

CARNATION



Taxonomy

Dianthus caryophyllus L., Caryophyllaceae, Caryophyllales. The genus name, *Dianthus*, is derived from the Greek words *dios* (of Zeus, divine) and *anthos* (flower). It was first coined by the Greek philosopher and "father of botany" Theophrastus (ca 300 B.C.), a disciple of Aristotle. The species name, *caryophyllus*, comes from the Greek words *karyon* (nut, kernel) and *phylon* (leaf).

Botany

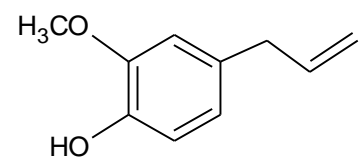
The dicotyledonous Caryophyllaceae family to which the genus *Dianthus* belongs consists of 80 genera and more than 2000 annual or perennial species. The *Dianthus*-genus has more than 300 species and the term 'carnation' refers to the various cultivars and hybrids of the species *Dianthus caryophyllus* L. Carnations apparently originated in Mediterranean regions such as Greece, Italy, Sardinia and Sicily. They have been widely cultivated for ornamental purposes for more than 2000 years.

Perpetual flowering carnations are amongst the most popular cut flowers in the world. Based on plant form and flower size and type, the many cut flower varieties of carnation can be divided into three groups, viz. standard (Sim) carnations, midi (*chinensii*) carnations and spray (mini) carnations. Standard carnations have a solitary large flower per stem about 5-8 cm in diameter when fully open. Their stems are typically 40-70 cm long. Midi carnations also have a single flower per stem, but the flowers are smaller (2-3 cm in diameter) and the stems shorter (40-60 cm) than standard carnations. Spray or miniature carnations have branched clusters (panicles or sprays) of 5-6 flowers per stem (40-60 cm) with smaller blooms (3-4 cm across). The flowers of the wild-type have 5 petals in a

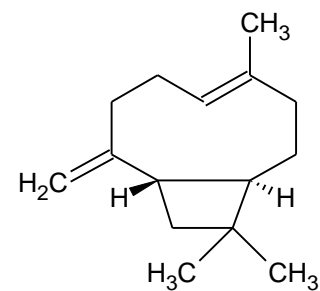
single whorl. However, the flowers of modern cut flower varieties are double, i.e. they have many more petals than the wild-type, arranged in more than one whorl in an overlapping arrangement. These petals are generally clawed or serrated. The flower has a cylindrical calyx. Carnation flowers are hermaphroditic, having both male (androecium) and female (gynoecium) reproductive organs. Each flower has 10 stamens in one or two whorls and a superior ovary situated above the attachment point of other floral parts (hypogynous), with two separate styles. Floral nectaries are located at the base of the flower. Four ovate bracteoles (small leaf-like structures) are located just below the flower.

Carnations are evergreen plants. Their leaves are simple (not subdivided), flat and lanceolate to linear-lanceolate in shape with entire (smooth) margins. They are arranged in an opposite manner and have conspicuous sheaths attached at the swollen and brittle nodes of the stiff flowering stems. Carnation leaves are glabrous (smooth without hairs), glaucous (covered with a waxy coating that is easily rubbed off) and grey-green to blue-green in colour.

Some carnation cultivars are fragrant. Their clovelike sweet scent is due to essential oils containing varying proportions of predominantly eugenol (characteristic of clove oil), β -caryophyllene (characteristic of clove oil and black pepper) and derivatives of benzoic and salicylic acid. The first two compounds give the flower its strong clove scent. It was reportedly for this reason that the old Latin species name of the clove tree (*Eugenia caryophyllus* (Spreng.) Bullock & S. G. Harrison) was transferred to the carnation. The level of these fragrance compounds increase during flower development.

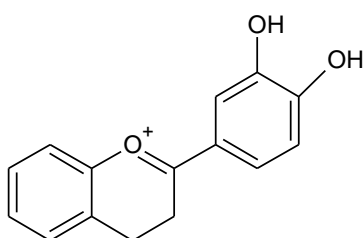


Eugenol

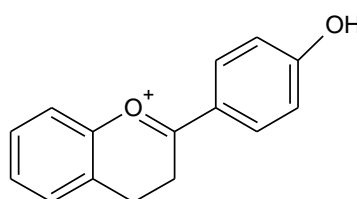


β -caryophyllene

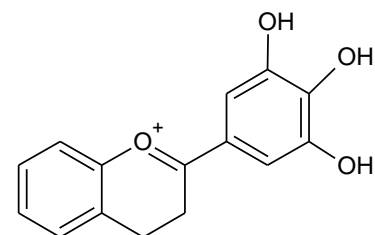
Carnation flowers are available in a vast range of colours (except blue), as well as numerous bicouours. These colours can be attributed to two types of pigments: carotenoids and anthocyanins. Carotenoids are responsible for colours ranging from yellow to orange, are insoluble in water and are located in organelles in the cell known as chromoplasts. Anthocyanins are water-soluble pigments located in the vacuole of the cell, and are responsible for the shades of violet, purple, pink, and red colours. The most common anthocyanins in carnations are glycosides of cyanidin, pelargonidin and delphinidin.



Cyanidin - red



Pelargonidin - orange-red



Delphinidin - blue-violet

Harvesting and Quality Indices

Carnation stems to be harvested should be long and straight with undamaged foliage free from obvious disease symptoms, no flower shattering and flowers free from split calyxes, pistils extending above the petals or any other deformity or damage. Carnation flowers are harvested at different stages of maturity to suit the intended marketing procedure. Flowers intended for long-term storage are harvested at the star-bud stage. Prior to marketing, such buds must be opened using an appropriate bud-opening solution. Flowers intended for short-term storage are harvested at the paintbrush stage when petals stick out vertically from the calyx (half open). Such buds will open quickly. Flowers intended for immediate sale should be harvested when the petals in the outer whorl are between vertical and horizontal (half to three-quarters open). Miniature carnations should be purchased when one to three flowers per stem are open. Fragrant cultivars are more popular with consumers.

Postharvest Care

Harvested carnation flowers should reach the cold store in the shortest possible time after harvest. Any delay in cooling will reduce the vase life of the flowers. Overnight cold storage in water or a suitable flower food is a good way of conditioning the flowers prior to shipping to the markets. Carnation flowers that have been stored and shipped dry need to be hydrated prior to sale. Hydration is done at grower and wholesaler level to rehydrate dry packed and stored flowers and thus restore the water balance or turgidity in water-stressed or wilted flowers. Hydration is usually done in a cold room at 1-2°C and 90-95% relative humidity. It is done by removing all foliage that will be below the water line, re-cutting the stems with a sharp knife or shears and placing them in a solution containing a suitable flower preservative or in a hydration solution containing a germicide (but no sugar), citric acid (acidifying the solution to pH 2.5-5.0 depending of the germicide) and/or aluminium sulphate. Water uptake is improved by degassing the water or by adding a suitable wetting agent.

Carnation flowers are sensitive to ethylene, which causes petal incurling and wilting. Ethylene effects can be delayed by pre-treatment with anti-ethylene agents such as silver thiosulfate (STS) or 1-methylcyclopropene (1-MCP). Pulsing the flowers after treatment with a solution containing 10% sucrose overnight will improve flower opening and longevity.

Precooling and Storage

Carnation flowers should be cooled down to storage temperature soon after harvest. Flowers or bud-cut flowers for dry storage should be treated with an anti-ethylene agent and a fungicide prior to packing and storage at 0-1 °C. In this way open flowers can be stored dry for 2-4 weeks and bud-cut flowers for up to 5 weeks. Open flowers can also be stored in water or flower food for 4-5 days at 1-2°C and 90-95% relative humidity. Any breaks in the cold chain from producer to consumer will reduce the vase life of the flowers.

Vase Life

Carnations have a good vase life and will last for 1-2 weeks during which time the flowers will continue to open. Vase life can be doubled by pre-treatment with anti-ethylene agents as described above. Prior to placing them in the vase solution, stems should be re-cut to remove the bottom 2-5 cm of the stem for maximum solution uptake. Although the bottom foliage is removed prior to placing the stems in the vase, excessive leaf removal will reduce vase life because it reduces solution uptake.

Ethylene

Carnation flowers are sensitive to ethylene and exposure to ethylene (exogenous or endogenous) results in accelerated senescence as indicated by premature wilting (sleepiness). Ethylene-induced senescence is delayed by prompt cooling to storage temperature and pre-treatment with an anti-ethylene agent (STS or 1-MCP). Some of the newer GM cultivars are insensitive to ethylene.

Physiological Disorders

Calyx splitting is well known disorder of carnations. It is caused by the formation of a large number of petals or adventitious buds inside the flower calyx at fluctuating temperatures. The flower bud is most sensitive to this disorder when it is 3 – 6 mm in diameter. The problem can be reduced by placing a band around the calyx or wrapping tape around the bud when the buds have just started to open.