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# Flowers for edible gardens: combinations of species and colours for northwestern Italy

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## Abstract

Flowers have been used for centuries to flavour and garnish food in several ancient cultures, both in Europe (Romans and Greeks) and Asia (Chinese and Indians). After a period of abandon, the recent growing interest towards nutraceutical and functional food revives the consumption of edible flowers. Edible flowers represent an important source of biologically active compounds with positive effects on consumer health. Flowers are in fact a source of mineral elements and phytochemicals with remarkable antioxidant activity. The Alcotra Fr-It 2014-2020 ANTEA project aims at developing a transboundary supply chain (France-Italy) of edible flowers. The activities involve also the design and planning of new *edible landscapes*, i.e. multi-functional spaces with aesthetic value aimed to the production of edible flowers. In this report, we analysed and selected ornamental species with edible flowers suitable for garden design in northwestern Italy.

**Keywords:** nutraceutical, ornamentals, urban landscape, urban horticulture

## INTRODUCTION

Flowers have been used in traditional cooking as decoration, relishes and flavour enhancers by several cultures and for several thousand years, from Asia to ancient Greece and Rome, from medieval France to Victorian England (Mlcek and Rop, 2011; Lu et al., 2016). In recent years, edible flowers are increasingly demanded worldwide due to their health benefits (Lu et al., 2016). Flowers have indeed nutritional compounds such as proteins, amino acids and carbohydrates, but above all phytochemicals, i.e. bioactive non-nutrient compounds mainly represented by carotenoids and phenolics, which strongly reduce the risk of major chronic diseases (Sandhya et al., 2014; Liu, 2003).

The ecological importance of urban landscapes can be deeply enhanced through the planning of gardens composed by edible flowers, in which the aesthetic value of ornamental plants is combined with the nutraceutical properties of their flowers. This approach of *edible landscape* was recently adopted to design a public garden situated in Cherasco (CN, Italy, 44°39'14.0"N 7°51'25.9"E), in the framework of the Alcotra Fr-It 2014-2020 ANTEA project.

In this paper, we report the criteria and the characteristics of the species selected accordingly, which can be adopted in other sites with similar environmental conditions.

## MATERIALS AND METHODS

Ornamental species were selected according to five main criteria: (I) the flower edibility, which was carefully verified by examining the scientific literature; (II) the adaptability to the site's environmental conditions (44°39'14.0"N 7°51'25.9"E); (III) the low maintenance requirements, which have led to prefer perennial plants; (IV) flower colour assortment and (V) bloom at different times of the year. For each species selected, the uses as food and the properties were then documented.

## RESULTS AND DISCUSSION

The species selected to design and plan the public garden of Cherasco and their characteristics are reported and described in Table 1, grouped by flower colour. These species

could be effectively combined to design a urban garden, fulfilling the growing interest of merging ornamental and edible plant in the same place.

Table 1. List of the species selected in the project, grouped by flower colour, with related flowering time, beneficial properties and food use.

Flower colour	Species	Flowering time	Flower properties	Eaten in/as
Rose	<i>Allium schoenoprasum</i> L.	June-August	Antioxidant, antibacterial, anticancer [1,2]	Flavouring of butter, oil, cooked vegetables, salads, cheeses, pasta and rice. Mild onion flavour and taste
	<i>Antirrhinum majus</i> L.	May-September	Antioxidant, antimicrobial [3,4]	Salads
	<i>Dianthus caryophyllus</i> L.	May-August	Antioxidants, antibacterial [3,5]	Flavouring of oil, vinegar, vegetable and fruit salads. Decoration of cakes and bakery products. Clove flavour
	<i>Hibiscus syriacus</i> L.	June-September	Antioxidant [6]	Salads, soups and herb teas. Food colouring
	<i>Trifolium pratense</i> L.	January-December	Expectorant, antispasmodic [7]	Salads and herb teas
Blue-Violet	<i>Borago officinalis</i> L.	April-August	Purifying, antitussive, sudorific, anti-inflammatory [1,8,9,10]	Salads, soups, desserts, syrups and drinks. Cucumber taste
	<i>Crocus sativus</i> L.	September-November	Antioxidant, antidepressant, anti-inflammatory, sedative, carminative, eupeptic [1,8,9,10]	Salads. Stigmas are known as saffron
	<i>Cynara cardunculus</i> L.	June-August	Anticancer, antimicrobial, anti-inflammatory, eupeptic, diuretic, hepatoprotective [1,8,9,11,12]	Vegetable rennet is produced from dried flowers
	<i>Lamium purpureum</i> L.	March-October	Antioxidant [1,13]	Snacks or decoctions
	<i>Lavandula angustifolia</i> Mill.	June-September	Antispasmodic, antiseptic, sedative, carminative, cicatrizing [1,8,9]	Flavouring and decoration of cakes and bakery products. Essential oil to flavour food
	<i>Passiflora incarnata</i> L.	June-July	Antispasmodic, sedative, soothing, anxiolytic [1,8,9,14,15]	Herb teas and syrups
	<i>Rosmarinus officinalis</i> L.	April-August	Antibacterial, antispasmodic, antioxidant, anti-inflammatory, antiseptic, eupeptic [1,8,9,16]	Flavouring of butter, oil, salads, soups, broths, roasts. Essential oil to flavour food
	<i>Viola odorata</i> L.	February-April	Antitussive, diuretic, emollient, expectorant [8,9,17]	Salads, creams. Flavouring and decoration of herb teas, cakes and bakery products
White	<i>Allium ursinum</i> L.	May-June	Antioxidant, anti-inflammatory, antimycotic, cardio protective [1,18,19]	Garlic substitute
	<i>Bellis perennis</i> L.	January-December	Antispasmodic, anti-inflammatory, antidepressant, diuretic, expectorant [8,10]	Salads and soups

Flower colour	Species	Flowering time	Flower properties	Eaten in/as
(continued)	<i>Crataegus monogyna</i> Jacq.	April-May	Antioxidant, antispasmodic, sedative, hypotensive [1,8,9,20]	Syrups, puddings and herb teas. Flower buds are eaten in salads
	<i>Magnolia denudata</i> Desr.	March-April	Antioxidant <sup>[15]</sup>	Salads. Fried in batter. Pickled, to flavour rice
	<i>Osmanthus fragrans</i> Lour.	Spring and autumn	Antioxidant, anti-inflammatory, antitussive <sup>[21]</sup>	Herb teas, decoctions and sweets. Apricot flavour
	<i>Sambucus nigra</i> L.	April-June	Antioxidant, anti-inflammatory, antibacterial, diuretic, emollient, sudorific, laxative [1,8,9]	Herb teas and drinks. Flavouring honey, jellies and jams
Yellow-Orange	<i>Calendula officinalis</i> L.	June-December	Anti-inflammatory, antispasmodic, antiseptic, hepatoprotective, emollient, refreshing, cicatrizing [1,8,9,22]	Flavouring and decoration of salted dishes, bakery products and herb teas. Food colouring
	<i>Helianthus tuberosus</i> L.	August-October	Antibacterial, antimycotic <sup>[23]</sup>	Decoration of soups and rice
	<i>Helichrysum italicum</i> G.Don	May-September	Anti-inflammatory, antibacterial, emollient, antitussive, expectorant [1,9,24]	Herb teas and drinks. Essential oil to flavour food
	<i>Hemerocallis fulva</i> L.	May-June	Antioxidant, anticancer <sup>[25]</sup>	After drying, flavouring of salted and sweet dishes. Flower buds have peas flavour
	<i>Mahonia aquifolium</i> Nutt.	April-May	Antioxidant <sup>[26]</sup>	Herb teas and drinks
	<i>Primula vulgaris</i> Hudson	February-May	Antioxidant <sup>[27]</sup>	Flavouring and decoration of cakes, bakery products and salads. Frozen, to flavour drinks and sorbets
	<i>Taraxacum officinale</i> Weber	February-May	Antioxidant, anti-inflammatory, hepatoprotective, diuretic, laxative, depurative, analgesic [1,8,9,28]	Salads and soups
Various	<i>Tilia cordata</i> Mill.	May-June	Antispasmodic, antitussive, diuretic, emollient, refreshing, sedative, anxiolytic [1,8,9,29]	Herb teas and decoctions
	<i>Mentha</i> spp.	April-October	Antioxidant, antimicrobial, antispasmodic, antitussive, anaesthetic, tonic, carminative [1,8,9]	Decoration. Essential oil to flavour food
	<i>Prunus</i> spp.	March-April	Antioxidant, anticancer <sup>[30,31]</sup>	Flavouring and decoration of soups, salads and sweets. Pickled
	<i>Rosa</i> spp.	May-July	Antioxidant, inflammatory, antibacterial, neurotonic [1,8,9,32]	Salads. Dried, flavouring and decoration of herb teas, drinks and sweets
	<i>Salvia</i> spp.	March-August	Inflammatory, antibacterial, antiseptic, eupeptic [1,8,9]	Flavouring of butter, vinegar, oil, salads and creams. Essential oil to flavour food

Flower colour	Species	Flowering time	Flower properties		Eaten in/as
(continued)	Thymus spp.	April-August	Antioxidant, antimicrobial, antispasmodic, diuretic, rheumatic	antiseptic, eupeptic, sedative, anti- <sup>[1,8,9,33]</sup>	Flavouring of butter, oil, cooked vegetables, salads, soups, pasta and drinks. Essential oil to flavour food
<sup>[1]</sup> Marzi and De Mastro, 2008	<sup>[9]</sup> Corbetta et al., 2001	<sup>[17]</sup> Vishal et al., 2009	<sup>[26]</sup> Gunduz, 2013		
<sup>[2]</sup> Kucekova et al., 2011	<sup>[10]</sup> Grzeszczuk et al., 2016	<sup>[18]</sup> Sobolewska et al., 2015	<sup>[27]</sup> Demir et al., 2014		
<sup>[3]</sup> Rop et al., 2012	<sup>[11]</sup> Velez et al., 2016	<sup>[19]</sup> Sendl, 1995	<sup>[28]</sup> Schütz et al., 2006		
<sup>[4]</sup> Riaz et al., 2013	<sup>[12]</sup> Christaki et al., 2012	<sup>[20]</sup> Barros et al., 2011	<sup>[29]</sup> Anesini et al., 1999		
<sup>[5]</sup> Mohammed and Al-Bayati, 2009	<sup>[13]</sup> Budzianowski and Budzianowska, 2006	<sup>[21]</sup> Wu et al., 2009	<sup>[30]</sup> Shi et al., 2009		
<sup>[6]</sup> Geng et al., 2012	<sup>[14]</sup> Dhawan et al., 2001	<sup>[22]</sup> Muley et al., 2009	<sup>[31]</sup> Lee et al., 2007		
<sup>[7]</sup> Lin et al., 2000	<sup>[15]</sup> Lu et al., 2016	<sup>[23]</sup> Denoroy, 1996	<sup>[32]</sup> Ochir et al., 2013		
<sup>[8]</sup> Mauquini et al., 2006	<sup>[16]</sup> Kontogianni et al., 2013	<sup>[24]</sup> Sala et al., 2002	<sup>[33]</sup> Nikolić et al., 2014		
		<sup>[25]</sup> Fu et al., 2009			

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## Literature cited

- Anesini, C., Werner, S., and Borda, E. (1999). Effect of *Tilia cordata* flower on lymphocyte proliferation: participation of peripheral type benzodiazepine binding sites. *Fitoterapia* 70(4), 361-367.
- Barros, L., Carvalho, A.M., and Ferreira, I.C. (2011). Comparing the composition and bioactivity of *Crataegus monogyna* flowers and fruits used in folk medicine. *Phytochem. Anal.* 22(2), 181-188.
- Budzianowski, J., and Budzianowska, A. (2006). Chromatographic and spectrophotometric analyses of the DPPH free radical scavenging activity of the fractionated extracts from *Lamium album* L., *Lamium purpureum* L. and *Viscum album* L. L. *Herba Pol.* 52(1/2), 51-57.
- Corbetta, F., De Santis, A., Forlani, L., and Murari, G., eds. (2001). *Piante Officinali Italiane*-Il Nuovo Lodi (Bologna, Italy: Edagricole), pp.872.
- Christaki, E., Bonos, E., and Florou-Paneri, P. (2012). Nutritional and functional properties of *Cynara* crops (Globe Artichoke and Cardoon) and their potential application: a review. *International Journal of Applied Science and Technology* 2(2) 64-70.
- Demir, N., Gungor, A.A., Nadaroglu, H., and Demir, Y. (2014). The antioxidant and radical scavenging activities of Primrose (*Primula vulgaris*). *Eur. J. Exp. Biol.* 4, 395-401.
- Denoroy, P. (1996). The crop physiology of *Helianthus tuberosus* L.: a model oriented view. *Biomass Bioenerg.* 11(1), 11-32.
- Dhawan, K., Kumar, S., and Sharma, A. (2001). Anti-anxiety studies on extracts of *Passiflora incarnata* Linneaus. *J. Ethnopharmacol.* 78(2), 165-170.
- Fu, M., He, Z., Zhao, Y., Yang, J., and Mao, L. (2009). Antioxidant properties and involved compounds of daylily flowers in relation to maturity. *Food Chem.* 114(4), 1192-1197.
- Geng, M., Ren, M., Liu, Z., and Shang, X. (2012). Free radical scavenging activities of pigment extract from *Hibiscus syriacus* L. petals *in vitro*. *Afr. J. Biotechnol.* 11(2), 429-435.
- Grzeszczuk M., Stefabuak A., Pachlowska A. (2016). Biological value of various edible flower species. *Acta Sci. Pol.-Hortum Cultus* 15 (2), 109-119.
- Gunduz, K. (2013). Morphological and phytochemical properties of *Mahonia aquifolium* from Turkey. *Pak. J. Agri. Sci.* 50(3), 439-443.
- Kontogianni, V.G., Tomic, G., Nikolic, I., Nerantzaki, A.A., Sayyad, N., Stosic-Grujicic, S., Stojanovic, I., Gerothanassis, I.P. and Tzakos, A.G. (2013). Phytochemical profile of *Rosmarinus officinalis* and *Salvia officinalis* extracts and correlation to their antioxidant and anti-proliferative activity. *Food Chem.* 136(1), 120-129.

- Kucekova, Z., Mlcek, J., Humpolicek, P., Rop, O., Valasek, P., and Saha, P. (2011). Phenolic Compounds from *Allium schoenoprasum*, *Tragopogon pratensis* and *Rumex acetosa* and their antiproliferative effects. *Molecules* 16(11), 9207–9217.
- Lee, B.B., Cha, M.R., Kim, S.Y., Park, E., Park, H.R., and Lee, S.C. (2007). Antioxidative and anticancer activity of extracts of cherry (*Prunus serrulata* var. *spontanea*) blossoms. *Plant Food Hum. Nutr.* 62(2), 79.
- Lin, L.Z., He, X.G., Lindenmaier, M., Yang, J., Cleary, M., Qiu, S.X., and Cordell, G.A. (2000). LC-ESI-MS study of the flavonoid glycoside malonates of red clover (*Trifolium pratense*). *J. Agric. Food Chem.* 48(2), 354–365.
- Liu, R.H. (2003). Health benefits of fruit and vegetables are from additive and synergistic combinations of phytochemicals. *Am. J. Clin. Nutr.* 78(3), 517S–520S.
- Lu, B., Li, M., and Yin, R. (2016). Phytochemical content, health benefits, and toxicology of common edible flowers: a review (2000–2015). *Crit. Rev. Food Sci. Nutr.* 56(1), S130–S148.
- Marzi, V., and De Mastro, G. eds. (2008). *Piante officinali* (Bari, Italy: Mario Adda), pp.472.
- Maugini, E., Maleci Bini, L., and Mariotti Lippi, M., eds. (2006). *Manuale di botanica farmaceutica*, VI edn. (Padova, Italy: Piccin), pp.490.
- Mlcek, J., and Rop, O. (2011). Fresh edible flowers of ornamental plants—A new source of nutraceutical foods. *Trends Food Sci. Technol.* 22(10), 561–569.
- Mohammed, M.J., and Al-Bayati, F.A. (2009). Isolation and identification of antibacterial compounds from *Thymus kotschyanus* aerial parts and *Dianthus caryophyllus* flower buds. *Phytomedicine* 16(6), 632–637.
- Muley, B.P., Khadabadi, S.S., and Banarase, N.B. (2009). Phytochemical constituents and pharmacological activities of *Calendula officinalis* Linn (*Asteraceae*): a review. *Trop. J. Pharm. Res.* 8(5), 455–465.
- Nikolić, M., Glamočlija, J., Ferreira, I.C., Calhelha, R.C., Fernandes, Â., Marković, T., Marković, D., Giweli, A., and Soković, M. (2014). Chemical composition, antimicrobial, antioxidant and antitumor activity of *Thymus serpyllum* L., *Thymus algeriensis* Boiss. and Reut and *Thymus vulgaris* L. essential oils. *Ind. Crop. Prod.* 52, 183–190.
- Ochir, S., Yuki, T., Kanazawa, T., Nishizawa, M., and Yamagishi, T. (2013). Two galloylated flavonoids as antioxidants in *Rosa gallica* petals. *Chem. Nat. Compd.* 49(5), 940–942.
- Riaz, M., Rasool, N., Rasool, S., Rashid, U., Bukhari, I.H., Zubair, M., Noreen, M., and Abbas, M. (2013). Chemical analysis, cytotoxicity and antimicrobial studies by snapdragon: a medicinal plant. *Asian J. Chem.* 25(10), 5479–5482.
- Rop, O., Mlcek, J., Jurikova, T., Neugebauerova, J., and Vabkova, J. (2012). Edible flowers—A new promising source of mineral elements in human nutrition. *Molecules* 17(6), 6672–6683.
- Sala, A., Recio, M.D.C., Giner, R.M., Máñez, S., Tournier, H., Schinella, G., and Ríos, J.L. (2002). Anti-inflammatory and antioxidant properties of *Helichrysum italicum*. *J. Pharm. Pharmacol.* 54(3), 365–371.
- Sandhya Deepika, D., Sowjanya Lakshmi, G., Laxmi Sowmya, K., and Sulakshana, M. (2014). Edible flowers—A Review article. *International Journal of Advanced Research in Science and Technology*, 3(1), 51–57.
- Sendl, A. (1995). *Allium sativum* and *Allium ursinum*: Part 1 Chemistry, analysis, history, botany. *Phytomedicine* 1(4), 323–339.
- Schütz, K., Carle, R., and Schieber, A. (2006). *Taraxacum*—A review on its phytochemical and pharmacological profile. *J. Ethnopharmacol.* 107(3), 313–323.
- Shi, J., Gong, J., Liu, J.E., Wu, X., and Zhang, Y. (2009). Antioxidant capacity of extract from edible flowers of *Prunus mume* in China and its active components. *LWT-Food Sci. Technol.* 42(2), 477–482.
- Sobolewska, D., Podolak, I., and Makowska-Wąs, J. (2015). *Allium ursinum*: botanical, phytochemical and pharmacological overview. *Phytochem. Rev.* 14(1), 81–97.
- Velez, Z., Campinho, M.A., Guerra, Â.R., García, L., Ramos, P., Guerreiro, O., Felício L., Schmitt, F., and Duarte, M. (2012). Biological characterization of *Cynara cardunculus* L. methanolic extracts: antioxidant, anti-proliferative, anti-migratory and anti-angiogenic activities. *Agriculture* 2(4), 472–492.
- Vishal, A., Parveen, K., Pooja, S., Kannappan, N., and Kumar, S. (2009). Diuretic, laxative and toxicity studies of *Viola odorata* aerial parts. *Pharmacology online* 1, 739–748.
- Wu, L.C., Chang, L.H., Chen, S.H., Fan, N.C., and Ho, J.A.A. (2009). Antioxidant activity and melanogenesis inhibitory effect of the acetonetic extract of *Osmanthus fragrans*: A potential natural and functional food flavor additive. *LWT-Food Sci. Technol.* 42(9), 1513–1519.