Cydonia oblonga

Scientific Name

Cydonia oblonga Mill.

Synonyms

Cydonia communis Poiret, *Cydonia cydonia* Persoon, *Cydonia europaea* Savi, *Cydonia vulgaris* Pers., *Pyrus cydonia* L, *Sorbus cydonia* Crantz.

Family

Rosaceae

Common/English Names

Apple-shaped Quince, Common Quince, Quince, Quince Seeds, Quince Tree.

Vernacular Names

Albanian: Ftua;
Arabic: Habbus Safarjal (Seeds), Safarjal;
Brazil: Marmelo;
Chinese: Wen Po;
Czech: Kdouloň, Kdouloň Obecná;
Danish: Almindelig Kvæde, Kvæde, Kvædetræ, Pærekvæde;
Dutch: Japanse Kwee, Kwee, Kweeboom, Kweepeer, Kweepeer Sort, Lijsterbes Sort;
Eastonian: Harilik Küdoonia;
Finnish: Kvitteni;
French: Cognassier, Cognassier À Fruit Comestible, Coing, Graines De Coing;
Gaelic: Cainche;
German: Echte Quitte, Kittenbaum, Kötte, Köttenbaum, Kütte, Küttenbaum, Quittenbaum, Quitte, Quittenbaum, Schmeckbirne;
Greek: Kydoni, Kydonion;
Hebrew: Habush;
Hungarian: Birs, Birsalma, Birskörte;
India: Behidana (Seeds);
Iran: Beh;
Italian: Cotogno, Mela, Mela Cotogna, Melocotogno, Pomo Cotogno;
Japanese: Marumero;
Lebanon: Sfarjel;
Malta: Gamm Ta' L-Isfargel;
Norwegian: Kvede;
Persian: Safarjal, Tukhme Safarjal (Seeds);
Polish: Pigwa, Pigwa Pospolita;
Portuguese: Cidónia, Marmeleiro, Marmelo;
Russian: Aiva, Ajva Aiva Obyknovennaia;
Serbian: Dunja;
Slovašcina: Kutina, Kutina Navadna;
Spanish: Membrillero, Membrillo;
Swedish: Kvitten, Kvitten-Arter;
Turkish: Ayva, Ayva Agh.

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Origin/Distribution

The species is indigenous to Western Asia; its primary wild area is probably limited to the Caucasus – Armenia, Azerbaijan, Turkmenistan, and the Russian Federation – Ciscaucasia, Dagestan. Partially connected with this core area are populations in Iran, Anatolia, Syria, Turkmenia and Afghanistan.

Agroecology

Quince grows in the warm temperate to cool temperate zone from 0°C to 25°C. Quince is frost hardy and requires a cold chilling period of 100–450 hours below 7°C to flower properly. Quince flowers later in the spring than pears, because some vegetative growth must occur before the flowers appear. The tree is self fertile, however, yield can be enhanced from cross fertilization.

Edible Plant Parts and Uses

Quince is primarily grown for its edible fruit, although its flowers are also edible. Only cultivars with a soft skin, matured in a warm climate can be eaten raw. Most varieties of quince are too hard, astringent and sour to eat raw. They are roasted, baked or stewed or processed into jams, marmalades, pastes, jelly and quince pudding. Quince paste is still widely made in France and Spain, while in Argentina, Chile and Uruguay quince is cooked into a reddish jello-like block or firm reddish paste known as *dulce de membrillo* which is then eaten as a spread in sandwiches and with cheese. Boiled quince is also popular in desserts such as the *murta con membrillo* that combines *Ugni molinae* with quince. In Spain, the fruit is cooked into a firm reddish paste and is eaten with *manchego* cheese. In Syria, quince is cooked in pomegranate paste (*dibs rouman*) with shank meat and *kibbeh* (a middle eastern meat pie with burghul and mince meat) and is called "*kibbeh safarjalieh*". Because of its strong and intensive fragrance and flavour, the fruit it is used in mixed products including juices pure and mixed, liqueurs, wine, cider, fruits in liqueur, jam, marmalade, jelly, and dried jelly as a special "quince-bread". Quinces have long been grown for flavouring apple pies, ices and confections. Quince juice mixes well with other fruit juices. In Bosnia, the quince is made into brandy. Quince wine was popular in Britain in the nineteenth century, and was reputed to be beneficial to asthma sufferers.

Quince scalding water, rich in phenolic compounds, flavonoids, organic acids and sugars could be use in low-fat yogurt production (Trigueros et al. 2011). Quince scalding water had inhibitory effect against lactic acid bacteria, probably due to its high content of polyphenols. As a consequence, quince scalding water enriched yogurts had higher pH and lower lactic acid content compared to control yogurts. Such changes were reflected in their rheological and textural properties: soft yogurts of higher deformability and lower elastic behavior and viscosity.

Botany

Quince is a deciduous, unarmed, perennial shrub or small tree, 4–8 m high with crowded gnarled branches and branchlets. Branchlets are purplish red when young, turning purplish brown with age, terete, initially densely tomentose becoming glabrous when old. Leaves are alternate, petiolate (0.8–1.5 cm long) with caducous, tomentose ovate stipules (Plate 1). Lamina is simple, ovate to oblong, 5–10 × 3–5 cm, lower surface pale green with conspicuous veins and densely villous, upper surface dark green glabrous or sparsely pubescent when young, base rounded or subcordate, margin entire, apex acute or emarginate. Flowers are 4–5 cm across on tomentose pedicel with caducous, ovate bracts with campanulate hypanthium which is densely tomentose abaxially; sepals 5, ovate or broadly lanceolate, 5–6 mm, longer than hypanthium, both surfaces tomentose, margin glandular serrate, apex acute; petals 5, white or pinkish, 1.8 cm long; stamens less than 1/2 as long as petals. styles nearly as long as stamens, densely villous basally (Plate 2).

Plate 1 Leaves and developing quince fruits

Plate 2 Flower buds

Plate 3 Ripe quince fruit

Fruit is fragrant, light green turning yellow (Plates 1 and 3) when ripe, pear-shaped, 3–5 cm across, densely tomentose with persistent reflexed sepals and stout, tomentose fruiting pedicel, 5 mm long. Pulp is firm, fleshy and aromatic.

Nutritive/Medicinal Properties

The food value per 100 g edible portion of raw ripe quince fruit (exclude 39% of core, seeds and parings) is: water 83.80 g, energy 57 kcal (238 kJ), protein 0.4 g, total lipid 0.10 g, ash 0.4 g, carbohydrate 15.3 g, total dietary fibre 1.9 g, Ca 11 mg, Fe 0.70 mg, Mg 8 mg, P 17 mg, K 197 mg, Na 4 mg, Zn 0.04 mg, Cu 0.130 mg, Se 0.69 μg, vitamin C (total ascorbic acid) 15 mg, thiamine 0.020 mg, riboflavin 0.030 mg, niacin 0.2 mg, pantothenic acid 0.081 mg, vitamin B-6 0.040 mg, total folate 3 μg, vitamin A 2 μg RAE, vitamin A 40 IU, total saturated fatty acids 0.010 g, 16:0 (palmitic acid) 0.007 g, 18:0 (stearic acid) 0.002 g, total monounsaturated fatty acids 0.036 g, total polyunsaturated fatty acids 0.050 g, 18:1 undifferentiated (oleic acid) 0.036 g and 18:2 undifferentiated (linoleic acid) 0.049 g (USDA 2011). Quince is not a nutrient rich fruit, it has moderate amount of vitamin A, and low amounts of other vitamins and minerals. However, it is rich in health beneficial phenolic compounds.

A GC/FID (gas chromatography/flame ionization detector) methodology was employed for the determination of 21 free amino acids in quince fruit (pulp and peel) and jam (Silva et al. 2003). The detection limit values for amino acids were low, between 0.004 and 0.115 μg/mL, and the method was precise. The GC/FID procedure was rapid, sensitive, reproducible, accurate and low cost and could be useful in the quality control of quince products. Twenty-one free amino acids were found in quince fruit (pulp and peel) and quince jam (homemade and industrially manufactured) (Silva et al. 2004b). Generally, the highest content in total free amino acids and in glycine was found in peels. The three major free amino acids detected in pulps were aspartic acid, asparagine, and hydroxyproline. For quince peels, usually, the three most abundant amino acids were glycine, aspartic acid, and asparagine. Similarly, for quince jams the most important free amino acids were aspartic acid, asparagine, and glycine or hydroxyproline. All samples of quince fruit (pulp and peel) and quince jam (homemade and industrially manufactured) presented a similar organic acid profile composed of at least six identified organic acids: citric, ascorbic, malic, quinic, shikimic, and fumaric acids (Silva et al. 2002b). Several samples also contained oxalic acid. A homo-monoterpenic compound (trans-9-amino-8-hydroxy-2,7-dimethylnona-2,4-dienoic acid glucopyranosyl ester) was isolated, identified and quantified in quince pulps, peels and jams (Sousa et al. 2007). The compound can be used as a tool for the characterization of quince and its jam.

Total soluble solids (TSS) of five Spanish quince clones were found to range from 11.5°Brix to 14.7°Brix, with fructose and glucose as predominant sugars; clone MEMB3 yielded the highest sugar content of all (17.93%) (Rodríguez-Guisado et al. 2009). Malic was the main organic acid (0.78%) followed by tartaric (0.22%), while quince juice yielded very low citric acid (0.009–0.014%). Quince generally showed high crude fibre contents (8.14% for MEMB1), low fat contents and can weigh up to 290 g.

Various parts of the quince fruit were found to be rich in phenolic compounds. The total phenolic content of the pulp and peel parts ranged from 37–47 to 105–157 mg/100 g of fresh weight, respectively (Fattouch et al. 2007). Chlorogenic acid (5-O-caffeoylquinic acid) was the most abundant phenolic compound in the pulp (37%), whereas rutin (quercetin 3-O-rutinoside) was the main one in the peel (36%). Another study reported that the pulp contained mainly caffeoylquinic acids (3-, 4-, and 5-O-caffeoylquinic acids and 3,5-dicaffeoylquinic acid) and one quercetin glycoside, rutin (in low amount) (Silva et al. 2002a). The peels presented the same caffeoylquinic acids and several flavonol glycosides: quercetin 3-galactoside, kaempferol 3-glucoside, kaempferol 3-rutinoside, and several unidentified compounds (probably kaempferol glycoside and quercetin and kaempferol glycosides acylated with p-coumaric acid). The highest content of phenolics was found in peels.

Fifty-nine secondary metabolites were isolated from quince fruit peels, among them, five metabolites, 3β-(18-hydroxylinoleoyl)-28-hydroxyurs-12-ene, 3β-linoleoylurs-12-en-28-oic acid, 3β-oleoyl-24-hydroxy-24-ethylcholesta-5, 28(29)-diene, tiglic acid 1-O-β-d-glucopyranoside and 6,9-dihydroxymegastigmasta-5,7-dien-3-one 9-O-β-d-gentiobioside were isolated for the first time (Alesiani et al. 2010). A cytosolic carotenoid cleavage enzyme with a molecular weight of 20 kD was isolated and partially purified from quince fruit (Fleischmann et al. 2002). Using β-carotene as substrate, the enzyme activity was detected spectrophotometrically at a wavelength of 505 nm.

The difference between quince pulp and peel phenolic profiles was more apparent during principal component (PC) analysis (Silva et al. 2005b). Two PCs accounted for 81.29% of the total variability, PC1 (74.14%) and PC2 (7.15%). PC1 described the difference between the contents of caffeoylquinic acids (3-O-, 4-O-, and 5-O-caffeoylquinic acids and 3,5-O-dicaffeoylquinic acid) and flavonoids (quercetin 3-galactoside, rutin, kaempferol glycoside, kaempferol 3-glucoside, kaempferol 3-rutinoside, quercetin glycosides acylated with p-coumaric acid, and kaempferol glycosides acylated with p-coumaric acid). PC2 related the content of 4-O-caffeoylquinic acid with the contents of 5-O-caffeoylquinic and 3,5-O-dicaffeoylquinic acids. Two main principal component characterised the quince jam phenolic composition (54.4% of all variance): PC1 (37.4%) and PC2 (17.0%) (Silva et al. 2006). The analyses of 17 Portuguese quince jam samples showed that all the samples presented a similar profile composed of at least eight identified phenolic compounds, several unidentified characteristic procyanidin polymers, and sodium benzoate as preservative of quince jams (Silva et al. 2002a). Several samples also contained arbutin, suggesting that these quince jam samples were fraudulently adulterated with pear puree. The use of non-polar sorbents technique was found useful in the evaluation of commercial quince jams genuineness (Silva et al. 2001). The detection limit values for phenolic compounds were between 0.1 and 1.6 mg/ml and the method was precise. Generally, the recovery values were high, except for arbutin. All samples of quince jellies samples presented a similar phenolic profile with at least eight identified phenolic compounds and also contained 5-HMF (5-(hydroxymethyl) furfural), a sugar derivative, as the major compound (Silva et al. 2000b).

An HPLC diode array detection methodology for separating 13 phenolic compounds from quince purees could also be applied to the detection of apple and/or pear fraudulently added to quince puree (Andrade et al. 1998). The presence of apple can be detected by phloretin 2′-xylosylglucoside and phloretin 2′-glucoside, while that of pear detected by the presence of arbutin. In addition, 3-O-caffeoylquinic acid was found to be present at an appreciable amount (~23.4%) in quince puree, while the sample of pear puree contained only 8.2% was absent in apple puree.

Quince seeds exhibited a phenolic profile composed of 3-O-caffeoylquinic, 4-O-caffeoylquinic, 5-O-caffeoylquinic and 3,5-dicaffeoylquinic acids, lucenin-2, vicenin-2, stellarin-2, isoschaftoside, schaftoside, 6-C-pentosyl-8-C-glucosyl chrysoeriol and 6-C-glucosyl-8-C-pentosyl chrysoeriol (Silva et al. 2005a). Six organic acids constituted the organic acid profile of quince seeds: citric, ascorbic, malic, quinic, shikimic and fumaric acids. The free amino acid profile was composed of 21 identified free amino acids and the three most abundant were glutamic acid, aspartic acid and asparagine. The following C-glycosyl flavones: vicenin-2 (6,8-di-C-glucosyl apigenin), lucenin-2 (6,8-di-C-glucosyl luteolin), stellarin-2 (6,8-di-C-glucosyl chrysoeriol), isoschaftoside (6-C-arabinosyl-8-C-glucosyl apigenin), schaftoside (6-C-glucosyl-8-C-arabinosyl apigenin), 6-C-pentosyl-8-C-glucosyl chrysoeriol and 6-C-glucosyl-8-C-pentosyl chrysoeriol were identified in quince seed (Ferreres et al. 2003).

Solvent partition of quince wax with n-hexane or acetone yielded an insoluble (crystalline) and a soluble (oily) fraction (Lorenz et al. 2008). The insoluble fraction consisted of saturated n-aldehydes, n-alcohols and free n-alkanoic acids of carbon chain lengths between 22 and 32, with carbon chain lengths of 26 and 28 dominating. Also odd-numbered unbranched hydrocarbons, mainly C27, C29 and C31, were detected particularly in the acetone-insoluble fraction (total, 15.8%). Triterpenoic acids were separated from the hexane-insoluble matter and identified as a mixture of ursolic, oleanolic and betulinic acids. The major constituents of the hexane-soluble fraction were glycerides of linoleic [Δ(9,12), 18:2] and oleic [Δ(9), 18:1] acids, accompanied by free linoleic, oleic and palmitic acids (C16). In addition, β-sitosterol, Δ(5)-avenasterol as well as trace amounts of other sterols were detected. Finally the carotenoids phytoene and phytofluene were identified and quantified yielding 1.0% and 0.3% of the quince wax, respectively.

Quince leaves presented a common organic acid profile composed of six constituents: oxalic, citric, malic, quinic, shikimic and fumaric acids (Oliveira et al. 2008). Total organic acid content varied from 1.6 to 25.8 g/kg dry matter (mean value of 10.5 g/kg dry matter). Quinic acid was the major compound (72.2%), followed by citric acid (13.6%). Significant differences were found in malic and quinic acids relative abundances and total organic acid contents at various times of the year. *Cydonia oblonga* leaves also contained phenolic compounds. Quince leaves presented a common phenolic profile composed by nine compounds (Oliveira et al. 2007): 3- O-, 4- O- and 5- O-caffeoylquinic acids, 3,5- O-dicaffeoylquinic acid, quercetin-3- O-galactoside, quercetin-3-O-rutinoside, kaempferol-3- O-glycoside, kaempferol-3- O-glucoside, and kaempferol-3-O-rutinoside. 5- O-caffeoylquinic acid was the major phenolic compound (36.2%), followed by quercetin 3- O-rutinoside (21.1%). Quince leaves had higher relative contents of kaempferol derivatives than fruits (pulps, peels, and seeds), especially in regards to kaempferol-3- O-rutinoside (12.5%). *C. oblonga* leaf total phenolic content was very high, varying from 4.9 to 16.5 g/kg dry matter (mean value of 10.3 g/kg dry matter), indicating that these leaves can be used as a good and cheap source of bioactive constituents. Two new ionone glucosides 9-O-β-D-glucopyranosides of (6R)-3-oxo-4-hydroxy-7,8-dihydro-α-ionol 1 and 3-oxo-5,6-epoxy-β-ionol 2 were isolated from quince leaves (Lutz et al. 2002). The novel quince leaf constituents were characterized as peracetates 1a and 2a.

The chloroform-methanol extract of quince plant was shown to contain four new sesterterpene esters, namely 24,25-O-diacetylvulgaroside (1), 25-O-acetylvulgaroside (2), 24-O-acetyl-25-O-cinnamoylvulgaroside (3), and 25-O-cinnamoylvulgaroside (4) (De Tommasi et al.

1996a). Four new flavonol glycosides (1–4) and nine new α-ionol-derived glycosides (5–13) together with the known 3-oxo-α-ionol 9-O-β-d-apiofuranosyl-(1→6)-β-d-glucopyranoside (14), vomifoliol 9-O-β-d-glucopyranoside (roseoside) (15), and vomifoliol 9-O-β-d-apiofuranosyl-(1→6)-β-d-glucopyranoside (16) were isolated from the methanol extract of the aerial parts of quince plant (De Tommasi et al. 1996b).

Fibre-rich products (e.g. powder) could be obtained from quince wastes with useful functional and physiological properties (de Escalada Pla et al. 2010). The products obtained presented interesting hydration properties comparable to those reported for citrus and apple pulps. At the same time, all dried fractions showed high spontaneous water absorption rate in kinetics assay. Oil absorption seemed to essentially depend on the microstructural characteristics of the fibre powders whereas water absorption were determined by the material's hydrophilicity.

Quince leaves were found to constitute a promising natural source of bioactive phytochemicals such as phenolics and organic acids, with antioxidant and antiproliferative properties suitable for application in nutritional/pharmaceutical fields (Oliveira et al. 2010). Comparisons with green tea, considered by the scientific community as an effective natural antioxidant, were established. Phenolics from quince fruit and leaves were found to possess antimicrobial, antioxidant, anticancer, hypoglycaemic antiulcerative, antimicrobial, antiviral, antiallegic and immunomodulatory activities.

Antioxidant Activity

In one study, thirteen fatty acid esters of cinnamyl alcohols, three fatty acid esters of hydroxybenzoic acid, three fatty acid esters of hydroxybenzaldehyde, three glucosides of aromatic acids, four chlorogenic acids, two flavonols, and a benzylamine were isolated and identified from organic extract of quince peels (Fiorentino et al. 2008). The chlorogenic acids and the flavonols exhibited more antioxidant and radical scavenger capacity than the positive standards α-tocopherol and ascorbic acid. Another research showed that the strength of antioxidant activity and 2,2′-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity of the fruit phenolics varied according to different in-vitro evaluation systems, whereas the antioxidative property of rat blood increased in all rats orally administered fruit phenolics (Hamauzu et al. 2005, 2006). Quince was found to have considerable amounts of hydroxycinnamic derivatives mainly composed of 3-caffeoylquinic acid and 5-caffeoylquinic acid and polymeric procyanidins. The antioxidant functions of quince and Chinese quince phenolic extracts were superior to that of chlorogenic acid standard or ascorbic acid evaluated in both the linoleic acid peroxidation system and the DPPH radical scavenging system.

The phenolic fraction of the methanol extract of quince fruit (pulp, peel, and seed) and jam exhibited a stronger antioxidant activity than the whole methanolic extract (Silva et al. 2004a). Organic acid fractions were always the weakest in terms of antiradical activity, implying that the phenolic fraction contributed more to the antioxidant potential of quince fruit and jam. The methanol peel extract showed the highest antioxidant capacity. Among the phenolic fractions, the seed fraction was the one that exhibited the strongest antioxidant activity. The IC_{50} values of quince pulp, peel, and jam phenolic fractions were strongly correlated with caffeoylquinic acids and phenolics total contents. For organic acid fractions, the peel was the one that had the strongest antiradical activity. The IC_{50} values of quince pulp, peel, and jam organic acid fractions were correlated with the ascorbic acid and citric acid contents.

Quince leaf was found to have comparable antioxidant activity as green tea (*Camellia sinensis)* (Costa et al. 2009). Quince leaf exhibited a significantly higher reducing power than green tea (mean value of 227.8 and 112.5 g/kg dry leaf, respectively). Quince leaf extracts showed similar DPPH (2,2′-diphenyl-1-picrylhydrazyl) radical-scavenging activities (EC_{50} mean value of 21.6 μg/ml) but significantly lower than that presented by green tea extract (EC_{50} mean value of 12.7 μg/ml). Caffeoylquinic acid was found to be the major phenolic compound in quince leaf extract. Under the oxidative action of AAPH (2,2′-azobis(2-amidinopropane) (dihydrochloride)), quince leaf methanolic extract significantly protected the erythrocyte membrane from hemolysis in a similar manner to that found for green tea (IC_{50} mean value of 30.7 and 24.3 μg/ml, respectively).

Anticancer Activity

Studies revealed that quince leaf and fruit extracts exhibited marked antiproliferative activities (Carvalho et al. 2010). The extracts from quince leaf showed concentration-dependent growth inhibitory activity toward human colon cancer cells (IC_{50} = 239.7 μg/ml), while no effect was observed in renal adenocarcinoma cells. Concerning the fruit, seed extracts exhibited no effect on colon cancer cell growth, whereas strong antiproliferative efficiency against renal cancer cells was observed for the highest concentration assayed (500 μg/ml). The antiproliferative activity of pulp and peel extracts was low or absent in the selected range of extract concentrations.

Antimicrobial Activity

Quince peel extract was found to be the most active in inhibiting bacterial growth with minimum inhibitory and bactericide concentrations in the range of $102^{-5} \times 10^{3}$ μg polyphenol/ml (Fattouch et al. 2007). It was postulated that chlorogenic acid acted in synergism with other components of the extracts to exhibit their total antimicrobial activities.

Antiviral Activity

Chloroform-methanolic extract of quince fruit yielded four new sesterterpene esters, namely 24, 25-O-diacetylvulgaroside, 25-O-acetylvulgaroside, 24-O-acetyl-25-O-cinnamoylvulgaroside, and 25-O-cinnamoylvulgaroside that exhibited antiviral (HIV) activity (De Tommasi et al. 1996a, b).

Hypoglycaemic Activity

Oral administration of *Cydonia oblonga* ethanol leaf extract (500 mg/kg) for 5 days in diabetic rats caused a decrease in blood glucose levels by 33.8% (Aslan et al. 2010). Moreover, the *Cydonia oblonga* extract induced significant alleviation on only heart tissue TBARS levels (44.6%) but did not restore reduced glutathione (GSH) levels in kidney, liver, and heart tissues of diabetic rats.

Antiallergic Activity

Gencydo(®), a combination of lemon (*Citrus limon*) juice and aqueous quince (*Cydonia oblonga*) extract had been used as a traditional topical treatment of allergic disorders. Studies by (Gründemann et al. 2011) revealed that Gencydo(®) downregulated soluble mediators, which were essential for the initiation and maintenance of allergic reactions. Gencydo(®) reduced the degranulation and histamine release of IgE-activated basophilic cells and mast cells and inhibited the IgE- and PMA/A23187-induced increases in IL-8, TNF-α and GM-CSF production in mast cells. The effects were comparable to that of the used concentration of azelastine and dexamethasone. Furthermore, Gencydo(®) partially blocked eotaxin release from human bronchial epithelial cells, but had no impact on the viability and activation of GM-CSF-activated eosinophil granulocytes.

Immunomodulatory Activity

Hot water quince extract reduced the induction of intracellular cyclooxygenase (COX)-2 expression but not COX-1 expression in mouse bone marrow-derived mast cells (Kawahara and Iizuka 2011). The extract reduced the elevation of interleukin-13 and tumour necrosis factor-α expression level. The extract also suppressed these cytokine expressions and leukotriene C(4) and prostaglandin D(2) production in mouse bone marrow-derived mast cell. The results suggested that quince hot water extract had an inhibitory effect on broad range of the late-phase immune reactions of mast cells.

Antiulcerative Activity

In the ethanol-induced gastric ulcer, pre-administration of Chinese quince and quince phenolics suppressed the occurrence of gastric lesions in rats, whereas apple phenolics seemed to promote ulceration (Hamauzu et al. 2006). The trend of myeloperoxidase activity was similar to that of the ulcer index. The results showed that Chinese quince and quince phenolics might have health benefits by acting both in blood vessels and on the gastrointestinal tract.

Traditional Medicinal Uses

Quince has been used as an herbal medicine since ancient times.

The fruit is antivinous, astringent, cardiac, carminative, digestive, diuretic, emollient, expectorant, pectoral, peptic, refrigerant, restorative, stimulant and tonic. An infusion has been employed for sore throat, diarrhoea and haemorrhage of the bowel. It is effective against inflammation of the mucous membranes, intestines and stomach. The fruit, and its juice, can be used as a mouthwash or gargle to treat mouth ulcers, gum problems and sore throats Quince is also used in the cosmetic industry and for medicinal cosmetics. The unripe fruit is very astringent, a syrup made from it is used in the treatment of diarrhoea and is particularly safe for children. The fruit is rich in pectin. Pectin is said to protect the body against radiation and has a beneficial effect on the circulatory system and helps to reduce blood pressure. In Malta, a teaspoon of quince jam dissolved in a cup of boiling water relieves intestinal discomfort. The leaves contain tannin and pectin. Tannin can be used as an astringent. The stem-bark is astringent and used for ulcers in Chinese herbal medicine.

The seed is a mild but reliable laxative, astringent and antiinflammatory. The seeds are used as a remedy for pneumonia and lung disease in Iran. In parts of Afghanistan, the quince seeds are collected and boiled and then ingested to combat pneumonia. The seeds are also rich in pectin, soaked or boiled in water, release the mucilage from the seed coat. The mucilage has a soothing and demulcent action when taken internally and is used in the treatment of sore throat and respiratory diseases, especially in children. This mucilage is also applied externally to minor burns and use for eye lotions. Studies in Iran reported that quince seed mucilage proved to hasten wounds more rapidly than a commercial wound healing cream (1% phenytoin) or eucerin cream without mucilage (Hemmati and Mohammadian 2000). Quince leaves have been used as decoction or infusion, in folk medicine for their sedative, antipyretic, anti-diarrheic and antitussive properties and for the treatment of various skin diseases (De Tommasi et al. 1996a; Oliveira et al. 2007). *Cydonia oblonga* leaves are used as a folk remedy for the treatment of diabetes in Turkey (Aslan et al. 2010). In Germany, Gencydo(®), a combination of lemon (*Citrus limon*) juice and aqueous quince (*Cydonia oblonga*) extract has been used traditionally in anthroposophical medicine for treating patients with allergic rhinitis or asthma (Gründemann et al. 2011).

Other Uses

Quinces are very widely used as rootstocks for pears and is also suitable for loquat. Quince has the property of dwarfing the growth of pears, of forcing them to produce more precociously, and to bear more fruits, instead of vegetative growth, and of accelerating the maturity of the fruit. Quince flower is also a rich nectar source for bees. Quince fruit because of their strong and rich fragrance was once popularly used as room deodorisers. Mucilage from the seed coat is used as a gum arabic substitute to add gloss to a material. Quince leaves contain 11% tannin and can be used for tanning.

Comments

Four other species previously included in the genus *Cydonia* have now been moved to separate genera. These are the Chinese Quince, *Pseudocydonia sinensis*, a native of China, and the three flowering quinces of eastern Asia in the genus *Chaenomeles.*

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