GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Linaria vulgaris***

Linaria vulgaris 简体中文 正體中文

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Plantae	Magnoliophyta	Magnoliopsida	Scrophulariales	Scrophulariaceae

Common name gulsporre (Swedish, Sweden), linajola (Italian, Italy), butter-and-eggs (English, USA, UK), kannusruoho (Finnish, Finland), keltakannusruoho (Finnish, Finland), Gemeines Leinkraut (German, Germany), yellow toadflax (English, USA, UK), flaxweed (English, USA, UK), greater butter-and-eggs (English, USA, UK), wild snapdragon (English, USA, UK), Jacob's ladder (English, USA, UK), ramsted (English, USA, UK), Flachskraut (German, Germany), Löwenmaul (German, Germany), Leinkraut (German, Germany), torskemund (Danish, Denmark), linnete (English), hosoba-unran (English), nevruzotu (English), linaire vulgaire (French, France), flugblomster (Swedish, Sweden), sporrebloma (Swedish, Sweden), vlasbekje (Dutch, Netherlands), linaire commune (French, France), lnica pospolita (Polish, Poland), inice obecná (Czech, Czech Republic), pyštek obycajný (Slovak, Slovakia), közönséges gyújtóványfu (Hungarian, Hungary), Gewöhnliches Leinkraut (German, Germany)

Synonym *Linaria linaria* , (L.) Karst.

Similar species *Linaria genistifolia, Linaria purpurea, Linaria bipartita, Linaria pinifolia, Linaria canadensis*

Summary Linaria vulgaris (commonly known as yellow toadflax) is a creeping perennial forb, with bright yellow and orange snap-dragon-like flowers. It is widespread in North America, establishing in rangelands and disturbed areas in western states and provinces. Linaria vulgaris can form dense populations, mainly through vegetative reproduction from root buds along underground rhizomes.

view this species on IUCN Red List

Species Description

Linaria vulgaris is an herbaceous perennial that can reach a height of about one metre. The stem is glabrous to glandular hairy near the top portion of the stem (CDFA, undated) and develops woody tissue near the base of the stem (Ogden & Renz, 2005). The leaves are 2-5cm long, alternate, sessile not clasping (Ogden & Renz, 2005), linear to narrow, and pale green, soft, often drooping with small hairs (CDFA, undated). The flowers are zygomorphic, resembling snapdragon flowers, forming in racemes of 15-20 flowers(Arnold, 1982) in the axils of the upper portion of the stem and are about 2cm long (Ogden & Renz, 2005). The flower corolla is yellow to pale yellow (CDFA, undated) with an orange bearded throat and yellow spur (Ogden & Renz, 2005) that is about 1-2cm long in which nectar collects (Arnold, 1982). The fruit of the plant is about 1cm long, ovate (ANHP, 2006), two celled capsule that is brown (Ogden & Renz, 2005). The seeds are small, flat, dark brown in colour, with a circular papery wing (CFDA, undated).

Lifecycle Stages
Linaria vulgaris sets flower in mid-May to September depending on the location and elevation of the plant (Kadrmas & Johnson, undated). Seed production occurs in the late summer and seed dispersal can continue through the winter (Ogden & Renz, 2005). Seeds germinate best under stratification, cool to cold moist conditions, of 2-8 weeks (CDFA, undated). Seeds can remain viable in soils for up to 8-10 years (ANHP, 2006). Seed germination typically occurs in April or May, but it can be even earlier in warmer regions (Kadrmas & Johnson, undated). The majority of the seed, between 80-90%, falls within a half a metre from the parent plant (Ogden & Renz, 2005). Other seed dispersal mechanisms vary and no clear mechanism is outlined in the literature (Markin, undated); however potential dispersal mechanisms reviewed are wind, water, clinging to the surfaces of animals, vehicles, people, movement of substrates, sold as a contaminant in seed mixes or as an ornamental plant in nurseries (Ogden & Renz, 2005; CDFA, undated; ANHP, 2006).

Uses
Linaria vulgaris was used primarily as an ornamental due to its beautiful yellow and orange snapdragon-like flowers. It has also been used for medicinal purposes and as a dye (CDFA, undated).

Habitat Description
Linaria vulgaris is found in farmlands, pastures, rangelands, riparian corridors, along roadsides, railways, clearcuts, and old fields (Holdorf, undated). It can tolerate a wide range of conditions, prefering dry, open habitats (Holdorf, undated) but performing well in dark, wet, and high fertility sites (ANHP, 2006). It is common on chalky soils (USGS, 2006), as well as sandy, gravely soil (ANHP, 2006) and disturbances greatly increase establishment rate although plants can spread from established areas into undisturbed locations (Markin, undated). Yellow toadflax can be found at altitudes of up to 3000 metres in the Rockies (Beck, 2006) and can tolerate sub-artic conditions (CDFA, undated). Its vegetative patterns are typically small open patches or isolated plants widely scattered over large areas (Markin, undated), but large colonies can establish in areas (CDFA, undated). Vegetative reproduction is responsible for the colony forming habit of the plant (USGS, 2006).

Reproduction
Linaria vulgaris has a hemaphroditic (Peat & Fitter, undated), self-incompatible flower that requires cross-pollination in order for viable seed production. The mechanism is through insect pollination (Arnold, 1982). Seed production for an average individual plant is 30,000 seeds (Ogden & Renz, 2005). *L. vulgaris* has a low viability in seed production with only about a 10% germination rate under field conditions (Ogden & Renz, 2005). The plant can also reproduce vegetatively through the formation of suckers orginating from undergound root buds and buds located on the rhizome. Root fragments as small as 1cm can establish and initiate shoot growth (ANHP, 2006).

General Impacts
Linaria vulgaris can suppress native grasses and compete for soil water resources reducing biodiversity (ANHP, 2006). It also replaces valuable forbs in range and pasture land reducing the efficiency of livestock grazing; livestock do not prefer the taste of yellow toadflax and it is moderately toxic (ANHP, 2006). Yellow toadflax can also be an alternate host for several plant diseases, namely cucumber mosaic virus and broad bean wilt virus (CDFA, undated).

Management Info
Preventitive measures: Prevention may be the easiest, cheapest, and most effective means of control. Stricter regulation of what agents, materials, or development can be brought or done into wilderness areas and public lands needs consideration (ANHP, 2006). An example is the restriction of livestock in nature reserves should be considered (Tyser & Worley, 1992). Monitoring is critical in knowing where invading populations occur and how abundant. It is easier to control small infestations before a population build-up (Curran & Lingenfelter, 2001). Education, awareness programs, advertising and community outreach are all excellent ways to stay informed at a local or regional level and allows earlier detection (Mullin,*et al*, 2000). Research is neccessary in order to develop new methods and techniques of control and better understand the biology of the species (Mullin,*et al*, 2000).
Physical: Most physical methods of control for *Linaria vulgaris* alone are not satisfactory, and not recommended for medium to large stands (Kadrmas & Johnson, undated). Mowing can prevent the plant from going to seed, but mowing also stimulates vegetative reproduction from the lateral roots and rhizomes which can exasberate the problem further (Kadrmas & Johnson, undated). Fire is also not effective because the underground rhizome system is not damaged and will just resprout shoots(Kadrmas & Johnson, undated). Tilling on arable lands can be effective in eradicating *L. vulgaris*, but tilling needs to be done every 7-10 days over the course of the season and repeated yearly for several years in order to eradicate resprouting root fragments (Ogden & Renz, 2005). Grazing by livestock is also not recommended as it stimulates vegetative growth with viable seeds passing through the digestive tract (Ogden & Renz, 2005). Overgrazing can reduce competition and increase the disturbance to the site creating an ideal environment for toadflax establishment (Kadrmas & Johnson, undated). The plant is not preferred by grazing livestock and contains poisonous glucosides that are moderately toxic to livestock (ANHP, 2006).
Cultural: Some cultural options for control of *L. vulgaris* is proper timing of seeding agricultural crops, overseeding, fertilizing, using high quality seed, planting at high densities, and using species that are adapted to your region (Curran & Lingenfelter, 2001). Revegetating with native species in particular perennial grasses which are more competitive to perennial forbs is another option (Curran & Lingenfelter, 2001).
Chemical: Chemicals that have shown to be effective in controlling *L. vulgaris* are glyphosates, a nonselective herbicide, and Telar and Tordon, two selective herbicides, among many others. Repeated applications may be required periodically every few years for up to twelve years. Applications should be timed around flowering when the plants are most vulnerable or after a hard frost (Ogden & Renz, 2005). Integrated management by seeding competitive species shortly after a chemical application has shown to be effective in preventing reemergence (Beck, 2006). Always follow labled instructions for any chemical and make sure that any chemical being applied is not going to kill or reduce the competitive ability of any native species(Kadrmas & Johnson, undated).

Pathway
Linaria vulgaris was introduced into North America in the mid-1600s as a perennial ornamental (Holdorf, undated).*L. vulgaris* was introduced for use as a folklore remedy (Holdorf, undated).

Principal source: Ogden, J.A.O. & Renz, M.J., Nov. 6, 2005, Yellow toadflax (*Linaria vulgaris*), Weed Fact Sheet, New Mexico State University;
Alaska Natural Heritage Program, 2006, Yellow toadflax, *Linaria vulgaris* P. Miller, Environment and Natural Resources Institute, University of Alaska Anchorage;
Holdorf, R.H., undated, Biological Control of Yellow toadflax (*Linaria vulgaris*) (L.) (Scrophuliaraceae): Oppurtunities and Constraints Affecting the Reclamation of Rangelands in the Western United States, *Restoration and Reclamation Review*, University of Minnesota, St. Paul, MN, (USA).

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

Review:

Pubblication date: 2007-08-03

ALIEN RANGE

[1] AUSTRALIA
[1] CHILE
[1] GUATEMALA
[1] SOUTH AFRICA
[1] CANADA
[1] GREATER ANTILLES
[1] NEW ZEALAND
[1] UNITED STATES

BIBLIOGRAPHY

22 references found for **Linaria vulgaris**

Managment information

Alaska Natural Heritage Program, 2006, Yellow Toadflax, *Linaria vulgaris* P. Miller, Environment and Natural Resources Institute, University of Alaska Anchorage.
Summary: A general fact sheet on biology, reproduction, habitat, dispersal and management strategies.
Available from: http://akweeds.uaa.alaska.edu/pdfs/species_bios_pdfs/Species_bios_LIVU_ed.pdf [Acessed on 2 March 2007].

Beck, K.G., June 9, 2006, Biology and Management of the Toadflaxes, no. 3.114, Colorado State University Cooperative Extension.
Summary: A cooperative extension factsheet for the state of Colorado with general information on biology and management. Information on management more detailed than on biology.
Available from: http://www.ext.colostate.edu/pubs/natres/03114.html [Accessed on 2 March, 2007].

California Department of Food and Agriculture, undated, Noxious Weed Index, *Linaria vulgaris*, [online database], 1220 N Street Sacramento, CA, 95814.
Summary: Very detailed article on the CDFA database describing biology, habitat, cycles, and similar species.
Available from: http://www.cdfa.ca.gov/phpps/ipc/weedinfo/linaria.htm [Accessed on 2 March, 2007].

Curran, W.S., & Lingenfelter, D.D., 2001, Weed Management in Pasture Systems, Agronomy Facts 62, College of Agricultural Sciences, Agricultural Research and Cooperative Extension, Univeristy of Pennsylvannia.
Summary: A fact sheet underlying general principles of management of pasture systems and techniques for control in those systems. Not much specific biology information on *L. vulgaris*, but comprehensive on principles of management for weed species in general based on habit and growth characteristics.

Holdorf, R.H., undated, Biological Control of Yellow toadflax (*Linaria vulgaris* (L.) (Scrophuliaraceae)): Oppurtunities and Constraints Affecting the Reclamation of Rangelands in the Western United States, *Restoration and Reclamation Review*, University of Minnesota, St. Paul, MN, (USA).
Summary: An excellent article on potential biological control options for *L. vulgaris* as well as some general biology, introduction, distribution, and habitat. It refutes the effectiveness of other management options like grazing, fire, and herbicide.

Kadrmas, T. & Johnson, W.S., undated, Managing Yellow and Dalmation Toadflax, Fact sheet FS-02-96, University of Nevada Cooperative Extension, Reno, Nevada.
Summary: General extension factsheet giving basic plant biology information and management strategies. An excellent source of information on a variety of management approaches for the contol of toadflax.
Available from: http://www.unce.unr.edu/publications/FS02/FS0296.pdf [Accessed on 2 March, 2007].

Markin, G.P., undated, Weeds of National Forest Lands of the Northern Rockies, USDA Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, MSU, Bozeman, Montana, 59717
Summary: A survey article detailing the abundance of noxious weeds in the Northern Rockies. A brief description on the status of common toadflax along with a detailed map showing its distribution and abundance in the region. A few generalized weed management strategies and troubleshooting are discussed near the end of the article.

Mullin, B.H., Anderson, L.W.J, DiTomaso, J.M., Eplee, R.E., & Getsinger, K.D., Feb. 2000, Invasive Plant Species, Council for Agricultural Sciences and Technology, Issue Paper no. 13, pp. 1-18.
Summary: This paper was used for general management strategies against invasive weed species. There was no focus on *Linaria vulgaris* for management options, but the paper addressed preventive, regulatory, legislative, and educational approaches to weed management.

Ogden, J.A.O. & Renz, M.J., Nov. 6, 2005, Yellow toadflax (*Linaria vulgaris*), Weed Fact Sheet, New Mexico State University.
Summary: A fact sheet from New Mexico State University giving basic identification, reproduction and spread of yellow toadflax. Management options are discussed with emphasis on physical and chemical controls of the plant.
Available from: http://weeds.nmsu.edu/downloads/yellow_toadflax_factsheet_11-06-05.pdf [Accessed on 2 March, 2007].

Tyser, R.W., & Worley, C.A., Jun. 1992, Alien Flora in Grasslands Adjacent to Road and Trail Corridors in Glacier National Park, Montana (U.S.A.), *Conservation Biology*, Vol. 6, no. 2, pp.253-262.
Summary: This journal article described various means of introduction of a variety of weed species in Glacier National Park. It also investigated how these weed species were being further propagated and dispersed into the park through traveled corridors and construction. Interesting management suggestions more in the form of prevention of further introductions and spread.

General information

Arnold, R.M., 1982, Pollination, Predation and Seed Set in *Linaria vulgaris* (Scrophulariaceae), *American Midland Naturalist* Vol. 107, no. 2, pp. 360-369.
Summary: Ajournal article describing the reproductive abiliites of *L. vulgaris* and how insect pollination and predation effect seed viability and set. The article goes into more detail about possible reasons why the plant has low seed viability. Brief reproductive references were made concerning this article.

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]
Global Biodiversity Information Facility (GBIF), 2007. Species:*Linaria vulgaris*
Summary: Available from: http://www.gbif.net/species/13749594/ [Accessed 15 June 2010]
ITIS (Integrated Taxonomic Information System), 2007. Online Database *Linaria vulgaris*.
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=33216 [Accessed on 2 March, 2007].
Kress, H., 2007, Henriette s Herbal Homepage, *Linaria vulgaris*, [online photo database].
Summary: This website was used for the various common names associated with this plant. This site offers names in German, Fench, Swedish, Dutch, and Finnish.
Available from: http://www.henriettesherbal.com/pictures/p08/pages/linaria-vulgaris.htm [Accessed on 2 March, 2007].
Peat, H. & Fitter, A., undated, Ecological Database of the British Isles, *Linaria vulgaris*, [online database].
Summary: This site gives the European distribution of *Linaria vulgaris* as well as detailed plant characteristics.
Available from: http://www.ecoflora.co.uk/search_species2.php?plant_no=1540140340 [Accessed on 2 March 2007].
Plants For A Future, 2000, Species Database, *Linaria vulgaris*, Blagdon Cross, UK.
Summary: This website was referenced for common names used for yellow toadflax in other countries.
Available from: http://www.ibiblio.org/pfaf/cgi-bin/arr_html?Linaria+vulgaris [Accessed on 2 March, 2007].
Soural, P., undated, *Linaria vulgaris*, Naturephoto-cz.eu, [online photo database].
Summary: This site was only used for the additional common names associated with *Linaria vulgaris*.
Available from: http://www.naturephoto-cz.eu/linaria-vulgaris-picture-612.html [Accessed on 2 March, 2007].
UNEP-WCMC (United Nations Environment Programme-World Conservation Monitoring Centre), 2007. *Linaria vulgaris*, [online database].
Summary: This site was used to reference several subspecies and variations of *Linaria vulgaris*.
Available from:
http://sea.unep-wcmc.org/isdb/Taxonomy/tax-species-result.cfm?displaylanguage=eng&source=plants&Genus=Linaria&Species=vulgaris&Country=&tabname=names [Accessed on 2 March, 2007].
United States Department of Agriculture, ARS, National Genetic Resources Program, 2007, *Germplasm Resources Information Network*, [online database], National Germplasm Resources Laboratory, Beltsville, MD.
Summary: This database gave detailed information on the native distribution of yellow toadflax, along with economic importance and other common names.
Available from: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?102290 [Accessed on 26 February, 2007].
U.S. Geological Survey, 2006, An Assessment of Exotic Plant Species of Rocky Mountain National Park *Linaria vulgaris* P. Miller, Northern Prairie Wildlife Research Center, U.S. Department of the Interior.
Summary: A brief factsheet giving basic information on distribution, competition, biology, dispersal and a few management options.
Available from: http://www.npwrc.usgs.gov/resource/plants/explant/linavulg.htm [Accessed on 2 March, 2007].
Veblen, T.T., Mar., 1975, Alien Weeds in the Tropical Highlands of Western Guatemala, *Journal of Biogeography*, Vol. 2, no. 1, pp.19-25.
Summary: An article comparing the invasiveness of several different genera of weed species in California and the highlands of Guatemala. The article contained a lot of information on the disparities between the two locations and what possible factors could account for it. A few references were made to this article for distribution and general species introduction.