

Taraxacum

Taraxacum (/təˈræksəkəm/^[3]) is a large genus of flowering plants in the family Asteraceae, which consists of species commonly known as dandelions. The scientific and hobby study of the genus is known as taraxacology.^[4] The genus is native to Eurasia and North America, but the two most commonplace species worldwide, *T. officinale* (the common dandelion) and *T. erythrospermum* (the red-seeded dandelion), were introduced from Europe into North America, where they now propagate as wildflowers.^[5] The plant thrives in temperate regions and can be found in yards, gardens, sides of roads, among crops, and in many other habitats.^[6] Both species are edible in their entirety.^[7] The common name dandelion (/ˈdæɪndəliən/ DAN-d^ə-ly-ⁿ; from French *dent-de-lion* 'lion's tooth') is also given to specific members of the genus.

Like other members of the family Asteraceae, they have very small flowers collected together into a composite flower head. Each single flower in a head is called a floret. In part due to their abundance, along with being a generalist species, dandelions are one of the most vital early spring nectar sources for a wide host of pollinators.^[8] Many *Taraxacum* species produce seeds asexually by apomixis, where the seeds are produced without pollination, resulting in offspring that are genetically identical to the parent plant.^[9]

In general, the leaves are 50–250 mm (2–10 in) long or longer, simple, lobed-to-pinnatisect, and form a basal rosette above the central taproot. The flower heads are yellow to orange coloured, and are open in the daytime, but closed at night. The heads are borne singly on a hollow stem (scape) that is usually leafless and rises 10–100 mm (3⁄8–3+7⁄8 in) or more^[5] above the leaves. Stems and leaves exude a white, milky latex when broken. A rosette may produce several flowering stems at a time. The flower heads are 20–50 mm (3⁄4–2 in) in diameter and consist entirely of ray florets. The flower heads mature into spherical seed heads sometimes called blowballs^[10] or clocks (in both British and American English)^{[11][12][13][14]} containing many single-seeded fruits called achenes. Each achene is attached to a pappus of fine hair-like material which enables wind-aided dispersal over long distances.^[citation needed]

The flower head is surrounded by bracts (sometimes mistakenly called sepals) in two series. The inner bracts are erect until the seeds mature, then flex downward to allow the seeds to disperse. The outer bracts are often reflexed downward, but remain appressed in plants of the sections *Palustria* and *Spectabilia*. Between the pappus and the achene is a stalk called a beak, which elongates as the fruit matures. The beak breaks off from the achene quite easily, separating the seed from the parachute.^[citation needed]

The species of *Taraxacum* are tap-rooted, perennial, herbaceous plants, native to temperate areas of the Northern Hemisphere. The genus contains many species, which usually (or in the case of triploids, obligately) reproduce by apomixis, resulting in many local populations and endemism. In the British Isles alone, 234 microspecies (i.e. morphologically distinct clonal populations) are recognised in nine loosely defined sections, of which 40 are "probably endemic".^[15] A number of species of *Taraxacum* are seed-dispersed ruderals that rapidly colonize disturbed soil, especially the common dandelion (*T. officinale*), which has been introduced over much of the temperate world. After flowering is finished, the dandelion flower head dries out for a day or two. The dried petals and stamens drop off, the bracts reflex (curve backwards), and the parachute ball opens into a full sphere. When development is

complete, the mature seeds are attached to white, fluffy "parachutes" which easily detach from the seedhead and glide by wind, dispersing.

The seeds are able to cover large distances when dispersed due to the unique morphology of the pappus which works to create a unique type of vortex ring[16][17] that stays attached to the seed rather than being sent downstream. In addition to the creation of this vortex ring, the pappus can adjust its morphology depending on the moisture in the air. This allows the plume of seeds to close up and reduce the chance to separate from the stem, waiting for optimal conditions that will maximize dispersal and germination.[18][19]

Many similar plants in the family Asteraceae with yellow flowers are sometimes known as false dandelions. Dandelion flowers are very similar to those of cat's ears (*Hypochaeris*). Both plants carry similar flowers, which form into windborne seeds. However, dandelion flowers are borne singly on unbranched, hairless and leafless, hollow stems, while cat's ear flowering stems are branched, solid, and carry bracts. Both plants have a basal rosette of leaves and a central taproot. However, the leaves of dandelions are smooth or glabrous, whereas those of cat's ears are coarsely hairy.[citation needed]

Early-flowering dandelions may be distinguished from coltsfoot (*Tussilago farfara*) by their basal rosette of leaves, their lack of disc florets, and the absence of scales on the flowering stem.[20]

Other plants with superficially similar flowers include hawkweeds (*Hieracium*) and hawksbeards (*Crepis*). These are readily distinguished by branched flowering stems, which are usually hairy and bear leaves.[citation needed]

The genus is taxonomically complex due to the presence of apomixis: any morphologically distinct clonal population would deserve its own microspecies. Phylogenetic approaches are also complicated by the accelerated mutation in apomixic lines and repeated ancient hybridization events in the genus.[21]

As of 1970, the group is divided into about 34 macrospecies or sections, and about 2000 microspecies;[22] some botanists take a much narrower view and only accept a total of about 60 (macro)species.[22] By 2015, the number has been revised to include 60 sections and about 2800 microspecies. 30 of these sections are known to reproduce sexually.[21]

About 235 apomictic and polyploid microspecies have been recorded in Great Britain and Ireland alone.[23]

Botanists specialising in the genus *Taraxacum* are sometimes called taraxacologists[24], for example Gunnar Marklund, Johannes Leendert van Soest or A.J. Richards[25].

Dandelions are thought to have evolved about 30 million years ago in Eurasia.[31] Fossil seeds of *Taraxacum tanaiticum* have been recorded from the Pliocene of southern Belarus.[32] Dandelions have been used by humans for food and as an herb for much of recorded history. They were well known to ancient Egyptians, Greeks and Romans, and are recorded to have been used in traditional Chinese medicine for over a thousand years. The plant was used as food and medicine by Native Americans.[33] Dandelions were probably brought to North America on the Mayflower for their supposed medicinal benefits.[34]

The Latin name *Taraxacum* originates in medieval Arabic writings on pharmacy. The scientist

Al-Razi around 900 CE wrote "the tarashaquq is like chicory".[citation needed] The scientist and philosopher Ibn Sina around 1000 CE wrote a book chapter on Taraxacum.[citation needed] Gerard of Cremona, in translating Arabic to Latin around 1170, spelled it tarasacon.[35]

The English name, dandelion, is a corruption of the French dent de lion[36] meaning "lion's tooth", referring to the coarsely toothed leaves. The plant is also known as blowball, cankerwort, doon-head-clock, witch's gowan, milk witch, lion's-tooth, yellow-gowan, Irish daisy, monks-head, priest's-crown, and puff-ball;[37] other common names include faceclock, pee-a-bed, wet-a-bed,[38] swine's snout,[39] white endive, and wild endive.[40]

The English folk name "piss-a-bed" (and indeed the equivalent contemporary French pissenlit) refers to the strong diuretic effect of the plant's roots.[41] In various northeastern Italian dialects, the plant is known as pisacan ("dog pisses"), because they are found at the side of pavements.[42][unreliable source?] In Swedish, it is called maskros (worm rose) after the nymphs of small insects (thrips larvae) usually present in the flowers.[43]

Raw dandelion greens contain high amounts of vitamins A, C, and K, and are moderate sources of calcium, potassium, iron, and manganese.[44] Raw dandelion greens are 86% water, 9% carbohydrates, 3% protein, and 1% fat.[44] A 100 gram (3+1/2oz) reference amount supplies 45 Calories.[44]

The raw flowers contain diverse phytochemicals, including polyphenols, such as flavonoids apigenin, isoquercitrin (a quercetin-like compound), and caffeic acid, as well as terpenoids, triterpenes, and sesquiterpenes.[45] The roots contain a substantial amount of the prebiotic fiber inulin. Dandelion greens contain lutein.[46]

Taraxalisin, a serine proteinase, is found in the latex of dandelion roots.[47][48] Maximal activity of the proteinase in the roots is attained in April, at the beginning of plant development after the winter period.[48] Each dandelion seed has a mass(weight) of 500 micrograms or 0.0005g (1/125 of a grain).[citation needed]

The entire plant, including the leaves, stems, flowers, and roots, is edible and nutritious, with nutrients such as vitamins A and K as well as calcium and iron. [49] Dandelions are found on six continents and have been gathered for food since prehistory, but the varieties commercially cultivated for consumption are mainly native to Eurasia and North America. A perennial plant, its leaves grow back if the taproot is left intact. To make leaves more palatable, they are often blanched to remove bitterness,[50] or sauteed in the same way as spinach.[51] Dandelion greens have been a part of traditional Kashmiri cuisine, Spanish cuisine, Italian cuisine, Albanian cuisine, Slovenian, Sephardic Jewish, Chinese, Greek cuisine (χρῆμα) and Korean cuisines. In Crete, the leaves of a variety called 'Mari' (Μαρῖ), 'Mariaki' (Μαριῆκι), or 'Koproradiko' (Κοπρορῆδικο) are eaten by locals, either raw or boiled, in salads. T. megalorhizon, a species endemic to Crete, is eaten in the same way; it is found only at high altitudes (1,000–1,600 metres (3,300–5,200 ft)) and in fallow sites, and is called pentaramia (πενταρῆμια) or agrioradiko (αγριορῆδικο).[52]

The flower petals, along with other ingredients, usually including citrus, are used to make dandelion wine. Its ground, roasted roots can be used as a caffeine-free coffee alternative.[53] Dandelion was also traditionally used to make the traditional British soft drink dandelion and burdock, and is one of the ingredients of root beer. Dandelions were once

considered delicacies by the Victorian gentry, who used them mostly in salads and sandwiches.[citation needed]

The yellow flowers can be dried and ground into a yellow-pigmented powder and used as a dye.[54]

Dandelion pollen may cause allergic reactions when eaten, or adverse skin reactions in sensitive individuals. Contact dermatitis after handling has also been reported, probably from the latex in the stems and leaves.[55][unreliable source?][medical citation needed]

Dandelion has been used in traditional medicine in Europe, North America, and China.[45]

Dandelions do not depend on wildlife for distribution or pollination; however much of wildlife benefits from the abundance of the plant. Rabbits, wild turkeys, white-tailed deer, eastern chipmunks, bobwhite quail, and many species of birds will consume the seeds and foliage. Additionally, many insects will collect nectar from the flower, especially in early spring when there are very few other flowers in bloom.[56]

Taraxacum seeds are an important food source for certain birds (linnets, *Linaria* spp.).[57]

Szabo studied nectar secretion in a dandelion patch over two years (59.2 and 8.9 flowers per square metre (5.50 and 0.83/sq ft) in 1981 and 1982). He measured average nectar volume at 7.4 μl /flower in 1981 and 3.7 μl /flower in 1982. The flowers tended to open in the morning and close in the afternoon with the concentrations significantly higher on the second day.[58][59]

Dandelions are also important plants for Northern Hemisphere bees, providing an important source of nectar and pollen early in the season.[60] They are also used as a source of nectar by the pearl-bordered fritillary (*Boloria euphrosyne*), one of the earliest emerging butterflies in the spring.[citation needed]

Dandelions are used as food plants by the larvae of some species of Lepidoptera (butterflies and moths).

Dandelions can cause significant economic damage as an invasive species and infestation of other crops worldwide;[61] in some jurisdictions, the species *T. officinale* is listed as a noxious weed.[61][62] It can also be considered invasive in protected areas such as national parks. For example, Denali National Park and Preserve in Alaska lists *Taraxacum officinale* as the most common invasive species in the park [63] and hosts an annual "Dandelion Demolition" event where volunteers are trained to remove the plant from the park's roadsides.[64]

With a wide range of uses, the dandelion is cultivated in small gardens to massive farms. It is kept as a companion plant; its taproot brings up nutrients for shallow-rooting plants. It is also known to attract pollinating insects and release ethylene gas, which helps fruit to ripen.[65]

It has been a Western tradition for someone to blow out a dandelion seedhead and think of a wish they want to come true.[66]

Five dandelion flowers are the emblem of White Sulphur Springs, West Virginia.[67] The citizens celebrate spring with an annual Dandelion Festival.[citation needed]

The dandelion is the official flower of the University of Rochester in New York State, and "Dandelion Yellow" is one of the school's official colors. "The Dandelion Yellow" is an official University of Rochester song.[68]

The ability of dandelion seeds to travel as far as a kilometer in dry, windy and warm conditions, has been an inspiration for designing light-weight passive drones.

In 2018, researchers discovered that dandelion seeds have a separated vortex ring.[69] This work provided evidence that dandelion seeds have fluid behavior around fluid-immersed bodies that may help understand locomotion, weight reduction and particle retention in biological and man-made structures.

In 2022, researchers at the University of Washington demonstrated battery-free wireless sensors and computers that mimic dandelion seeds and can float in the wind and disperse across a large area.[70]

Dandelions secrete latex when the tissues are cut or broken, yet in the wild type, the latex content is low and varies greatly. *Taraxacum kok-saghyz*, the Russian dandelion, is a species that produced industrially useful amounts during WW2. Using modern cultivation methods and optimization techniques, scientists in the Fraunhofer Institute for Molecular Biology and Applied Ecology (IME) in Germany developed a cultivar of the Russian dandelion that is suitable for current commercial production of natural rubber. The latex produced exhibits the same quality as the natural rubber from rubber trees.[71] In collaboration with Continental AG, IME is building a pilot facility. As of May 2014[update], the first prototype test tires made with blends from dandelion-rubber are scheduled for testing on public roads over the next few years.[72] In December 2017, Linglong Group Co. Ltd., a Chinese company, invested \$450 million into making commercially viable rubber from dandelions.[73]

