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Significance of essential oils and herbal extracts on vase life of cut flowers: A review

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Abstract
Longer vase life of cut flowers is preferred in flower cultivation and marketing as good quality trait for retailers and consumers. Longevity of flower has been influenced by various biotic and abiotic factors. It can be improved using different preservatives substances. Essential oils and herbal extracts widely evaluated among which Thyme, Rosemary, Geranium, Mint, Eucalyptus, Ajowan, Savory, Coriander, Dill and *Piper betle* leaf extracts are used. For instance, essential oil was tested on lisianthus, gerbera, chrysanthemum, alstroemeria, gladiolus, rose and carnation cut flowers shown positive responses were reported in case of cut flowers longevity. Most studies reported usefulness of essential oils and herbal extracts for floriculture as noble alternative substitute to other silver and chemical compounds because of their antimicrobial activities and environmental friendly nature of the extracts. Different scientific findings on application of these organic products on longevity of cut flowers reviewed in this paper.

Keywords: cut flower, vase life, mode of action, essential oil, herbal extracts

Introduction
The longevity of cut flowers is one of the main challenges of floriculture industry (Marandi *et al*., 2011) [34]. Vase life of cut flowers is mainly affected by two main factors, namely ethylene which accelerates the senescence of many flowers and by microorganisms which cause vascular blockage and thus reduces the vase life of cut flowers (Kader, 2003) [27]. Microorganisms, especially bacteria and fungi which grow in preservative solutions have a marked adverse effect on the longevity of cut flowers. These microorganisms and their chemical products plug the stem ends and restrict the water absorption which in turn decreases the longevity of flowers (Dinesh *et al*., 2002) [18]. Because of such problems different growers use different environmental friendly materials and techniques in order to prolong vase life of cut flowers and to ensure quality as well as healthy of sellers and buyers (Bidarigh, 2015) [9]. It can be improved using different preservatives substances. Silver can pollute the environment due to its high phytotoxicity potential with harmful heavy metal environmental contamination (Shanan *et al*., 2010; Damunupola and Joyce, 2006) [45, 15].

In recent years, use of organics in the field of agriculture, medicine and food preservation is increasing. People giving more importance to organic or natural substances can be seen, because of their safe usage and eco-friendly nature. Nowadays, non chemical alternatives such plant extract, essential oils are being applied by many authors reported as extends vase life of many cut flowers (Bazaz *et al*., 2015; Bidarigh, 2015; Hashemabadi *et al*., 2013) [7, 8, 21]. These are natural organic compounds which are safe for the environment and due to the antimicrobial properties related to their high levels of phenolic and terpene compounds are used for the post harvest pathogen control (Basiri *et al*., 2011 and Braga *et al*., 2008) [4, 12]. Even though, in some cases the organic products are costlier than chemical or synthetic, they are ready to buy, in order to avoid the harmful chemicals. There is also a demand for novel floral preservatives which are safe and natural, as cut flowers are used in day to day life in one the other form. So, we can reduce the use of chemical preservatives.

However, even though there is a wider opportunity to use essential oil and plant extracts, there is limited information about utilization as alternative in vase life longevity of cut flowers in the country. Therefore, the aim of this study paper is to review effect of essential oil and plant

extract on vase life of cut flowers for further understanding and information provision for users.

Cut flower

Cut flowers are used for decorative purposes and used during weddings and funerals, gifts on occasions and in times of illness, and at holidays and to beautify homes and public places. The most important thing in cut flower handling is its post harvest treatments to prolong vase life (Hussen and Yassin, 2013) [25].

Vase life of flower

Vase life is post harvest duration of a cut flower and it varies among species and cultivars (Bayat *et al*., 2011) [5]. It is one of the quality traits as it represents amount of time spent and the conditions that flowers experience while in transit from farm to end user. The longevity of cut flowers is one of the main challenges of floriculture industry (Marandi *et al*., 2011) [34]. When flowers are cut from the mother plant, water loss from these continues through transpiration. When cut flower absorbs water from the solution it maintains a better water balance and flower freshness is maintained (Rogers, 1973) [41]. In addition to controlling and maintaining cut flower quality, keeping its longevity is another mandatory in flower markets as short postharvest vase life is one of the most important problems of the cut flowers (Nermeen *et al*., 2010) [37].Vase-life of cut flower is most attractive and economic component of cut flower (Chakrabarty, 2009) [14].

Thus, the techniques of prolonging the vase-life of cut flowers have to be given special attention as they play great role for growers, traders and final users. The use of preservative compounds in the vase solution is one of the common methods to extend the vase life of cut flowers (Hashemabadi *et al*., 2016) [22]. Because of this, herbal extracts and essential oils as preservative compounds becoming popular in prolonging vas life of cut flower.

Mode of action

Essential oils also contain high level of phenolic compounds such as carvacrol, thymol and eugenol (Bountirou *et al*., 2007, Michajilov *et al*., 2010) [11, 35]. Thus, active phenolic compounds might have several invasive targets which could lead to the inhibition of microorganisms (Ultee *et al*., 2000) [49]. A study conducted by Burt and Runders (2003) [13] and Braga *et al*. (2008) [12] showed that essential oil (carvacrol) derived from oregano plant damages bacterial cell walls of *Escherichia coli* Tyagi and Malik (2010) [48] reported that lemongrass essential oil treated cells (24 h) of Candia albicans showed shrinked and deshaped cells. Piper (Piper betel L.) extract at one per cent completely inhibited microbial growth in both in vitro tests and in vivo tests (holding solution of cut rose) it also delayed the bent neck, ethylene production and maintained freshness of leaves (Jitareerat *et al*., 2008) [26].

Essential oil and plant extract

An essential oil and plant are extracted from blossoms, seeds, fruits, fruit peels, leaves, stems, barks, wood and roots. It is used as odorants, flavorants, and pharmaceutical ingredients as a safe and environmentally friendly natural plant product that has strong antimicrobial properties against some pathogens (Bayat *et al*., 2013; Ozcan and Erkmen, 2001) [6, 38]. The essential oils of clove, cinnamon, lemongrass, rosemary, patchouli, eucalyptus, neem and pongamia have strong antimicrobial properties against some pathogens due to presence of high levels of phenolic, aldehyde, terpenes, alcohols and flavonoids compounds such as eugenol, methyl cinnamate, e-cinnamaldehyde, citrala, citral-b, alpha-pinene, beta-pinene, patchouli alcohol, 1-8-cineole, azadirachtin, pongamicin and karanjin (Prabuseenivasan *et al*., 2006; Biljana *et al*., 2011; Khan and Ahmad, 2011; Lavanya and Brahmaprakash, 2011) [39, 10, 29, 31]. Besides, have great role in floriculture industry because of its environmental friendly properties and its antimicrobial properties in prolonging cut flowers freshness and post harvest durations.

According to Sardoei *et al*. (2014) [42] post harvest vase life longevity and maintaining good quality include major post harvest practices in floriculture so as to make products deliver to customers with acceptable quality. Different preservatives have been used in various flower companies. Positive response of essential oil addition to vase solution with respect to cut flower water up take, its relative fresh weight and freshness of flower has been reported (Bayat *et al*., 2013) [6].

Dareini *et al*. (2014) [16] studied on the effect of pulse treatment of *Thymus vulgaris* at 50 mg/l and *Cuminum cyminum* 100 mg/l concentration along with sucrose 3% some essential oils and also thyme (0.2 mg/ liter) in pulsing with distilled water helped on postharvest quality and vase life of gerbera cut flowers (*Gerbera jamesonii* cv. Sorbet) (Amini *et al*., 2014) [2]. In addition, positive effects of thyme essential oil was reported in post harvest handling of various cut flowers such as cut narcissus, chrysanthemum, rose and alstroemeria (Sardoei *et al*., 2014; Bazaz *et al*., 2015; Eshaghdavatgar *et al*., 2013; Babarabie *et al*., 2015; Fariman and Tehranifar, 2011) [42, 7, 19, 3, 20]. Ali *et al.* (2014) [1] and reported that the effects thyme essential oil concentration 5% thyme resulted in the highest vase life *Narcissus* flowers. Lilium flowers treated with peppermint and thyme oil with a concentration of 900 mg/l increased the vase life of 15 days. Solgi *et al.* (2009) [47] evaluated the antimicrobial agents such as thymol, carvacrol, thyme oil and zataria oil in combination with 6% sucrose had a positive effect on the vase life and relative solution uptake gerbera (*Gerbera jamesonii* cv. Dune') flowers.

According to Davood *et al*. (2013) [17] 30% of artemisia oil improved vase life of chrysanthemum cut flowers. Furthermore, 10 % geranium essential oil significantly increases the vase life of cut chrysanthemum (*Dendranthema grandiflorum* L.) with 18.41 days (Shahla and Davood, 2015) [43]. Geranium essential oil (Hashemabadi *et al*., 2016) [22] were suggested as the most efficiency and enhancing impact on postharvest quality of cut chrysanthemum flowers as postharvest vase life prolonged. Zarchini *et al.* (2013) [51] reported that effect of different concentrations of artemisia oil on vase life and other post harvest characteristics of cut chrysanthemum cv. White flowers.

Another finding on post harvest vase life treatment of rosemary oil at a concentration of 200 mg/l in cut Lisianthus flowers (*Eustoma grandiflorum* L.) had significantly increase vase life of 15.6 days (Kazemi *et al*., 2014) [28]. Furthermore, Yeganeh *et al*. (2011) [50] observed that rosemary extract on vase life and some qualitative characteristics of cut carnation flowers (*Dianthus caryophyllus* cv. 'white liberty')

According to the report of Hashemabadi *et al*. (2015) [23] 12% Artemisia and Anethum essential oils induced the maximum vase life of cut carnation flowers and that of Shanan *et al*. (2010) [45] found that the maximum vase-life was recorded with dill oil followed by coriander in carnation cv. Farida. Moreover, effect of extract of ajowan oil at 500 ppm concentration had beneficial effect on fresh weight (%) and vase life of cut gladiolus Rasul *et al*. (2011) [40]. Marandi *et al.*

(2011) [34] investigated the effects of application of ajowan and summer savory essential oils (500 and 1000ppm) with 6% sucrose on post harvest quality sensors of gladiolus and rose cut flowers.

Besides, studies by Leila *et al*. (2016) [32] showed that eucalyptus and *Rosa damascene* essences on vase life and some physiological characteristics of gerbera cut flowers. Shamili and Samadizad (2010) [44] reported that the gladiolus cv. Holland pink flower were treated with essence of *Origanum vulgare* (1mg/l) had much effect in improvement of post-harvest quality and vase-life. Mahboobeh *et al.* (2012) [33] studied on the improvement vase life and postharvest quality of cut chrysanthemum (*Dendranthema grandiflorum* L.) by eryngo oil

Shanan (2012) [45] and Hegazi and Gan (2009) [24] reported that essential oils were investigated namely, anise, cumin, geranium, common lavender, sage, sweet basil, cinnamon, blue gum and lemon grass and tested as antimicrobial agents for effects on the vase life and other characters of rose and *gladiolus* cut flowers.The role of thyme, savory and ajowan essential oils as alternative input to chemical substance for extending vase life of gladiolus cut flowers studied and essential oils recommended with regards to alternative to compounds containing silver and chemical preservatives (Mirdehghan and Aghamolayi, 2016) [36]. Khatibi *et al.* (2012) [30] investigation on the effect of eryngo oil on vase life and postharvest quality of cut chrysanthemum cv. Yellow.

Table 1: Important research findings

Flowers	Essentail oil	Concentration (ppm)	Vase life (days)	Authors
Rose	Ajowan	500	20.00	Marandi *et al.*, 2011[34]
Gladiolus	Ajowan	500	20.00	Marandi *et al.*, 2011[34]
Carnation	Dill	300	16.00	Shanan *et al.*, 2010[45]
Gerbera	Carvacrol	50	16.00	Solgi *et al.*, 2009[47]
Alstroemeria	Pepper mint	100	13.03	Bazaz and Tehranifar, 2011[7]
Carnation	Summer savory	100	9.5	Bayat *et al.*, 2011[5]
Gladiolus	Clove	500	14.33	Hegazi and Gan, 2009[24]
Chrysanthemum	Thymol	125	19.58	Hashemabadi *et al.*, 2013[21]

Conclusion

Since the flowers are increasingly popular in either urban and rural areas in one way or the other, concern on its post-harvest life is also felt by various stake holders involved in the trade of this flower. At present only chemical preservatives are being used for extending the vase life of these flowers. But of late it is learnt that some of these preservatives are proved harmful to the persons who are involved in handling them. Essential oil and plant extracts are not only safe but eco-friendly. They are natural organic substances, which prevents the microbial proliferation on the vase solution, which in turn will extend the flower vase life. Essential oils along with its antimicrobial properties also keep the living place very pleasant and joy able. This novel agent can be used as alternatives to chemical floral preservatives.

Therefore, the importance of essential oil for vase life longevity of cut flowers in flower industry has to be supported by national research system in collaboration with commercial growers in order to find out cost effective and environmentally friendly alternative essential oils preservatives.

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