Holcus lanatus L.

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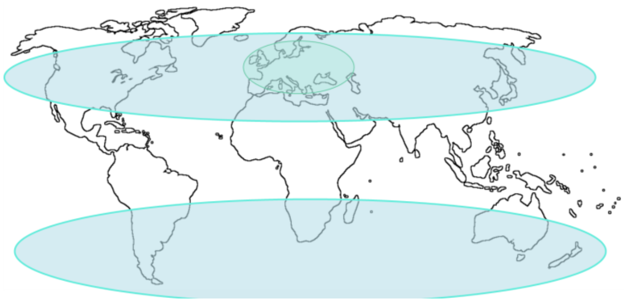
Origin and diffusion

Origin: Europe, western Asia, northwestern Africa, and the Canary Islands
Distribution: temperate zones worldwide
Invasive potential: high



Introduction

Holcus lanatus is a tufted long-lived grass growing up to 1 m tall. It can be found in in humid, often waterlogged soils in temperate zones around the world. This grass became invasive in some region, due to its rapid grow and propagation that make it highly competitive among crop and weed species. The plant is easily recognisable by the velvety textured leaves.

Common names: Yorkshire Fog (UK name), common velvetgrass (US name), Bambagione pubescente (Italian name)

Description

Life-form and periodicity: perennial grass

Height: 40 to 90 cm

Roots habit: The root system is fibrous and concentrated at shallow depths. Its roots may reach 90 cm deep. Site conditions may affect root development. When widely spaced, it may produce a dense network of fine, whitish, surface roots on the ground beneath the shading of its own canopy. When water tables are high, root penetration is limited.

Culm/Stem/Trunk: The stems are round, erect, glabrous, hollow and often hairy at the nodes. The bases of the stems are white with pink stripes or veins.

Fam. *Poaceae*

Description

Leaf: The leaves are pubescent and flat, with blade 8-13 mm wide and 5-20 cm long.

Rate of transpiration: No entries found

Reproductive structure: Inflorescences are highly variable in appearance, depending on their state of maturity. Initially they are spike-like, with the branches folded flat against the main stem, and purple in colour. During flowering the branches spread, making the whole head quite open in structure. Spikelets have generally 2 flowers, a hermaphrodite flower bottom and a male flower upper.

Propagative structure: the fruit is a caryopsis; as seeds mature the purple turns to straw colour, and eventually the branches contract against the main stem again.

Development

Sexual propagation: It is wind pollinated and predominantly an outcrossing species. The seed is spread in mud on machinery and vehicles, and can adhere to animals and clothing. Viable seed can be spread in animal manure; the plants require vernalization to flower.

Asexual propagation: H. lanatus is not usually considered a stoloniferous species, but regeneration can occur by the formation of decumbent tillers that subsequently produce roots and shoots at the nodes.

Growth rate: rapid

Habitat characteristics

Light and water requirement: velvetgrass grows best in moist and sunny areas

Soil requirements: It adapted to coarse and medium soil textures.

Tolerance/sensitivity: Velvetgrass tolerates a wide range of moisture conditions within temperate climate regimes. It can survive moderate periods of drought. It can grow well in potassium- and/or nitrogen-poor soils.

Phytotechnologies applications

H. lanatus has been extensively investigated for his tolerance to **Arsenicum**. Macnair & Cumbes (1987) found that among this species there are arsenate-tolerant and non-tolerant genotypes. Because of the chemical similarity of arsenate ion to phosphate, it would seem to compete with phosphate for the phosphate uptake system and is taken up actively; treatment with phosphate has been shown to alleviate the toxic effects of arsenate in non-tolerant clones (Andrew et al., 1990).

Also **lead, zinc** and **cadmium** tolerance was found to be genotype-dependent in *H. lanatus* species, as a result of the evolutionary adaptation of this plants to toxic metalliferous soils (Coughtley and Martin, 1978; Baker *et al.,* 1986; Rengel, 2000).

Studies shown that the heavy metals uptake in non-tolerant genotype of *H. lanatus*, was much greater than in tolerant genotype, yet the tolerant plants are capable of accumulating heavy metals to high concentration over longer time periods (Meharg & Macnair, 1990; Rengel, 2000).

Experimental studies

-Experiment 1-

Reference	Z. Rengel, 2000. Ecotypes of Holcus lanatus Tolerant to Zinc Toxicity also Tolerate Zinc Deficiency. Annals of Botany 86: 1119-1126.
Contaminants of concern	Zn
Mechanism involved in phytoremediation: Phytostabilisation/rhizodegradation/phytoaccumulation/phytodegradation/phytovolatilization/ hydraulic control/ tolerant	Tolerance, phytoaccumulation
Types of microorganisms associated with the plant	Not reported in the publication
Requirements for phytoremediation (specific nutrients, addition of oxygen)	Nutrients were applied in solution
Substrate characteristics	Zinc-deficient siliceous sandy soil, collected in South Australia
Laboratory/field experiment	Laboratory experiment (greenhouse)
Age of plant at 1st exposure (seed, post-germination, mature)	Seed
Length of experiment	Plants were harvested 28 and 38 d after sowing

Phytotechnologies applications

Initial contaminant concentration of the substrate	Plants were grown in Zn-deficient soil which was amended with Zn to create a range of conditions from Zn deficiency to Zn toxicity. Zn addition (mg/Kg soil): 0 - 0.05 - 0.5 – 5 - 50
Post-experiment plant condition	Except for one of Zn-tolerant ecotypes, the highest level of soil Zn addition (50 mg/kg) was detrimental to root and shoot growth of all ecotypes.
Contaminant storage sites in the plant and contaminant concentrations in tissues (root, shoot, leaves, no storage)	All ecotypes accumulated more Zn in roots than in shoots, with root concentrations exceeding 8 g Zn/Kg dry weight in extreme cases. Zn-tolerant ecotypes do not have high capacity to accumulate Zn in shoots under conditions of Zn toxicity, but they take up more Zn and grow better under conditions of Zn deficiency in comparison with the Zn-sensitive ecotypes.

-Experiment 2-

Reference	Meharg, A. A., & Macnair, M. R. (1991). Uptake, accumulation and translocation of arsenate in arsenate-tolerant and non-tolerant Holcus lanatus L. New Phytologist, 117(2), 225-231.
Contaminants of concern	Arsenate
Mechanism involved in phytoremediation: Phytostabilisation/rhizodegradation/phytoaccumulation/phytodegradation/phytovolatilization/ hydraulic control/ tolerant	Phytoaccumulation
Types of microorganisms associated with the plant	Not reported in the publication
Requirements for phytoremediation (specific nutrients, addition of oxygen)	Not reported in the publication

Phytotechnologies application

Substrate characteristics	Solutions of arsenate and phosphate
Laboratory/field experiment	Laboratory experiment (in vitro)
Age of plant at 1st exposure (seed, post-germination, mature)	Tip root fragment
Length of experiment	40 minutes
Initial contaminant concentration of the substrate	Concentrations of arsenate: 0,5 and 0,05 mol m^{-3} Concentrations of phosphate: 0, 0,05 or 0,5 mol m^{-3}
Post-experiment contaminant concentration of the substrate	Not reported in the publication
Post-experiment plant condition	Not reported
Contaminant storage sites in the plant and contaminant concentrations in tissues (root, shoot, leaves, no storage)	both arsenate and phosphate uptake occurred by the same carrier system, which had a higher affinity for phosphate