rainfall ranges from 500 to 1000 mm, and the mean annual temperatures from 10 to 20°C. Mean maximum temperatures of the hottest month are 30-35°C, mean minimum temperature of the coldest month -5-0°C. The absolute minimum temperature is -15°C.

Climatic and vegetational categorization
S. inaequidens is associated with areas with a warm to hot, wet summer and a cool winter (dry or wet). It is hardy to zone 7 (-18 to –12°C). It is associated with the following vegetation zones: temperate deciduous forests, temperate steppes and Mediterranean sclerophyllous forests and sclerophyllous shrubs succeeding them.

Geographical distribution
EPPO region: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy (including Sardinia), Netherlands, Norway, Poland, Spain, Sweden, Switzerland, UK (England, Wales, Northern Ireland).
Africa: Botswana, Lesotho, Mozambique, Namibia, South Africa, Swaziland.
North America: USA (Hawaii)
Central America: Mexico.
South America (recorded as *Senecio madascariensis*): Argentina, Brazil, Colombia.
Oceania (recorded as *Senecio madascariensis*): Australia (Queensland, New South Wales, Victoria)

Note: few plants have been discovered in Corsica and have been eradicated by pulling them out manually) (Laetitia Hugot, pers. comm.).

History of introduction and spread
Both diploid and tetraploid forms of *S. inaequidens* are native to the Lesotho region (Port Elisabeth) in South Africa. In European countries, *S. inaequidens* was first found around wool-processing factories in Germany (Hanover in 1889 and Bremen in 1896; Kuhbier, 1977), later in the UK in 1908, Belgium in 1922, France in 1935 and Italy in 1947. All five primaries were sites of introduction associated with the wool trade: Mazamet (Southern France; Senay, 1944; Guillerm *et al*., 1990), Calais (Northern France; Jovet and Bosserdet, 1962; Antoine and Weill, 1966), Verona (Northern Italy; Kiem, 1975), Lüttich (Eastern Belgium; Mosseray, 1936) and Bremen (Northern Germany; Kuhbier, 1977). Additional sites of introduction were also associated with the wool industry, such as Edinburgh in 1928 (Scotland, UK; Lousley, 1961) and Galashiels in 1908 (Scotland; Hayward and Druce, 1919; incorrectly identified as *S. lautus*). Since the 1970s, there has been an increasing number of records across Europe and the species continues to spread. It is most extensively documented in Germany (Werner *et al.,* 1991; Kuhbier, 1996) and in the Netherlands (Ernst, 1998) where the most important sites of initial colonization are roadsides and railways (Griese, 1996; Radkowitsch, 1997; Ernst, 1998; Bornkamm, 2002).

Pathways of movement

Natural dispersal
Huge numbers of seeds are wind-dispersed over large distances. Seeds may accidentally be carried by animals (birds and mammals).

Accidental transport
Conveyances via road and rail vehicles are considered a transport pathway for long distance movement by Ernst (1998). In fact, the plant extends its geographical repartition by first colonizing communication paths, then spreading to other habitats such as pastures. Movement with soil, building materials or machinery is also possible.

Agricultural practices
S. inaequidens is favoured by fires, hence cutting and burning turf is therefore to be avoided. The plant contains toxic alkaloids and is unpalatable to cattle. As a matter of fact, overgrazing favours its installation in pastures.

Movement in trade
Historically, *S. inaequidens* reached Europe as a contaminant of imported wool. Ernst (1998) considers containers and packing as a possible means of transport for this plant. achenes of the plant

could eventually be carried in trade and transport of plants products. But the plant itself is not known to be sold as an ornamental plant.

Impact

S. inaequidens has negative effects on crops, wild plants and biodiversity. It also has negative social impact.

Effects on plants
S. inaequidens is reported as a weed in vineyards (Michez, 1995; Mayor, 1996). It also reduces the value of invaded pastures (Brunel, 2003).

Environmental and social effects
S. inaequidens develops dense populations in ruderal habitats, potentially interfering with their management and improvement. It also invades natural habitats such as dunes and cliffs in littoral areas and temporary ponds in the French Mediterranean area. It is threatening biodiversity with impact on the native *Centaurea corymbosa* (Brunel, 2003).
It may also be considered as a nuisance in the management of railway tracks and motorway verges and is an unsightly colonizer of wasteland.
Like the native *S. jacobaea, S. inaequidens* is toxic to livestock and humans, as they contain pyrrolizidine alkaloids. These alkaloids represent a threat for the production of milk (observations made in Switzerland, Serge Bulhozer, pers. comm.). *S. inaequidens* is a honey plant, but its consequences on honey composition are not well known (Brunel, 2003). The plant is poisonous to horses and may provoke their death (Sarcey *et al*., 1992). Moreover, these plants modify landscapes, as they can flower all year round and cover large surfaces.

Summary of invasiveness

S. inaequidens is a prolific seed producer and has vigorous growth. It adapts to a wide range of environments. It is very actively spreading in Europe at present, following its accidental introduction over the last century in wool exports from South Africa and is likely to continue to spread, particularly along roads and railway tracks. These disturbed areas are sources for further colonization of vineyards, pastures and natural areas. The plant has adverse impact on crops, plants, biodiversity and even has social impact, being toxic to human and cattle. It could become of concern for trade and international relations.
The plant has shown invasive behaviour in other parts of the world and it seems to be the most invasive in Europe. Large areas of Southern and Eastern Europe remain to be invaded. Control of the plant is almost impossible once the plant is established.

Control

Cultural control
Reducing the risk of fires, not overgrazing or sowing with perennial species having a good ground cover such as *Trifolium* spp. are likely to limit the invasion of *S. inaequidens* (Brunel 2003).

Mechanical control
Hand-pulling or mowing before flowering, if repeated for several years, has proven to be effective in some natural areas of the South of France. This method requires constant care. Monitoring and control should be carried out over several years to remove the seed bank and should be undertaken each time new plants are established.

Hand-pulling is the most efficient method when plants are established in a small area. Eradication has been achieved in Corsica in this way. It is essential to collect and destroy the plants which have been pulled out as they can still produce achenes for 2 or 3 days.

Chemical control
In vineyards, treatment with low toxicity phytosanitary products has been experimented in the South of France and proved to be effective. In pastures, several selective phytosanitary products gave good results on mature plants of *S. inaequidens* (Brunel, 2003).

Biological control
The aphid *Aphis jacobaeae*, associated with the European native *S. jacobaea*, has been observed to attack and cause damage to *S. inaequidens* in France and is considered as a potential biocontrol agent (Fort *et al.*, 2003).

Regulatory status
S. inaequidens is not currently regulated by any European country. The plant is listed as a noxious weed in Hawaii. In Australia, it is a declared pest plant in Queensland and New South Wales and is a prohibited species in Western Australia.

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