

= *Verbascum thapsus* =

Verbascum thapsus (great mullein or common mullein) is a species of mullein native to Europe , northern Africa , and Asia , and introduced in the Americas and Australia .

It is a hairy biennial plant that can grow to 2 meters tall or more . Its small yellow flowers are densely grouped on a tall stem , which grows from a large rosette of leaves . It grows in a wide variety of habitats , but prefers well @-@ lit disturbed soils , where it can appear soon after the ground receives light , from long @-@ lived seeds that persist in the soil seed bank . It is a common weedy plant that spreads by prolifically producing seeds , but it rarely becomes aggressively invasive , since its seeds require open ground to germinate . It is a very minor problem for most agricultural crops , since it is not a very competitive species , being intolerant of shade from other plants and unable to survive tilling . It also hosts many insects , some of which can be harmful to other plants . Although individuals are easy to remove by hand , populations are difficult to eliminate permanently .

It is widely used for herbal remedies , with well @-@ established emollient and astringent properties . Mullein remedies are especially recommended for coughs and related problems , but also used in topical applications against a variety of skin problems . The plant has also been used to make dyes and torches .

= = Description = =

Verbascum thapsus is a dicotyledonous plant that produces a rosette of leaves in its first year of growth . The leaves are large , up to 50 cm long . The second year plants normally produce a single unbranched stem , usually 1 ? 2 m tall . In the eastern part of its range in China , it is , however , only reported to grow up to 1 @.@ 5 m tall . The tall pole @-@ like stems end in a dense spike of flowers that can occupy up to half the stem length . All parts of the plants are covered with star @-@ shaped trichomes . This cover is particularly thick on the leaves , giving them a silvery appearance . The species ' chromosome number is $2n = 36$.

On flowering plants the leaves are alternately arranged up the stem . They are thick and decurrent , with much variation in leaf shape between the upper and lower leaves on the stem , ranging from oblong to oblanceolate , and reaching sizes up to 50 cm long and 14 cm across (19 inches long and 5 inches wide) . They become smaller higher up the stem , and less strongly decurrent down the stem . The flowering stem is solid and 2 ? 2 @.@ 5 cm (nearly an inch) across , and occasionally branched just below the inflorescence , usually following damage . After flowering and seed release the stem and fruits usually persist in winter , drying into dark brown , stiff structures of densely packed , ovoid @-@ shaped and dry seed capsules . The dried stems may persist into the following spring or even the next summer . The plant produces a shallow taproot .

Flowers are pentamerous with (usually) five stamen , a 5 @-@ lobed calyx tube and a 5 @-@ petalled corolla , the latter bright yellow and an 1 @.@ 5 ? 3 cm (0 @.@ 59 ? 1 @.@ 18 in) wide . The flowers are almost sessile , with very short pedicels (2 mm , 0 @.@ 08 in) . The five stamens are of two types , with the three upper stamens being shorter , their filaments covered by yellow or whitish hairs , and having smaller anthers , while the lower two stamens have glabrous filaments and larger anthers . The plant produces small ovoid (6 mm , 0 @.@ 24 in) capsules that split open by way of two valves , each capsule containing large numbers of minute brown seeds less than a millimetre (0 @.@ 04 in) in size , marked with longitudinal ridges . A white @-@ flowered form , *V. thapsus* f. *candicans* , is known to occur . Flowering lasts for up to three months from early to late summer (June to August in northern Europe) , with flowering starting at the bottom of the spike and progressing irregularly upward ; each flower opens for part of a day and only a few open at the same time around the stem .

= = Taxonomy = =

For the purpose of botanical nomenclature , *Verbascum thapsus* was first described by Carl

Linnaeus in his 1753 *Species Plantarum*. The specific epithet *thapsus* had been first used by Theophrastus (as ????? , *Thapsos*) for an unspecified herb from the Ancient Greek settlement of Thapsos , near modern Syracuse , Sicily , though it is often assimilated to the ancient Tunisian city of Thapsus .

At the time , no type specimen was specified , as the practice only arose later , in the 19th century . When a lectotype (type selected amongst original material) was designated , it was assigned to specimen 242 @. @ 1 of Linnaeus ' herbarium , the only *V. thapsus* specimen . The species had previously been designated as type species for *Verbascum* . European plants exhibit considerable phenotypical variation , which has led to the plant acquiring many synonyms over the years . Introduced American populations show much less variation .

The taxonomy of *Verbascum* has not undergone any significant revision since Svanve Mürbeck 's monographies in the 1930s , with the exception of the work of Arthur Huber @-@ Morath , who used informal group in organizing the genus for the floras of Iran and Turkey to account for many intermediate species . Since Huber @-@ Morath 's groups are not taxonomical , Mürbeck 's treatment is the most current one available , as no study has yet sought to apply genetic or molecular data extensively to the genus . In Mürbeck 's classification , *V. thapsus* is placed in section *Bothrospermae* subsect . *Fasciculata* (or sect . *Verbascum* subsect . *Verbascum* depending on nomenclatural choices) alongside species such as *Verbascum nigrum* (black or dark mullein) , *Verbascum lychnitis* (white mullein) and *Verbascum sinuatum* (wavy @-@ leaved mullein) .

= = = Subspecies and hybrids = = =

There are three usually recognized subspecies :

V. thapsus subsp. *thapsus* ; type , widespread .

V. thapsus subsp. *crassifolium* (Lam .) Murb . ; Mediterranean region and to 2000 metres in southwestern Austria . (syn. subsp. *montanum* (Scrad .) Bonnier & Layens)

V. thapsus subsp. *giganteum* (Willk .) Nyman ; Spain , endemic .

In all subspecies but the type , the lower stamens are also hairy . In subsp. *crassifolium* , the hairiness is less dense and often absent from the upper part of the anthers , while lower leaves are hardly decurrent and have longer petioles . In subsp. *giganteum* , the hairs are densely white tomentose , and lower leaves strongly decurrent . Subsp. *crassifolium* also differs from the type in having slightly larger flowers , which measure 15 ? 30 mm wide , whereas in the type they are 12 ? 20 mm in diameter . Both subsp. *giganteum* and subsp. *crassifolium* were originally described as species . Due to its morphological variation , *V. thapsus* has had a great many subspecies described . A recent revision led its author to maintain *V. giganteum* but sink *V. crassifolium* into synonymy .

The plant is also parent to several hybrids (see table) . Of these , the most common is *V. x semialbum* Chaub . (\times *V. nigrum*) . All occur in Eurasia , and three , *V. x kernerii* Fritsch , *V. x pterocaulon* Franch. and *V. x thapsi* L. (syn . *V. x spurium* W.D.J.Koch) , have also been reported in North America .

= = = Common names = = =

V. thapsus is known by a variety of names . European reference books call it " great mullein " . In North America , " common mullein " is used while western United States residents commonly refer to mullein as " cowboy toilet paper " .

In the 19th century it had well over 40 different common names in English alone . Some of the more whimsical ones included " hig candlewick " , " indian rag weed " , " bullocks lungwort " , " Adams @-@ rod " , " hare 's @-@ beard " and " ice @-@ leaf " . Vernacular names include innumerable references to the plant 's hairiness : " woolly mullein " , " velvet mullein " or " blanket mullein " , " beggar 's blanket " , " Moses ' blanket " , " poor man 's blanket " , " Our Lady 's blanket " or " old man 's blanket " , and " feltwort " , and so on (" flannel " is another common generic name) .

Some names refer to the plant 's size and shape : " shepherd 's club (s) " or " staff " , " Aaron 's Rod " (a name it shares with a number of other plants with tall , yellow inflorescences) , and a

plethora of other " X 's staff " and " X 's rod " . The name " velvet dock " or " mullein dock " is also recorded , where " dock " is a British name applied to any broad @-@ leaved plant .

= = Distribution and habitat = =

Verbascum thapsus has a wide native range including Europe , northern Africa and Asia , from the Azores and Canary Islands east to western China , north to the British Isles , Scandinavia and Siberia , and south to the Himalayas . In northern Europe , it grows from sea level up to 1 @,@ 850 m altitude , while in China it grows at 1 @,@ 400 ? 3 @,@ 200 m altitude .

It has been introduced throughout the temperate world , and is established as a weed in Australia , New Zealand , tropical Asia , La Réunion , North America , Hawaii , Chile , Hispaniola and Argentina . It has also been reported in Japan .

In the United States it was imported very early in the 18th century and cultivated for its medicinal and piscicide properties . By 1818 , it had begun spreading so much that Amos Eaton thought it was a native plant . In 1839 it was already reported in Michigan and in 1876 , in California . It is now found commonly in all the states . In Canada , it is most common in the Maritime Provinces as well as southern Quebec , Ontario and British Columbia , with scattered populations in between .

Great mullein most frequently grows as a colonist of bare and disturbed soil , usually on sandy or chalky ones . It grows best in dry , sandy or gravelly soils , although it can grow in a variety of habitats , including banksides , meadows , roadsides , forest clearings and pastures . This ability to grow in a wide range of habitats has been linked to strong phenotype variation rather than adaptation capacities .

= = Ecology = =

Great mullein is a biennial and generally requires winter dormancy before it can flower . This dormancy is linked to starch degradation activated by low temperatures in the root , and gibberellin application bypasses this requirement . Seeds germinate almost solely in bare soil , at temperatures between 10 ° C and 40 ° C. While they can germinate in total darkness if proper conditions are present (tests give a 35 % germination rate under ideal conditions) , in the wild , they in practice only do so when exposed to light , or very close to the soil surface , which explains the plant 's habitat preferences . While it can also grow in areas where some vegetation already exists , growth of the rosettes on bare soil is four to seven times more rapid .

Seeds germinate in spring and summer . Those that germinate in autumn produce plants that overwinter if they are large enough , while rosettes less than 15 cm (6 in) across die in winter . After flowering the entire plant usually dies at the end of its second year , but some individuals , especially in the northern parts of the range , require a longer growth period and flower in their third year . Under better growing conditions , some individuals flower in the first year . Triennial individuals have been found to produce fewer seeds than biennial and annual ones . While year of flowering and size are linked to the environment , most other characteristics appear to be genetic .

A given flower is open only for a single day , opening before dawn and closing in the afternoon . Flowers are self @-@ fecundating and protogynous (with female parts maturing first) , and will self @-@ pollinate if they have not been pollinated by insects during the day . While many insects visit the flowers , only some bees actually accomplish pollination . *V. thapsus* ' flowering period lasts from June to August in most of its range , extending to September or October in warmer climates . Visitors include halictid bees and hoverflies . The hair on lower stamens may serve to provide footholds for visitors .

The seeds maintain their germinative powers for decades , up to a hundred years , according to some studies . Because of this , and because the plant is an extremely prolific seed bearer (each plant produces hundreds of capsules , each containing up to 700 + seeds , with a total up to 180 @,@ 000 or 240 @,@ 000 seeds) , it remains in the soil seed bank for extended periods of time , and can sprout from apparently bare ground , or shortly after forest fires long after previous plants have died . Its population pattern typically consists of an ephemeral adult population followed by a

long period of dormancy as seeds . Great mullein rarely establishes on new grounds without human intervention because its seeds do not disperse very far . Seed dispersion requires the stem to be moved by wind or animal movement ; 75 % of the seeds fall within 1 m of the parent plant , and 93 % fall within 5 m .

Megachilid bees of the genus *Anthidium* use the hair (amongst that of various woolly plants) in making their nests . The seeds are generally too small for birds to feed on , although the American goldfinch has been reported to consume them . Other bird species have been reported to consume the leaves (Hawaiian goose) or flowers (palila) , or to use the plant as a source when foraging for insects (white @-@ headed woodpecker) .

= = Fossil record = =

Seed of *Verbascum thapsus* has been recorded from part of the Cromer Forest Bed series and at West Wittering in Sussex from some parts of the Ipswichian interglacial layers .

= = Agricultural impacts and control = =

Because it cannot compete with established plants , great mullein is no longer considered a serious agricultural weed and is easily crowded out in cultivation , except in areas where vegetation is sparse to begin with , such as Californian semi @-@ desertic areas of the Eastern Sierra Nevada . In such ecological contexts , it crowds out native herbs and grasses ; its tendency to appear after forest fires also disturbs the normal ecological succession . Although not an agricultural threat , its presence can be very difficult to completely eradicate , and is especially problematic in overgrazed pastures . The species is legally listed as a noxious weed in the American state of Colorado (Class C) and Hawaii , and the Australian state of Victoria (regionally prohibited in the West Gippsland region , and regionally controlled in several others) .

Despite not being an agricultural weed in itself , it hosts a number of insects and diseases , including both pests and beneficial insects . It is also a potential reservoir of the cucumber mosaic virus , *Erysiphum cichoraceum* (the cucurbit powdery mildew) and Texas root rot . A study found *V. thapsus* hosts insects from 29 different families . Most of the pests found were western flower thrips (*Frankliniella occidentalis*) , *Lygus* species such as the tarnished plant bug (*L. lineolaris*) , and various spider mites from the family Tetranychidae . These make the plant a potential reservoir for overwintering pests .

Other insects commonly found on great mullein feed exclusively on *Verbascum* species in general or *V. thapsus* in particular . They include mullein thrips (*Haplothrips verbasci*) , *Gymnaetron tetrum* (whose larva consume the seeds) and the mullein moth (*Cucullia verbasci*) . Useful insects are also hosted by great mullein , including predatory mites of the genera *Galendromus* , *Typhlodromus* and *Amblyseius* , the minute pirate bug *Orius tristicolor* and the mullein plant bug (*Campylomma verbasci*) . The plant 's ability to host both pests and beneficials makes it potentially useful to maintain stable populations of insects used for biological control in other cultures , like *Campylomma verbasci* and *Dicyphus hesperus* (Miridae) , a predator of whiteflies . A number of pest Lepidoptera species , including the Stalk Borer (*Papaipema nebris*) and Gray Hairstreak (*Strymon melinus*) , also use *V. thapsus* as a host plant .

Control of the plant , when desired , is best managed via mechanical means , such as hand pulling and hoeing , preferably followed by sowing of native plants . Animals rarely graze it because of its irritating hairs , and liquid herbicides require surfactants to be effective , as the hair causes water to roll off the plant , much like the lotus effect . Burning is ineffective , as it only creates new bare areas for seedlings to occupy . *G. tetrum* and *Cucullia verbasci* usually have little effect on *V. thapsus* populations as a whole . Goats and chickens have also been proposed to control mullein . Effective (when used with a surfactant) contact herbicides include glyphosate , triclopyr and sulfometuron @-@ methyl . Ground herbicides , like tebuthiuron , are also effective , but recreate bare ground and require repeated application to prevent regrowth .

= = Uses = =

Great mullein has been used since ancient times as a remedy for skin , throat and breathing ailments . It has long had a medicinal reputation , especially as an astringent and emollient , as it contains mucilage , several saponins , coumarin and glycosides . Dioscorides recommended it for diseases of the lung and it is now widely available in health and herbal stores . Non @-@ medical uses have included dyeing and making torches .

= = = Medical uses = = =

Dioscorides first recommended the plant 2000 years ago , against pulmonary diseases , and this has remained one of its primary uses , especially against cough . Leaf decoctions or herbal teas were used for expectoration , consumption , dry cough , bronchitis , sore throat and hemorrhoids . Leaves were also smoked against pulmonary ailments , a tradition that in America was rapidly transmitted to Native American peoples . The Zuni people , however , use the plant in poultices of powdered root applied to sores , rashes and skin infections . An infusion of the root is also used to treat athlete 's foot . The combination of expectorant saponins and emollient mucilage makes the plant particularly effective for cough . All preparations meant to be drunk have to be finely filtered to eliminate the irritating hairs .

Oil from the flowers was used against catarrhs , colics and , in Germany , earaches , frostbite , eczema and other external conditions . Topical application of various *V. thapsus* @-@ based preparations was recommended for the treatment of warts , boils , carbuncles , hemorrhoids , and chilblains , amongst others . Recent studies have found that great mullein contains glycyrrhizin compounds with bactericide and potential anti @-@ tumoral action . These compounds are concentrated in the flowers . The German Commission E sanctioned medicinal use of the plant for catarrhs . It was also part of the National Formulary in the United States and United Kingdom . The plant 's leaves , in addition to the seeds , have been reported to contain rotenone , although quantities are unknown .

= = = Other uses = = =

Like many ancient medicinal plants (Pliny the Elder describes it in his *Naturalis Historia*) , great mullein was linked to witches , although the relationship remained generally ambiguous , and the plant was also widely held to ward off curses and evil spirits . The seeds contain several compounds (saponins , glycosides , coumarin , rotenone) that are toxic to fish , and have been widely used as piscicide for fishing .

The flowers provide dyes of bright yellow or green , and have been used for hair dye . The dried leaves and hair were made into candle wicks , or put into shoes to help with insulating them . The dried stems were also dipped into suet or wax to make torches . Due to its weedy capacities , the plant , unlike other species of the genus (such as *V. phoeniceum*) , is not often cultivated .

The stalk can also be dried as a spindle for making fire either by hand drill or bow drill .