

The earlier name, Compositae (now recognized as an alternative name^[9]) means "composite" and refers to the characteristic inflorescence, a special type of pseudanthium found in only a few other angiosperm families.

The vernacular name *daisy*, widely applied to members of this family, is derived from the Old English name of the daisy (*Bellis perennis*): *dægēs ēage*, meaning "day's eye". This is because the petals open at dawn and close at dusk.

Distribution

Asteraceae species have a cosmopolitan distribution, and are found everywhere except Antarctica and the extreme Arctic. They are especially numerous in tropical and subtropical regions (notably Central America, eastern Brazil, the Mediterranean, the Levant, southern Africa, central Asia, and southwestern China).^[8]

Taxonomy

Compositae, the original name for Asteraceae, were first described in 1792 by the German botanist Paul Dietrich Giseke.^[14] Traditionally, two subfamilies were recognised: Asteroideae (or

Tubuliflorae) and Cichorioideae (or Liguliflorae). The latter has been shown to be extensively paraphyletic, and has now been divided into 12 subfamilies, but the former still stands. The phylogenetic tree presented below is based on Panero & Funk (2002)^[15] updated in 2014,^[16] and now also includes the monotypic Famatinanthoideae.^{[16][17][18]} The diamond denotes a very poorly supported node (<50% bootstrap support), the dot a poorly supported node (<80%).^[5]

Characteristics

Members of the Asteraceae are mostly herbaceous plants, but some shrubs, climbers and trees (such as *Lachanodes arborea*) do exist. They are generally easy to distinguish from other plants, mainly because of their characteristic inflorescence and other shared characteristics.^[19] However, determining genera and species of some groups such as *Hieracium* is notoriously difficult (see "damned yellow composite" for example).

Roots and stems

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Members of the Asteraceae generally produce taproots, but sometimes they possess fibrous root systems. Stems are herbaceous aerial branched cylindrical with glandular hairs generally erect but can be prostrate to ascending. Some species have underground stems in the form of caudices or rhizomes. These can be fleshy or woody depending on the species.^[10]

Leaves

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The leaves and the stems very often contain secretory canals with resin or latex (particularly common among the Cichorioideae). The leaves can be

alternate, opposite, or whorled. They may be simple, but are often deeply lobed or otherwise incised, often conduplicate or revolute. The margins can be entire or lobed or toothed.

Flowers

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Floral heads

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*A typical
Asteraceae*



*A flower head
showing the*

<i>flower head</i>	<i>individual flowers</i>
<i>showing the</i>	<i>opening from the</i>
<i>individual</i>	<i>outside</i>
<i>flowers (<u>Bidens</u></i>	<i>(Chrysanthemum</i>
<i><u>torta</u>)</i>	<i>cultivar</i>
	<i>'Bridesmaid')</i>

In plants of the family Asteraceae, what appears to be a single flower is actually a cluster of much smaller flowers.^[20] The overall appearance of the cluster, as a single flower, functions in attracting pollinators in the same way as the structure of an individual flower in some other plant families.^[20] The older family name, Compositae, comes from the fact that what appears to be a single flower is

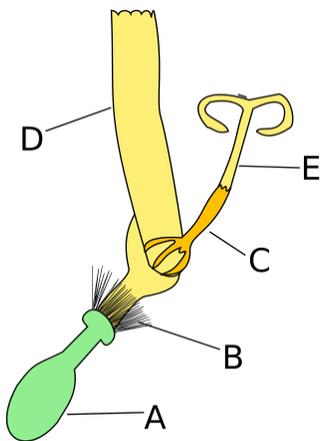
actually a *composite* of smaller flowers.^[20]
The "petals" or "sunrays" in a sunflower head are actually individual strap-shaped^[21] flowers called **ray flowers**, and the "sun disk" is made of smaller circular shaped individual flowers called **disc flowers**.^[20] The word "aster" means "star" in Greek, referring to the appearance of some family members, as a "star" surrounded by "rays".^[20] The cluster of flowers that may appear to be a single flower, is called a *head*.^[20] The entire head may move tracking the sun, like a "smart" solar panel, which maximizes reflectivity of the whole unit and can thereby attract more pollinators.^[20] At the base of the

head, and surrounding the flowers before opening, is a bundle of sepal-like bracts or scales called phyllaries, which together form the *involucre* that protects the individual flowers in the head before opening.^[20] The individual heads have the smaller individual flowers arranged on a round or dome-like structure called the *receptacle*.^[20] The flowers mature first at the outside, moving toward the center, with the youngest in the middle.^[20]

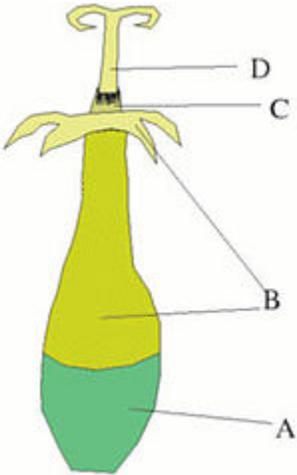
The individual flowers in a head have 5 fused petals (rarely 4), but instead of sepals, have threadlike, hairy, or bristly structures called pappus, which surround

the fruit and can stick to animal fur or be lifted by wind, aiding in seed dispersal. [20]

The whitish fluffy head of a dandelion, commonly blown on by children, is made of the pappus, with tiny seeds attached at the ends, whereby the pappus provides a parachute like structure to help the seed be carried away in the wind. [20]



Ligulate floret: A = ovary, B = pappus, C = anthers, D = ligule, E = style with stigmas



Disc floret: A = ovary, B = pappus, C = anthers, D = style with stigmas

A *ray flower* is a 3-tipped (3-lobed), strap-shaped, individual flower in the head of some members of the family

Asteraceae.^{[20][21]} Sometimes a ray flower is 2-tipped (2-lobed).^[20] The corolla of the ray flower may have 2 tiny teeth opposite the 3-lobed strap, or tongue, indicating evolution by fusion from an originally 5-

part corolla.^[20] Sometimes, the 3:2 arrangement is reversed, with 2 tips on the tongue, and 0 or 3 tiny teeth opposite the tongue.^[20] A *ligulate flower* is a 5-tipped, strap-shaped, individual flower in the heads of other members.^[20] A *ligule* is the strap-shaped tongue of the corolla of either a ray flower or of a ligulate flower.^[21] A *disk flower* (or *disc flower*) is a radially symmetric (i.e., with identical shaped petals arranged in circle around the center) individual flower in the head, which is ringed by ray flowers when both are present.^{[20][21]} Sometimes ray flowers may be slightly off from radial symmetry, or weakly bilaterally symmetric, as in the

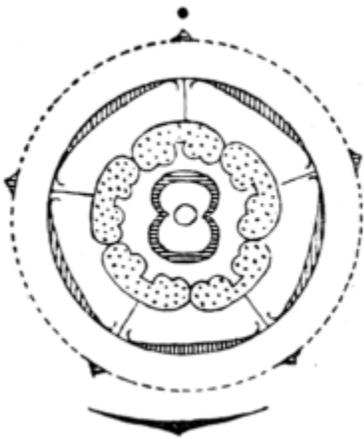
case of desert pincushions *Chaenactis fremontii*.^[20]

A *radiate head* has disc flowers surrounded by ray flowers.^[20] A *ligulate head* has all ligulate flowers.^[20] When a sunflower family flower head has only disc flowers that are sterile, male, or have both male and female parts, it is a *discoid head*.^[20] *Disciform heads* have only disc flowers, but may have two kinds (male flowers and female flowers) in one head, or may have different heads of two kinds (all male, or all female).^[20] *Pistillate heads* have all female flowers. *Staminate heads* have all male flowers.^[20]

Sometimes, but rarely, the head contains only a single flower, or has a single flowered pistillate (female) head, and a multi-flowered male staminate (male) head. [20]

Floral structures

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Flower diagram of Carduus (Carduoideae) shows (outermost to innermost): subtending bract and stem axis; fused calyx; fused corolla; stamens fused to corolla; gynoecium with two carpels and one locule

The distinguishing characteristic of Asteraceae is their inflorescence, a type of specialised, composite flower head or pseudanthium, technically called a calathium or capitulum,^{[22][23]} that may look superficially like a single flower. The *capitulum* is a contracted raceme composed of numerous individual sessile flowers, called *florets*, all sharing the same receptacle.

A set of bracts forms an involucre surrounding the base of the capitulum. These are called "phyllaries", or "involucral bracts". They may simulate the sepals of the pseudanthium. These are mostly

herbaceous but can also be brightly coloured (e.g. Helichrysum) or have a scarious (dry and membranous) texture. The phyllaries can be free or fused, and arranged in one to many rows, overlapping like the tiles of a roof (*imbricate*) or not (this variation is important in identification of tribes and genera).

Each floret may be subtended by a bract, called a "palea" or "receptacular bract". These bracts are often called "chaff". The presence or absence of these bracts, their distribution on the receptacle, and their size and shape are all important

diagnostic characteristics for genera and tribes.

The florets have five petals fused at the base to form a corolla tube and they may be either actinomorphic or zygomorphic.

Disc florets are usually actinomorphic, with five petal lips on the rim of the corolla tube. The petal lips may be either very short, or long, in which case they form deeply lobed petals. The latter is the only kind of floret in the Carduoideae, while the first kind is more widespread. *Ray florets* are always highly zygomorphic and are characterised by the presence of a *ligule*, a strap-shaped structure on the edge of the

corolla tube consisting of fused petals. In the Asteroideae and other minor subfamilies these are usually borne only on florets at the circumference of the capitulum and have a 3+2 scheme – above the fused corolla tube, three very long fused petals form the ligule, with the other two petals being inconspicuously small. The Cichorioideae has only ray florets, with a 5+0 scheme – all five petals form the ligule. A 4+1 scheme is found in the Barnadesioideae. The tip of the ligule is often divided into teeth, each one representing a petal. Some marginal florets may have no petals at all (filiform floret).

The calyx of the florets may be absent, but when present is always modified into a pappus of two or more teeth, scales or bristles and this is often involved in the dispersion of the seeds. As with the bracts, the nature of the pappus is an important diagnostic feature.

There are usually five stamens. The filaments are fused to the corolla, while the anthers are generally connate (*syngenesious* anthers), thus forming a sort of tube around the style (*theca*). They commonly have basal and/or apical appendages. Pollen is released inside the tube and is collected around the growing

style, and then, as the style elongates, is pushed out of the tube (*nüdelsspritze*).

The pistil consists of two connate carpels. The style has two lobes. Stigmatic tissue may be located in the interior surface or form two lateral lines. The ovary is inferior and has only one ovule, with basal placentation.

Fruits and seeds

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In members of the Asteraceae the fruit is achene-like, and is called a *cypsela* (plural *cypselae*). Although there are two fused carpels, there is only one locule, and only

one seed per fruit is formed. It may sometimes be winged or spiny because the pappus, which is derived from calyx tissue often remains on the fruit (for example in dandelion). In some species, however, the pappus falls off (for example in Helianthus). Cypsela morphology is often used to help determine plant relationships at the genus and species level.^[24] The mature seeds usually have little endosperm or none.^[19]

Pollen

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The pollen of composites is typically echinolophate, a morphological term



Anemochory in Carlina *Epizoochory in Bidens tripartita*

Asteraceans are especially common in open and dry environments.^[19]

Many members of Asteraceae are pollinated by insects, which explains their value in attracting beneficial insects, but anemophily is also present (e.g. Ambrosia, Artemisia). There are many apomictic species in the family.

Seeds are ordinarily dispersed intact with the fruiting body, the cypsela. Anemochory (wind dispersal) is common, assisted by a hairy pappus. Epizoochory is another common method, in which the dispersal unit, a single cypsela (e.g. Bidens) or entire capitulum (e.g. Arctium) has hooks, spines or some structure to attach to the fur or plumage (or even clothes, as in the photo) of an animal just to fall off later far from its mother plant.

Uses



The twining succulent, Senecio angulatus, is used for its cut flowers,^[27] despite being an invasive weed in some places, such as Australia and New Zealand.^[28]

Commercially important plants in Asteraceae include the food crops Lactuca sativa (lettuce), Cichorium (chicory), Cynara scolymus (globe artichoke), Helianthus annuus (sunflower), Smallanthus sonchifolius (yacón), Carthamus tinctorius (safflower) and Helianthus tuberosus (Jerusalem artichoke).

Plants are used as herbs and in herbal teas and other beverages. Chamomile, for example, comes from two different species: the annual *Matricaria chamomilla* (German chamomile) and the perennial *Chamaemelum nobile* (Roman chamomile). *Calendula* (known as pot marigold) is grown commercially for herbal teas and potpourri. *Echinacea* is used as a medicinal tea. The wormwood genus *Artemisia* includes absinthe (*A. absinthium*) and tarragon (*A. dracunculus*). Winter tarragon (*Tagetes lucida*), is commonly grown and used as a tarragon substitute in climates where tarragon will not survive.

Many members of the family are grown as ornamental plants for their flowers, and some are important ornamental crops for the cut flower industry. Some examples are Chrysanthemum, Gerbera, Calendula, Dendranthema, Argyranthemum, Dahlia, Tagetes, Zinnia, and many others. [29]

Many species of this family possess medicinal properties and are used as traditional antiparasitic medicine. [26]

Members of the family are also commonly featured in medical and phytochemical journals because the sesquiterpene lactone compounds contained within them

are an important cause of allergic contact dermatitis. Allergy to these compounds is the leading cause of allergic contact dermatitis in florists in the US.^[30] Pollen from ragweed Ambrosia is among the main causes of so-called hay fever in the United States.^[31]

Asteraceae are also used for some industrial purposes. Marigold (Tagetes patula) is common in commercial poultry feeds and its oil is extracted for uses in cola and the cigarette industry.^[29]

Several members of the family are copious nectar producers^[29] and are useful for

evaluating pollinator populations during their bloom. Centaurea (knapweed), Helianthus annuus (domestic sunflower), and some species of Solidago (goldenrod) are major "honey plants" for beekeepers. Solidago produces relatively high protein pollen, which helps honey bees over winter.

Some members of Asteraceae are economically important as weeds. Notable in the United States are Senecio jacobaea (ragwort), Senecio vulgaris (groundsel), and Taraxacum (dandelion).