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Packaging technology for extending shelf life of jasmine (*Jasminumsambac* CV. Mysuru Mallige) flowers

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Abstract
A research on standardization of method of packaging to extend shelf life of *Jasminumsambac* Cv. Mysuru Mallige was conducted in College of Horticulture, Mysuru during 2016-17. Effects of different packaging material and storage condition on physiological loss of weight, freshness score, fragrance score, colour retention index and shelf life were studied. The flowers treated with 4% boric acid, packed in 60 micron polyethylene bags without ventilation and stored in thermocole box with aluminium foil lining in gel – ice pad cold condition shows effective in extending shelf life of Mysuru Mallige flowers up to 48hrs with minimum physiological losses in weight of 0.034%, high freshness score of 4.96, fragrance score of 4.65 and colour retention of 4.53 when compare to shelf life of 24hrs in control with physiological losses in weight of 11.94, high freshness score of 1.000, fragrance score of1.667 and colour retention of 2.80.

Keywords: Jasmine, Packages, Post-harvest technology, Shelf life.

Introduction
Jasmine is one of the first flowers that come to mind when one thinks about pleasant fragrance. It belongs to the family oleaceae of order oleales and the genus jasminum have more than 200 species, among them 04 are cultivated commercially in India. The cultivar Mysuru Mallige belongs to the group *J sambac* and has got G.I status due its unique fragrance. These flowers are commonly cultivated in Mysuru and Mandya regions of Karnataka and are used for various purposes like religious offering, veni, making garland, extraction of essential oil in the form of absolute and concrete which are used in cosmetic and perfumery industry. These flowers have good demand for export due to its attractive fragrance. But one of the major problem faced by farmers are lack of suitable packaging material, less shelf of flowers and browning of petals on the second day of harvest with abrupt loss in fragrance.
In India, if we avoid wastage of horticultural produce up to 2% from field to market, there will be saving of 100 to 200 crores per year (*Ramana et al.* 1988) [10]. Keeping this in mind, A study was undertaken to enhance the shelf life of Mysuru Mallige flower along with developing a packaging material for export.

Material and method
The present research was carried out in the department of Floriculture and Landscape Architecture, college of Horticulture, Mysuru during 2017. This experiment was laid out in CRD design with 10 treatments and 3 replication. The treatments are: T_1 – 4% boric acid + flowers are stored under ambient condition, T_2- 4% boric acid + flowers are stored under 7 °c, T_3 - 4% boric acid + flowers are packed in polythene packing (60micron) without ventilation, T_4 - 4% boric acid + flowers are packed in polythene packing (80micron) without ventilation, T_5 - 4% boric acid + flowers are packed in polythene packing (60micron) without ventilation and stored under 7 °c, T_6 - 4% boric acid + flowers are packed in polythene packing (80micron) without ventilation and stored under 7 °c, T_7 - 4% boric acid + flowers are packed in polythene packing (60micron) without ventilation and stored in thermocole box with gel ice pads. T_8 - 4% boric acid + flowers are packed in polythene packing (80micron) without ventilation and stored in thermocole box with gel ice pads. T_9- Flowers are kept in normal

polythene carry bag and stored at 7 °c, T_{10}- water spray + storage under ambient condition with normal polythene.

50g of uniform size, freshly harvested flowers are used for each treatments and observation like physiological loses of weight (PLW), freshness score, fragrance score, shelf life and colour retention index were recorded during storage of flowers at regular intervals.

Physiological loses of weight was calculated by subtracting fresh weight of flowers at the time of packing and at 12th, 24th, and 36thhr after harvesting of flowers and expressed as percentage. Visual parameters like freshness, fragrance score and colour retaintation index were recorded based on hedonic scale scoring (1999), the score was expressed on 0 to 5 and average was calculated. Shelf life of the flower was measured as time taken to wilt 50% of flowers. The resulted data were statistically analysed using the method of Sukhatme and Amble (1985) [11].

Table 1: Effect of different gauges of polythene, thermocole packing and storage condition on Physiological loses in weight, Freshness score and Fragrance score of Mysuru Mallige flowers.

Treatment details	Physiological loses in weight (%)			Freshness score (5 point scale)			Fragrance score (5 point scale)		
	12thhr	24thhr	36thhr	12thhr	24thhr	36thhr	12thhr	24thhr	36thhr
Treatment 01	1.066	2.534	3.294	5.00	4.00	1.00	5.00	4.00	1.66
Treatment 02	0.70	0.894	1.586	5.00	4.33	3.16	5.00	4.33	2.66
Treatment 03	0.254	0.854	1.054	5.00	4.00	2.00	5.00	4.00	2.00
Treatment 04	0.346	2.20	-1.206	5.00	4.00	2.00	5.00	4.16	1.00
Treatment 05	0.114	1.106	0.846	5.00	4.66	4.33	5.00	5.00	4.16
Treatment 06	0.140	-0.9	-7.866	5.00	5.00	3.50	5.00	5.00	3.66
Treatment 07	0.034	0.046	0.034	5.00	5.00	4.96	5.00	5.00	4.65
Treatment 08	0.146	0.254	0.734	5.00	5.00	4.93	5.00	5.00	4.67
Treatment 09	0.160	0.054	3.20	5.00	4.00	2.16	5.00	4.00	2.00
Treatment 10	1.334	10.93	11.94	5.00	4.00	1.00	5.00	2.83	1.66
CD @ 5%	0.3	0.03	0.25	0.00	0.21	0.17	0.00	0.19	0.14
SEm+/_	0.01	0.01	0.08	0.00	0.07	0.03	0.00	0.06	0.05
CV %	4.51	1.03	10.40	0.00	2.68	2.17	0.00	2.49	2.88

Table 2: Effect of different gauges of polythene, thermocole packing and storage condition on colour retention index and shelf life of Mysuru Mallige flowers.

Treatment details.	Colour retention index (5 point scale)			Shelf life. (hr)
	12thhr	24thhr	36thhr	
Treatment 01	5.00	4.00	3.80	25.10
Treatment 02	5.00	4.20	3.77	27.28
Treatment 03	5.00	4.40	3.98	32.13
Treatment 04	5.00	4.50	4.10	31.56
Treatment 05	5.00	4.55	4.35	41.51
Treatment 06	5.00	3.90	4.20	40.39
Treatment 07	5.00	4.80	4.53	48.13
Treatment 08	5.00	4.70	4.42	44.28
Treatment 09	5.00	3.65	3.21	28.32
Treatment 10	5.00	3.50	2.80	23.52
CD @ 5%	0.00	0.17	0.28	1.53
SEm+/_	0.00	0.04	0.07	0.51
CV%	0.00	1.75	3.04	2.56

Result and Discussion

Packaging of jasmine flowers in polythene bags of different gauges and different storage condition viz: ambient temperature, refrigerator condition and also in thermocole box packings, and the observation were recorded and shown improved shelf life, less physiological loss in weight, high fragrance score, high colour retention index and high freshness score (Table 1 and 2)

Flowers packed in different packages were significantly affected the PLW (Table 1). The minimum PLW at 12th, 24th and 36th hours were noticed in flowers treated with 4% boric acid and packed in polythene packing (60micron) without ventilation and stored in thermocole box with gel ice pads (Treatment 7) followed by treatment 5. (4% boric acid + flowers are packed in polythene packing (60micron) without ventilation and stored under 7 °c) while the unpacked flowers recorded the maximum value at 12th, 24th and 36thhrs of storage (T_{10}- water spray + storage under ambient condition with normal polythene). This might be due to maintenance of optimum humidity temperature and proper balance of CO_2 and O_2 concentration under thermocole packing condition which interns slows down the process of respiration and evapotranspiration and ultimately reduced the PLW (Ahn-Gwiyeen and Ahn, 1997) [1]. The results are in close agreement with the findings of Nirmala and Venkatesh Reddy (1993) [9].

It is revealed from the result that, the freshness score, fragrance score and colour retention were significantly influenced by the treatments (Table 1 and 2). The high freshness score and fragrance scorewere observed in treatment 7 (4% boric acid and packed in polythene packing (60micron) without ventilation and stored in thermocole box with gel ice pads) followed by treatment 8 (4% boric acid + flowers are packed in polythene packing (80micron) without ventilation and stored in thermocole box with gel ice pads) while the treatment 10 (water spray + storage under ambient condition with normal polythene) treatment 1(4% boric acid + flowers are stored under ambient condition) and treatment 4 (4% boric acid + flowers are packed in polythene packing (80micron) without ventilation) are failed to maintain the freshness and

fragrance score up to 36thhrs. This might be due to polyethylene films of 60 micron storage in thermocole boxes with gel ice pad are capable of modifying the atmosphere in the packs and thus allowing the flowers to be stored for several days without affecting the freshness. This results are in close agreement with the findings of Marchal and Nolin (1990) [7] and Madaiah and Venkatesh Reddy (1994) [5].

Packaging of jasmine flowers in polythene bags of 60 micron and 80 micron thickness without ventilation retained the characteristic white colour (freshness) and fragrance up to 24thhr when stored under refrigerated condition and storage under thermocole boxes with gel ice pads retained up to 48.13 hrs while flower packed in normal polythene last their colour and fragrance with in 24thhrs of packaging. The phenol accumulation was also found to be minimum with normal colour retention and fragrance in the packed flowers than the control. This might be due to treatment of boric acid is an antisence agent. Burzo *et al.* (1998) [2] reported that the brown colouration and loss of fragrance might be due to the accumulation of flavins and other phenolic substances in flower cell vacuoles.

In this investigation flowers packed in 60 micron polythene bags treated with no ventilation along with boric acid treatment and store under thermocole boxes proved effectiveness in extending of shelf life of jasmine up to 48.13 hr which was closely followed by 60 micron polythene bag under refrigerated condition. The results are in line with the findings of Mukopadhyay *et al.* (1980) [8] and Nirmala and Venkatesa Reddy (1993) [9].

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