GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Centaurea solstitialis***

Centaurea solstitialis 简体中文 正體中文 **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Plantae	Magnoliophyta	Magnoliopsida	Asterales	Asteraceae

Common name geeldissel (English), golden star thistle (English), St. Barnaby's thistle (English), yellow centaury (English), yellow cockspur (English), yellow star thistle (English), sonnwend-Flockenblume (German)

Synonym *Leucantha solstitialis* , (L.) A.& D. L�

Similar species *Centaurea melitensis*

Summary Centaurea solstitialis is a winter annual that can form dense impenetrable stands that displace desirable vegetation in natural areas, rangelands, and other places. It is best adapted to open grasslands with deep, well-drained soils and an annual precipitation range of 25 to 150cm per year. It is intolerant of shade. Although populations can occur at elevations as high as 2,400 m, most large infestations are found below 1,500 m. Human activities are the primary mechanisms for the long distance movement of *C. solstitialis* seed. The short, stiff, pappus bristles are covered with barbs that readily adhere to clothing, hair, and fur. The movement of contaminated hay and uncertified seed are also important long distance transportation mechanisms. Wind disperses seeds over short distances.

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Species Description
DiTomaso (2001) reports that *Centaurea solstitialis* is an erect winter annual (sometimes biennial), which grows mostly to 1m tall (occasionally to 2m tall) with spiny yellow-flowered heads. The first few leaves are typically oblanceolate (shaped like a lance-point reversed, with the tapering point attached to the leafstalk). Subsequent rosette leaves are oblanceolate or entire to pinnate-lobed. Later rosette leaves are 15cm long, typically deeply lobed to midrib. Lobes are mostly acute, with toothed to wavy margins. Stems are stiff, openly branched from near or above the base or sometimes not branched in very small plants. Leaf bases extend down the stems (decurrent) and give stems a winged appearance. Largest stem wings are typically 3mm wide. Foliage is grayish to bluish green, densely covered with fine, white, cottony hairs that hide thick, stiff hairs and glands. Taproots grow vigorously early in the season to soil depths of 1m or more, giving plants access to deep soil moisture during the dry summer and early fall months.
Flowerheads are ovoid, spiny, solitary on stem tips, and consist of numerous, yellow disk flowers. Vigorous individuals of *C. Solstitialis* may develop flower heads in branch axils. The involucre (phyllaries as a unit) is approximately 12-18mm long. Phyllaries are palmately spined, with one, long central spine and 2 or more pairs of short lateral spines. Phyllaries are more or less densely to sparsely covered with cottony hairs or with patches at the spine bases. The central spines of the main phyllaries are 10-25mm long, stout, and yellowish to straw-coloured throughout. Lateral spines occur typically in 2-3 pairs at the base of the central spine. The corollas are yellow, and mostly 13-20mm long. Flowerheads produce two types of achenes (seeds), both glabrous, approximately 2-3mm long, and with broad bases. Achenes are barrel-shaped, compressed, and laterally notched at the base. Flowers at the periphery of the flowerheads produce dull, dark brown (often speckled with tan) achenes that are darker and have no pappus (the bristly, feathery, or fluffy perianth whorl crowning the ovary). This seed type represents between 10 and 25% of the total seed and often remains in the seedheads until late fall or winter. The central flowers produce glossy, gray, or tan to mottled cream-coloured and tan seeds with a short, stiff, unequal, white pappus (2-5mm long). This represents the majority of seed produced (75-90%).

Lifecycle Stages
Over 90% of *Centaurea solstitialis* seeds are germinable one week after seed dispersal (Benefield *et al*. 2001, Joley *et al.* 1997, Roché et al. 1997, Sheley et al. 1983, 1993, in DiTomaso, 2001). Maximum germination of seeds (nearly 100%) occurs when seeds are exposed to moisture, light and temperatures of 10, 15, or 20 Celsius (Joley et al. 1997, Roché et al. 1997, in DiTomaso, 2001). At temperatures above 30 Celsius, germination is dramatically reduced (Joley et al. 1997, Roché et al. 1997, in DiTomaso, 2001). When exposed to light and moisture, germination occurs rapidly (typically by 24 hours) with nearly all seed germinating within 96 hours (Sheley et al. 1983, 1993, in DiTomaso, 2001). DiTomaso (2001) reports that seeds may be relatively short-lived under normal field conditions where seeds are predominantly dispersed on the soil surface. Furthermore, microbial degradation and invertebrate predation of *C. solstitialis* seeds contribute significantly to the rapid depletion of the soil seedbank.

Uses
Zouhar (2002) reports that *Centaurea solstitialis* is regarded as an important honey source plant in California and other western states. It is used in Turkish folk medicine for the treatment of ulcers. In a laboratory study, aqueous extracts of fresh or dried flowers of *C. solstitialis* given orally showed significant ($p<0.01$) antiulcerogenic activity in rats.

Habitat Description
DiTomaso (2001) states that *Centaurea solstitialis* is best adapted to open grasslands with an annual precipitation range of 25 to 150cm per year. It is generally associated with deep, well-drained soils and infestations thrive in disturbed areas with high sunlight exposure. Although populations can occur at elevations at high as 2,400 m, most large infestations are found below 1,500 m. Zouhar (2002) reports that it is uncommon in deserts and moist coastal sites. It invades and dominates annual grasslands by using the deep soil moisture that remains after shallow-rooted annual grasses die in early summer. Seedlings are more likely to establish in soils with deep silt loam and loam with few coarse fragments (Larson and Sheley 1994, in DiTomaso, 2001).

Reproduction
Zouhar (2002) states that the plant is monoecious (male and female flowers on the same plant), pollinator-dependent, and facultatively xenogamous (can cross fertilise with other plants). Most of the plants are self-incompatible. Honeybees play an important role in the pollination of *C. solstitialis* and can account for 50% of seed set (Barthell *et al*. 2001, Maddox et al. 1996, in DiTomaso, 2001). Bumblebees are the second most important floral visitor to flowers, but several other insects also contribute to fertilisation of the ovules (Barthell et al. 2001, Harrod and Taylor 1995, in DiTomaso, 2001). Seed production per seedhead ranges from about 35 to over 80 seeds (Benefield et al. 2001, Maddox 1981, in DiTomaso, 2001), depending upon the site. DiTomaso (2001) states that large plants can produce over 100,000 seeds. *C. solstitialis* infestations can produce 50-100 million seeds per acre (DiTomaso et al. 1999a, Maddox 1981, in DiTomaso, 2001).

Nutrition
The nutritional component of yellow starthistle leaves is high during the growing season (Callihan *et al*. 1995), However, its nutrient value declines as the plants mature. Yellow starthistle in the pre-spiny stage contains between 8 to 14% protein (Thomsen et al. 1990). However, an analysis of the nutritional status of cattle manure in the fall indicated that yellow starthistle-infested pastures contain considerably less crude protein and total digestible nutrients compared to uninfested pastures (Barry 1995).

General Impacts
DiTomaso (2001) states that due to the spiny nature of the plant, livestock and wildlife avoid grazing in heavily infested areas. Thus, infestations can greatly increase the cost of managing livestock. In addition to rangeland, pastures and grasslands, *C. solstitialis* is also an important weed problem along roadsides and an occasional problem in dryland cereals, orchards, vineyards, cultivated crops, and wastelands (Maddox *et al*. 1985, in DiTomaso, 2001). It can also reduce land value and reduce access to recreational areas (DiTomaso et al. 1998, Roché and Roché 1988, in DiTomaso, 2001). In addition, *C. solstitialis* infestations can reduce wildlife habitat, displace native plants, and decrease native plant and animal diversity (Sheley and Larson 1994, in DiTomaso, 2001). Because of its high water usage, *C. solstitialis* threatens both human economic interests as well as native plant ecosystems (Dudley 2000, in DiTomaso, 2001). Although no economic assessments have been conducted for *C. solstitialis*, millions of dollars in losses probably occur from interference with livestock grazing and forage harvesting procedures, producing lower yield and forage quality of rangelands (Callihan et al. 1982, Roché and Roché 1988, in DiTomaso, 2001). DiTomaso (2001) states that when ingested by horses, it causes a neurological disorder of the brain called nigropallidal encephalomalacia or \"chewing disease.\" Continued feeding results in brain lesions and ulcers in the mouth (Kingsbury 1964, in DiTomaso, 2001). In most cases, poisoning destroys the animal’s ability to chew and swallow and death occurs through starvation or dehydration (Panter 1991, in DiTomaso, 2001). DiTomaso (2001) states that only horses are affected by ingesting *C. solstitialis*. Other animals, including mules and burros, are not susceptible to the toxic effect of the weed.

Management Info
DiTomaso (2001) states that mechanical, cultural, biological, and chemical control options are available for management of *C. solstitialis*. Most often a single method is not effective in the sustainable control of *C. solstitialis* and other range weeds. A successful long-term management program should be designed to include combinations of mechanical, cultural, biological, and chemical control techniques.
\r\nPhysical: Mowing can be used as a mechanical option for control provided it is well timed and used on plants with a high branching pattern. Cultural control options include grazing, prescribed burning, and re-vegetation with competitive species. Burning should be timed to coincide with the very early *C. solstitialis* flowering stage; at this time, it has yet to produce viable seed, whereas seeds of most desirable species have dispersed and grasses have dried to provide adequate fuel. Fire has little, if any, impact on seeds in the soil. In addition to controlling *C. solstitialis*, burning will reduce the thatch layer, expose the soil, and recycle nutrients held in the dried vegetation. Re-vegetation programs using perennial grasses or legumes can be effective for management of *C. solstitialis*, but establishment may be difficult in areas without summer rainfall.
\r\nChemical: Clopyralid and picloram (not registered in California) are the most effective herbicides for full season control of the weed. Unlike most post-emergence herbicides, they provide both foliar and soil activity. The best timing for application is when *C. solstitialis* is in the early rosette stage. Clopyralid gives one season of control and is generally used at 110gm a.e./ha; 290gm product/ha. Picloram has longer soil residual activity than clopyralid (two to three years) and is applied at 0.28kg and 0.42kg a.e./ha. Glyphosate is a non-selective herbicide that is also effective on *C. solstitialis*. It will control bolted plants at 1.1kg a.e./ha; 9.4 liters product/ha or 1% solution and can be used as a late season spot treatment to small infestations or escaped plants.
\r\nBiological: Sheep, goats, or cattle are effective in reducing *C. solstitialis* seed production when grazed after plants have bolted but before spines form on the plant. Goats will eat the plant even in the spiny stage. Six biological control agents of *C. solstitialis* have been imported from Europe and are well established in the western United States. Of these, most effective are the hairy weevil (*Eustenopus villosus*) and the false peacock fly (*Chaetorellia succinea*). These insects attack the flower/seed head, and directly or indirectly reduce seed production by 43 to 76%. They do not, by themselves, provide sustainable management of *C. solstitialis* but can be an important component of an integrated approach. The most widely studied pathogen for *C. solstitialis* control is the Mediterranean rust fungus, *Puccinia jaceae*. It can attack the leaves and stem of *C. solstitialis*, causing enough stress to reduce flowerhead and seed production. The organism is currently under investigation and has not been released for use.

Pathway
Its introduction in North America probably occurred sometime after 1849 as a seed contaminant in Chilean-grown alfalfa seed (DiTomaso, 2001).The movement of contaminated hay and uncertified seed are also important long distance transportation mechanisms (DiTomaso, 2001).Seed is transported in large amounts on the undercarriage of vehicles (DiTomaso, 2001).

Principal source: Element Stewardship Abstract for *Centaurea solstitialis* L. (DiTomaso, 2001) SPECIES: *Centaurea solstitialis* (Zouhar, 2002)

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

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ALIEN RANGE

[5] CANADA
[43] UNITED STATES

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7 references found for **Centaurea solstitialis**

Managment information

DiTomaso J. (2001) *Element Stewardship Abstract for Centaurea solstitialis L.*. The Nature Conservancy.

Summary: An Element Stewardship Abstract containing detail report on description, distribution, dispersal methods, impacts, habitats and control.

DiTomaso J. (Undated) *Yellow Starthistle Information*. Weed Research and Information Center, The University of California.

Summary: Detailed report containing information on description, distribution, dispersal methods, impacts, habitats and control.

European and Mediterranean Plant Protection Organization (EPPO), 2006. Guidelines for the management of invasive alien plants or potentially invasive alien plants which are intended for import or have been intentionally imported. EPPO Bulletin 36 (3), 417-418.

Hierro, Jose´ L., Ozkan Eren, Liana Khetsuriani, Alecu Diaconu, Katalin Torok, Daniel Montesinos, Krikor Andonian, David Kikodze, Levan Janoian, Diego Villarreal, Maria E. Estanga-Mollica and Ragan M. Callaway., 2009. Germination responses of an invasive species in native and non-native ranges. Oikos 118: 529538, 2009 doi: 10.1111/j.1600-0706.2009.17283.x,

Summary: Abstract: Studying germination in the native and non-native range of a species can provide unique insights into processes of range expansion and adaptation; however, traits related to germination have rarely been compared between native and nonnative populations. In a series of common garden experiments, we explored whether differences in the seasonality of precipitation, specifically, summer drought vs summer rain, and the amount and variation of annual and seasonal precipitation affect the germination responses of populations of an annual ruderal plant, *Centaurea solstitialis*, from its native range and from two non-native regions with different climates. We found that seeds from all native populations, irrespective of the precipitation seasonality of the region in which they occurred, and non-native populations from regions with dry summers displayed similarly high germination proportions and rates. In contrast, genotypes from the non-native region with predominantly summer rain exhibited much lower germination fractions and rates. Also, percent germination was strongly correlated with variation in precipitation in winter, the season that follows germination for *C. solstitialis*. Specifically, germination was lower for native and non-native populations experiencing greater variation in winter precipitation. This correlation, however, was greatly influenced by the non-native region with summer rain, which also exhibited the greatest variation in winter precipitation among studied regions. These results suggest that rather than general climatic patterns, the degree of risk experienced at early developmental stages could exert an important control over the germination strategy of *C. solstitialis* populations in both native and non-native ranges. Also, these findings reveal a largely unique germination response in *C. solstitialis* genotypes.

Mack, R. N and W. M. Lonsdale., 2002. Eradicating invasive plants: Hard-won lessons for islands. In *Turning the tide: the eradication of invasive species*: 311-318. Veitch, C.R. and Clout, M.N.(eds). IUCN SSC Invasive Species Specialist Group. IUCN. Gland. Switzerland and Cambridge. UK.

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

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

General information

CONABIO. 2008. Sistema de informaci�n sobre especies invasoras en M�xico. Especies invasoras - Plantas. Comisi�n Nacional para el Conocimiento y Uso de la Biodiversidad. Fecha de acceso.

Summary: English:

The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (http://www.conabio.gob.mx/invasoras/index.php/Portada), under the section Novedades for information on updates.

Invasive species - Plants is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Plantas [Accessed 30 July 2008]

Spanish:

La lista de especies del Sistema de informaci�n sobre especies invasoras de m�xico cuenta actualmente con informaci�n aceca de nombre cient�fico, familia, grupo y nombre com�n, as� como h�bitat, estado de la invasi�n en M�xico, rutas de introducci�n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p�gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci�n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci�n novedades, para conocer los cambios.

Especies invasoras - Plantas is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Plantas [Accessed 30 July 2008]

ITIS (Integrated Taxonomic Information System), 2004. Online Database *Centaurea solstitialis*

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.

Available from: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=36972 [Accessed December 31 2004]