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Herbal extract of *Nyctanthes arbor-tristis* L. as holding solution for rose

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Abstract

Rose (*Rosa hybrida*) is very important flower crop as it is the highest demanded flower in international flower trade. Senescence of rose flower buds is still not completely understood. It is important to explore the mechanisms of oxidative stress management to understand petal senescence. Flower senescence is being a hot concern in research related to floriculture here the investigation has conducted on the effect of herbal extract on vase life of rose. Leaf extract of *Nyctanthes arbor-tristis* and betel are known for antibacterial activities so used as a component of vase solution. vase solution 2% sucrose +1000 µg/ml *Nyctanthes arbor-tristis* extract+2% Piper extract found the best on the basis of changes in physiology in rose variety grand gala.

Keywords: Senescence, vase solution, leaf extract

Introduction

Rose (*Rosa hybrid*) is very important flower crop as it is the highest demanded flower in international flower trade. Senescence of rose flower buds is still not completely understood. It is important to explore the mechanisms of oxidative stress management to understand petal senescence. Plant extracts have been well documented to inhibit microbial growth. Studies on the effects of plant extracts on microorganisms have been examined by several researchers in different parts of the world. Preservative solutions usually increase the vase life of cut roses but the use of plant extracts as antimicrobials in vase solutions has been rarely reported. Microbial proliferation on the vase solution can be checked by use of plant extract, which in turn will extend the flower vase life. Plants with possible antimicrobial activity, biochemical and physiological parameters should be tested against an appropriate microbial, biochemical and physiological model to confirm the activity and to ascertain the parameters associated with it.

Materials and methods

The present investigations were carried out at the Model Floriculture Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, District Udham Singh Nagar (Uttarakhand). The experiment was carried out using the Completely Randomised Design method (Steel and Torrie, 1981) [1]. Grand Gala variety was used in this experiment. Number of replications was three and Number of cut stems/vase was one.

Holding solution treatments were

1. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract
2. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract +2% Piper extract
3. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract +0.25 ppm Azadirachtin
4. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract +150 ppm 8-HQC
5. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract + 2% Piper extract +0.25 ppm Azadirachtin
6. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract + 0.25 ppm Azadirachtin +150 ppm 8-HQC
7. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract + 2% Piper extract +150 ppm 8-HQC
8. 2% sucrose +1000 µg/ml *Nyctanthes arbor- tristis* leaf extract +2% Piper extract +150 ppm 8-HQC + 0.25 ppm Azadirachtin
9. Control (distilled water)

Result

Fresh weight

On the first day the fresh weight was maximum in 2% sucrose +1000 µl/ml of *Nyctanthes arbour-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (12.95 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (12.65 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+0.25 ppm Azadirachtin (11.45 g/stem) and minimum was 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (8.15 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (8.75 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (9.55 g/stem).

On 3rd day 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (14.675 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (13.765 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (13.745 g/stem) and minimum was 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (10.625 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (10.805 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (11.005 g/stem).

On 5th day maximum fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (14.945 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (13.97 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (12.85 g/stem) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (9.495 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (9.905 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (10.855 g/stem).

On 7th day maximum fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (16.125 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (12.45 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (11.055 g/stem) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (7.5 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (8.23 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (8.255 g/stem).

On 9th day maximum fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (17.355 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (10.305 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (8.655 g/stem) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (5.295 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25

ppm Azadirachtin + 150 ppm 8-HQC (5.46 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (5.97 g/stem).

On 11th day maximum fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (16.755 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (8.205 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (8.655 g/stem) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (3.395 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (3.85 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (3.98 g/stem).

On 13th day maximum fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (15.555 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (7.295 g/stem) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (4.85 g/stem) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (2.905 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (2.96 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (3.275 g/stem).

On 15th day maximum fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (14.255 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (6.865 g/stem) and control (4.045 g/stem) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (2.36 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (2.495 g/stem) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin.

Percent of change in fresh weight

Percent of change in fresh weight from first day to 3rd day the percentage of change in fresh weight by roses was maximum in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (32.57%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (29.13%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 0.25 ppm Azadirachtin+ 150 ppm 8-HQC (28.27%) while minimum was 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (8.8%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (13.27%) and control (17.34%).

On 5th day percentage of change in fresh weight was maximum in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (21.4%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (14.14%) and 2% sucrose+1000 µl/ml of *Nyctanthes*

arbor-tristis leaf extract + 0.25 ppm Azadirachtin+ 150 ppm 8-HQC (12.32%) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (6.22%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (7.14%) and control (7.26%).

On 7th day maximum percentage of change in fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (24.53%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (22.81%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 0.25 ppm Azadirachtin+ 150 ppm 8-HQC (18.82%) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (8.63%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (11.34%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (14.78%).

On 9th day percentage of change in fresh weight was maximum in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (30.41%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (28.29%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (26.67%) while minimum in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (7.41%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (16.895) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (19.44%).

On 11th day maximum percentage of change in fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (32.26%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (29.65%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 0.25 ppm Azadirachtin+ 150 ppm 8-HQC (25.02%) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (6.48%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (18.31%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (19.37%). on 13th day maximum percentage of change in fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (17.06%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (15.54%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (15.41%) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (7.02%) followed by control (8.77%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (9.06%). on 15th day maximum percentage of change in fresh weight was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (19.09%) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (12.86%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (12.63%) while minimum was in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (4.61%) followed

by control (6.44%) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (6.50%).

Maximum head Diameter

The maximum head diameter was observed in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (8.85 cm) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (7.53 cm) and control (6.855 cm) while minimum in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (5.255 cm) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (5.59 cm) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 0.25 ppm Azadirachtin+ 150 ppm 8-HQC (5.805 cm).

Days taken to maximum diameter of flower

During the year 2013-14 maximum days taken to attain maximum diameter of the flower was by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (9.205 days) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (7.15 days) and control (6.4 days) while minimum days taken to attain maximum diameter of the flower was 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (3.4 days) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin (4.4 days) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+ 0.25 ppm Azadirachtin (4.45 days).

Vase life

The maximum vase life was observed in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract (14.26 days) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract (9.75 days) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 150 ppm 8-HQC (8.315 days) while minimum vase life was observed in 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract+2% piper extract + 0.25 ppm Azadirachtin + 150 ppm 8-HQC (5.05 days) followed by 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 150 ppm 8-HQC (6.725 days) and 2% sucrose+1000 µl/ml of *Nyctanthes arbor-tristis* leaf extract + 0.25 ppm Azadirachtin+ 150 ppm 8-HQC (6.75 days).

In present investigation attempt has been made to standardize vase solution by using sucrose, 8- Hydroxyl Quinoline Citrate with herbal extracts of *Nyctanthes arbour-tristis*, *Piper betel* and Azadirachtin as these herbal extracts and 8-HQC has been proved to be biocide.

The fresh weight in treatment 1 rapidly increased upto 3rd day then afterwards it decreased slowly. While in treatment 2 the fresh weight increased up to 9th day and decreased afterwards. The rate was very slow but constant. In case of all other treatments the fresh weight increased upto 3rd day but the rate of changing in fresh weight is erratic. Similar results have been reported by Gebremedhin *et al.* 2013 [2]. The increase in fresh weight may be due to higher water uptake during early days. Decrease in fresh weight and percentage change in fresh weight of flower after some days is due to high water loss and the declining water uptake and confirmed by Bayleyegn *et al.* (2012) [3].

Increase in the pool of dry matter, lowering of osmotic potential of petals is due to use of sucrose (Halevy and Mayak, 1979) [4] so promotes respiration (Coorts, 1973) and extension of longevity causes due to delaying in autocatalytic rise in ethylene. Nicholas (1979) [7] has been explained about the biocheinhhibition zoneal basis for this was due to rapid conversion of absorbed sucrose into reducing sugar which get accumulated in corolla to suppress senescence of cut flowers. The herbal extract of *Piper betel* and *Nyctanthes arbour-tristis* is responsible for the antiinhibition zonerobial activity against the inhibition zonerobes responsible for vascular plugging. Anisha, 2013 and Hirapure and pote, 2014 [5], Suparna *et al.*, 2014 [8], Balasubramanian, 2012 [9] has been already confirmed about antiinhibition zonerobial activity of

Piper betel and *Nyctanthes arbour-tristis* respectively. So these extracts facilitate the solution uptake for vase life longevity. The treatment 2 (2% sucrose +1000 µg/ ml *Nyctanthes arbour-tristis* extract +2% Piper extract) shows better result than others may be due to the combination of extracts *Piper betel* and *Nyctanthes arbour-tristis* have symbiosis relationship among them and are more effective in controlling the bacteria in vase solution in comparison to use of single extract. The performance of combinations of all cheinhhibition zoneal is poor regarding vase life is may be due to the interaction between all herbal extracts and cheinhhibition zoneal. It shows the incompatibility of inhibition zoneals and herbal extracts.

Table 1: Fresh weight of rose flower in different vase solution during (gram/flower)

Treatments/ days	1 st day	3 rd day	5 th day	7 th day	9 th day	11 th day	13 th day	15 th day	Gm
2% sucrose + 1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract	8.75	10.62	11.22	9.705	7.91	5.91	4.81	4.02	7.86
2% sucrose +1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract+2% Piper extract	12.65	13.76	14.94	16.12	17.35	16.75	15.55	14.25	15.17
2% sucrose +1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract+0.25 ppm Azadirachtin	11.45	13.74	12.85	11.05	8.65	6.65	4.85	3.25	9.06
2% sucrose +1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract+150 ppm 8-HQC	8.15	10.80	9.49	7.5	5.29	3.39	2.90	2.49	6.25
2% sucrose +1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract+ 2% Piper extract +0.25 ppm Azadirachtin	8.75	11.00	9.90	8.23	5.97	3.98	3.27	2.96	6.76
2% sucrose +1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract+ 0.25 ppm Azadirachtin +150 ppm 8-HQC	9.55	12.25	10.91	9.04	6.72	4.74	4.04	3.64	7.61
2% sucrose +1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract+ 2% Piper extract +150 ppm 8-HQC	12.95	14.67	13.97	12.45	10.30	8.20	7.29	6.86	10.83
2% sucrose +1000 µg/ml <i>Nyctanthes arbour-tristis</i> extract+2% Piper extract +150 ppm 8-HQC + 0.25 ppm Azadirachtin	10.33	13.35	10.85	8.25	5.46	3.85	2.96	2.36	7.17
Control (distilled water)	10.26	12.04	11.23	9.64	7.14	5.04	4.44	4.04	7.98
Gm	10.31	12.47	11.71	10.22	8.31	6.50	5.57	4.87	8.74
Sem	0.46	0.18	0.92	0.15	0.92	0.92	0.6	0.63	
CD at 1%	0.22	0.86	0.43	0.75	0.43	0.43	0.28	0.302	
CV	0.639	0.206	0.111	0.219	0.156	0.200	0.152	0.185	
CV	7.12	5.59	5.88	6.65	7.84	8.35	10.18	14.76	

Table 2: Percentage of change in fresh weight by roses

Treatments/ days	3 rd day	5 th day	7 th day	9 th day	11 th day	13 th day	15 th day	
1	19.50	7.17	14.85	18.79	24.33	10.965	6.15	14.53
2	11.03	10.84	10.44	11.49	3.63	9.065	11.32	9.68
3	22.40	7.71	16.13	18.29	19.07	9.46	5.60	14.09
4	27.88	11.90	21.40	21.52	28.80	8.344	6.00	17.97
5	27.25	12.07	16.09	25.53	26.08	10.365	5.69	17.58
6	29.01	12.67	22.86	29.24	27.25	14.265	7.44	20.39
7	64.43	5.45	12.22	15.74	17.79	9.184	4.51	18.47
8	30.78	22.08	23.23	23.08	24.54	12.8	8.15	20.66
9	18.81	8.11	15.38	23.26	22.42	8.76	5.21	14.56
Gm	27.90	10.89	16.95	20.77	21.54	10.356	6.67	16.44
Sem	16.70	0.85	1.15	2.27	3.58	2.098	1.42	
CD at 1%	79.11	4.06	5.47	10.77	16.98	9.938	6.73	
CV	84.67	11.13	9.64	15.49	23.54	28.656	30.13	
CV	4.393	11.947	4.43	7.74	22.61	46.66	62.47	

Table 3: Dry weight of rose flower in different vase solution during 2013-14 (Gram/ flower)

Treatments/ days	1 st day	3 rd day	5 th day	7 th day	9 th day	11 th day	13 th day	15 th day	Gm
1	1.15	1.39	1.52	1.36	1.13	0.85			1.23
2	1.67	1.83	2.08	2.29	2.5	2.4	2.3	2.16	2.15
3	1.4	1.7	1.69	1.48					1.56
4	1.03	1.38	1.26	1.03					1.17
5	1.09	1.3	1.28	1.09					1.19
6	1.20	1.51	1.40	1.21					1.33
7	1.67	1.96	1.79	1.79	1.54				1.75
8	1.18	1.53	1.43						1.38
9	1.43	1.75	1.67	1.67	1.43				1.59
Gm	1.31	1.49	1.58	1.33	0.73	0.36	0.25	0.24	0.91
Sem	0.25	0.56	0.21	0.45	0.16	0.16	0.49		

CD at 1%	0.11	0.26	0.10	0.21	0.76	0.78	0.23		
CV	0.27	0.53	0.19	0.47	0.31	0.64	0.27		

Table 4: Maximum diameter of flower (cm)

Treatments/ year	Diameter in cm
1	7.53
2	8.85
3	6.005
4	5.59
5	6.105
6	5.805
7	6.805
8	5.255
9	6.855
Gm	6.5333
Sem	0.161
CD at 1%	0.762
CV	0.3486

Table 5: Days taken to maximum diameter of flower (Days)

Treatment/year	1st year
1	7.15
2	9.205
3	4.45
4	4.65
5	4.4
6	4.55
7	6.15
8	3.4
9	6.4
Gm	5.595
Sem	0.4815
CD at 1%	0.228
CV	1.2171

Table 6: Vase life of rose flower in different treatments (Days)

Treatments/year	1st year
1	9.75
2	14.26
3	6.95
4	6.725
5	6.91
6	6.75
7	8.315
8	5.05
9	8.1
Gm	8.09
Sem	0.6283
CD at 1%	0.2975
CV	1.0984

Conclusion

On the basis of physiological studies of rose flower vase solution 2% sucrose +1000 µg/ml *Nyctanthes arbour-tristis* extract+2% Piper extract was found to be the best among all vase solutions taken for the present investigation.

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