Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/2t24g185

EFFECT OF SOME CHEMICAL PRESERVATIVES AND THEIR PULSE TREATMENT IN ENHANCING THE VASE LIFE OF CUT FLOWERS OF TEPHROSIA PUPUREA LINN.

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Abstract:
The present studies was done on wild flowers of *Tephrosia pupurea* study the shelf life of cut flowers. These wild flowers of T. purpurea have beautiful and attractive inflorescence and can be used as an alternative for costly cut flowers. The treatment of cut flowers with vase solution having different concentration of chemicals like sucrose, $AgNO_3$, ethephon having different concentrations were studied for different parameters like flowers abscission, bud opening and longevity of flowers. It was observed that flower opening was considerably higher in 4 % sucrose solution bud opening was recorded as 76% and flower abscission was 18.7%.. the highest longevity was recorded in higher concentration of sucrose in vase solution. In silver nitrate treatment bud opening was observed to be highest (48%) in 600 ppm solution and lowest (26%) in 800 ppm solution as compared to control (13%). Longevity of flowers was high (4.5 days) in vase solution with 300 ppm.. Early loss of flowers from twigs was reported in ethephon as compared to other vase solutions taken in present study. Different concentration of pulse treatment was given to the cut flower twigs to study similar parameters. The pulse treatment with ethephon to cut flowers resulted in loss of flowers very early. The present studies attributes the use of sucrose and $AgNO_3$ can be good source for vase life of cut flowers of T. purpurea as compared to other chemicals for vase solution.

Keyword: Sucrose, longevity, cut flowers, vase solutions, $AgNO_3$

Introductiom

Cut flower market is creating a big revenue in the fresh market commodities. The cut flower market is flourishing and is highly competitive both domestically and internationally. India is now one of the flourishing country in this sector. Researchers related to cut flowers are working to enhance the shelf life, packaging storage and transport of the cut flowers. Cut ornamentals are complex plant organs, in which loss of quality of stem, leaves, or flower part may result in rejection in the market and decrease market value. Loss of quality may result from one of several causes, including wilting or abscission of leaves and/or petals, yellowing of leaves, and geotropic or phototropic bending of peduncle and stems (Hicklenton, 1991).

“Specialtiy cut fower” may be defined as any cut flower other than roses, carnation and chrysanthemum (Allan M Armitage 1992). Development of “novel specialty cut flower crops” is the need of the day and it has registered a distinct increase in the overall cut flower market due to consumer demand for new crops. Introduction of new crops begins with the search for alternative

crops determining the quality characteristics such as growth, development and aging, flower senescence, wilting leaf yellowing and senescence and shattering. Study of factor effecting post harvest quality including pre harvest factors, food supply, light water supply, growth tropism and mechanical damage are essential to develop new cut flower crops (Jaime and Teixeria, 2003).. Some of the native plants of arid and semi arid regions have beautiful flowers of varying characteristics.

Basic studies on post harvest life and longevity need to exploit desert plants for newly specialty cut flower crops. *Tephrosia purpurea* flowers can be used as a cut flower; it is a matter of study in the present investigation. In earlier time most of cut flowers were kept in water but now days scientists have introduced many floral preservatives to improve the vase life of cut flowers by chemical treatments after harvest have been made with varying success. When flowers are kept at room temperature in houses for decoration, flowers dry up due to water loss. If flowers are kept in vase containing water, the main cause of deterioration is stem end rot. Hence, if stem rot at cut end of the stalk is controlled, it may results in enhanced vase-life of the flowers (Singh et al., 1993).

Several preservatives/chemicals i.e. silver nitrate, aluminium sulphate, cobalt sulphate, 8-hydroxyquinoline sulphate, boric acid, citric acid, ascorbic acid, sucrose etc. have been used in different formulations and combinations to enhance the vase life of tuberose (Saini et al., 1994; Reddy et al., 1995; Reddy and Singh, 1996; Reddy et al., 1997 and De and Barman 1998). Among the other differently used chemicals of special concern are growth regulators i.e. benzyl adenine, gibberellic acid, naphthalene acetic acid, maleic hydrazide etc. (Bhaskar and Rao, 1998). Other growth regulators often act by modifying the action of natural hormones. Growth regulators are antagonistic such as anionic silver thiosulphate (STS) have been used in post harvest handling of cut flowers and potted plants to delay process involving ethylene, such as petal wilting drying of buds, fruits and leaves. 1-MCP (1- methyl cyclopropane) is a relatively newly introduced non toxic gaseous chemical which blocks ethylene binding at the receptor level, and renders fruit and flowers of several plants insensitive to ethylene (Sisler and Serek, 1997). Use of floral preservative is the most economical and practicable method for extending the post-harvest life of cut flowers (Salunkhe et al., 1990). Flowers remain fresh longer if they are placed in a suitable floral preservative (Nowak and Rundnicki, 1990). Amongst the inhibitors only STS has commercial application in many countries. However, its continued use is being question as silver a potent pollutant, and many countries have proposed to prohibit its use (Abdi et al., 1998). At present plant growth regulators are perhaps the most powerful tools for achieving increased vegetative and reproductive growth of plants. The combination of different vase solution and various treatment can increase the shelf life of the cut flowers. The present study focus on the two underexplored flowers plants *Tephrosia purpurea* to be used as cut flower.

Material and Methods

Tephrosia purpurea: Plant of *T. purpurea* is much branched, erect perennial herb, stem is more or less hairy, and leaves are up to 13 cm long stipulate lanceolate, linear and subulate or reflexed. It is found along road sides, pathways, open waste lands and fields specifically in nutrient poor soil. Flowers are reddish purple; peduncles are terminals or leaf opposed and raceme with 6-25 flowers. Calyx is lanceolate- acuminate and exceeding the tube in length. Corolla is deep purple in color. Style is glabrous and stigma penicillate. Pods are slightly recurved, glabrous or softly pubescent and 5-6 seeded. Flowering and fruiting occur in month of July to December (PLATE 1).

Standard preservatives were prepared by dissolving calculated amount of these chemicals in distilled water. The vase solutions were mixed with 200 ppm of 8 HQS (8- Hydroxyquinone sulphate), which act as germicide in water. The pH of all the solutions was adjusted by citric acid to 4.5 because at low pH water travels faster in the water conducting system (xylem), thereby preventing or reducing wilting. Data were recorded on; percentage of flowers opened, percentage of flowers abscission and vase life in days.

The vase life of flowers resulting from treatment effects was analysed with 2-way ANOVA using the statistical package ANALYSE IT (STD EDTN.) Treatment means were compared by LSD at $p <$

0.05 and the means (± SE) were shown as appropriate. Where possible, comparisons between the means were made using Duncan's Multiple Range Test.

Methods: Flowers were harvested and kept in different vase solutions for further observation. The spikes of flowers were placed in glass bottles containing 100 ml of chemical/preservative solution with desired concentration and kept in laboratory at room temperature. The experiment was laid down in a completely randomized design with three replications. Data were recorded on percentage of bud opened and number of flower abscission (after every 24hrs). The details of treatment/chemical solutions used is given below :

sucrose solution
•1% sucrose solution •2% sucrose solution •4% sucrose solution • 6% sucrose solution

Ethephon
1)Ethephon 195 ppm 2)Ethephon 360 ppm 3)Ethephon 780 ppm

Silver Nitrate
1)Silver Nitrate ($AgNO_3$) 300 ppm 2)Silver Nitrate ($AgNO_3$) 600 ppm •Silver Nitrate ($AgNO_3$) 800 ppm

Pulse treatment was also given to cut flowers with different chemicals or preservative for 24 hours and then placed in respective vase solution. The details of pulse treatment are given below:

pulse treatment 1	pulse treatment 2	pulse treatment 3	pulse treatment 4
•Flowers treated with sucrose (1, 2, 3 and 4%) and then placed in distilled water.	Flowers treated with ethephon (135,360 and 780 ppm) and then placed in distilled water.	Flowers treated with 195 ppm and ethephon then placed in sucrose (1%, 2%, 3% and 4%).	•Flowers treated with 195 ethephon and then placed In $AgNO_3$ (300 ppm, 600ppm and 800 ppm).

RESULTS

Effect of different vase solutions:

Sucrose: Flower opening was considerably increased, when flowers were placed in different concentrations of sucrose solution. In 4 % sucrose solution bud opening was recorded as 76% and flower abscission was 18.7%. Longevity of flowers increased as the concentration of sucrose solution was increased, highest longevity (6.5 days) of flowers was found in 4% sucrose solution and lowest (3.8 days) was in 1% sucrose as compared to 4.1 days in control.(Figure 1)

Silver Nitrate ($AgNO_3$): In silver nitrate treatment highest (48%) bud opening was seen in 600 ppm solution and lowest (26%) in 800 ppm solution as compared to control (13%) (Figure1). Longevity of flowers was high (4.5 days) in vase solution with 300 ppm $AgNO_3$ as compared to vase solution with 600 and 800 ppm AgNO3 solutions (Figure 1). Longevity of flowers was high (4.5 days) in 300 ppm vase solution as compared to 4.1 days in control.

Ethephon: Application of ethephon to cut flowers resulted in loss of flowers very early. In flower of *T. purpurea* maximum (96%) flower abscission was recorded at 780 ppm ethephon in vase solution as compared to 195 and 360 ppm ethephon (Figure 2). The longevity of flowers in ethephon treated samples was very less as compared to all other treatments. It was recorded as 1.5 days at 780 ppm and 3.1 days in 195 ppm ethephon which is quite low as compared to control (4.1 days).

Abscissic Acid (ABA): Abscissic acid hastens abscission of flower buds in *T. purpurea*. Flower abscission was 38% and 59% in 2 and 5 ppm ABA in vase solution respectively. The longevity of flowers was 3.6 days at 5 ppm concentration of ABA as compared to 4.1 days in control (Figure 2)

Effect of pulse treatment:

Sucrose: Different types of pulse treatment were given to flower of *T. pupurea*. Twigs with flower of *T. pupurea* when treated with sucrose (4%) for 24 hours (pulse treatment) and then placed in distilled water (DW) shows decrease in flower abscission and increase in number of bud opening as compared to low concentration of sucrose (1-3%) in vase solution (Figure 3). Flowers treated with sucrose (1%) as pulse treatment showed 18% bud opening and 64% flower abscission as compared to 50% bud opening and 22% abscission at 4% sucrose pulse treatment. Longevity of flowers also increased at high concentration of sucrose solution (4%) by 5.4 days as compared to 3.6 days in 1% sucrose solution. The longevity of flowers was also high in 2% (4.2 days), 3 % (5.1 days) and 4% (5.4 days) sucrose solution as compared to control (4.1 days).

Ethephon: Flowers treated with ethephon and then placed in distilled water showed delay in number of bud opening and high percent of flower abscission. In flowers with 780 ppm of ethephon showed highest 90% of flower abscission as compared to 40.2% in control (Figure 4). Lowest bud opening (14%) and 1.3 days longevity was recorded in flowers with 780 ppm ethephon. The longevity of flowers was very low (1.3 days in 780 ppm) as compared to 4.1 days in control.

Pulse treatment with Ethephon then placed in Sucrose: Flower twigs treated with 195 ppm of ethephon and then placed in sucrose solution showed more longevity of flowers as compared to flowers pulse treated with ehtephon and then placed in D.W. In 1% sucrose solution the % flower abscission was 89% whereas, in 4 % sucrose solution it was 77% which is very high as compared to 40% in control (Figure 5). As compared to 13% bud opening in control the bud opening in 2% sucrose was 15%, in 3% sucrose it was 17% and in 4 % sucrose the opening was 22%. The longevity of flower was high (3.2 days) in 4% sucrose solution as compared to 1.2 days in 3% sucrose solution but it was low as compared to 4.1 days in control.

Pulse treatment with Ethephon then placed in $AgNO_3$: Flowers treated with 195 ppm ethephon and then placing them in $AgNO_3$ solution increases its longevity and bud opening. In 300 ppm $AgNO_3$ solution the bud opening was recorded as 12% which is lower than 13 % in control whereas, in 600 ppm (15%) and 800 ppm (17%). Flower abscission was highest in 800 ppm as compared to 300 and 600 ppm $AgNO_3$ solution. The longevity of flower increased in 800 ppm (2.8days) as compared to 300ppm (1.8 days) and 600 ppm (2.4 days) $AgNO_3$, but the longevity of flowers is low as compared to 4.1 days in control (Figure 6).

Discussion : Cut flowers, have limited shelf life, their appearance, quality and longevity depends upon several factor including cultivation, proper harvest time, product transport conditions and post harvest handling. Several stress factors imposed on cut flowers are mechanical injury, decrease in water uptake, transpiration, hydraulic conductivity, fresh weight, water content of flowers and water potential (Jaime and Teixeira, 2003). Therefore methods of maintaining the quality of these fresh products over time, such that the consumer may be able to still enjoy them after harvest, have been improved dramatically. The traditional cut flowers in the market seems costly as it is imported from either other states or countries. The present study on the vase life of cut flowers of *T. purpurea* is to explore and introduce an alternative cut flower variety that is a wild plant and easily available and cultivated in any lkind of soil and environmental contions.

The treatment of the cut flowers with various concentration of solutions and pulse treatment reveals some traditional results as shown by any other cut flowers. Unlike many other cut flowers *Tephrosia purpurea* flowers shows continued improvement of vase life in 4% of sucrose solution. The number of buds opened is observed to be highest in 4% sucrose solution in both the cases of cut flowers. The flower abscission is also reduced at high concentration of sucrose solution and longevity was also increases at 4% sucrose solution in cut flowers of *T. purpurea*.. This shows that vase life of flowers is increased in high concentration of sucrose solution because it acts as good osmoticum and plays role as substrate of respiration. It is also observed by Cho et al., (2001) in flowers of Lisianthus (*Eustoma grandiflorum*) post harvest life is greatly improved by providing sugars in vase solution. Treatment of flowers with pulsing solutions containing sucrose (5 to 15%) improves the vase life of cyclamen (Halevy et al., 1984) and *Gladiolus* sp. (Mor et al., 1981). Pulsing of cut *Leucadendron* with sucrose concentrations as high as 20 to 30% for 24 hours at 1^{o}C, prevented foliage desiccation and improved the post-storage life (Jones, 1995). An understanding of the plant's physiological requirements after harvest is necessary. The synthesis and degradation of carbohydrates, organic acid, proteins, lipids, pigments, aromatic compound, phenolics, vitamins and phytohormone are classified as secondary processes, but are vital and influential to the quality of cut flowers (Wills et al., 1998). As studied by Asrar 2012 in the waxflower, sugar was most effective vase solution when applied in combination with a biocide, such as HQS, to prevent the growth of microorganisms in xylem vessels and maintain water uptake, thus prolonging the longevity of cut flowers although HQS can become toxic. The increase in vase life in vase solutions containing fructose or glucose may be due to the flower cells being supplied with an increased respiratory substrate to maintain stem water balance and stem fresh weight above the initial stem fresh weight for a longer time when compared with maltose or galactose (dung et al 2017). On other hand, sucrose pulsing increased the vase life of different cut flowers. Different concentrations of sucrose had been investigated by Butt (2005) on two cultivars of Rasa hybirida and results showed that sucrose at 25 gmL−1 extended the vase life by 8.2 days in var. Whisk Mc and 7.5 days in var. Trika as compared to 5.3days. Since the amount of sugars contained in cut flowers is limited, the addition of sugars such as sucrose to vase water is effective in promoting flower opening as well as extending the vase life of many cut flowers (Halevy and Mayak, 1979; Koyama and Uda, 1994 and Kuiper et al., 1995). In bird-of-paradise, pulsing with 10 to 25% sucrose extended flower longevity and increased the number of open florets throughout vase life, without causing any apparent injury due to high sucrose concentration (Halevy et al., 1978). Influences of sucrose on longevity and number of open florets were noted in work on bird-of-paradise and *Gladiolus* (Halevy et al., 1978 and Serek et al., 1994). High concentrations of sucrose in pulsing did not cause desiccation of the stem and florets when pulsed for 24 hour.

Pulsing with sucrose for 24 hrs and then placing the inflorescense in distilled water also increased the vase life of flowers of *T. purpurea* as compared to flowers pulse treated for 24 hours with ethephon and $AgNO_3$. But the longevity of flowers of *T. pupurea* was highest in vase solution with only sucrose as compared to flowers with pulse treatment of sucrose for 24 hours. These findings suggest that the promotive effect of sugar is probably due to the requirement of sugars for flower opening as substrates of respiration and osmoticum (Ichimura et al., 1998). Silver nitrate (AgNO3) is very potent inhibitors of ethylene action in plant tissues. The treatment of AgNO3 may be decreased the ethylene production by rose cut flowers tested in comparison to control .It is also provides some antimicrobial activity inside the plant tissues, thus its beneficial for ethylene sensitive flowers such as carnation (Nowak and Rudnicki, 1990) A significant improvement in vase life of rose cut flowers was occurred when treated with 30 ppm silver nitrate and the effect was further improved when sliver nitrate at 30 ppm combined with 3% (w/v) sucrose which attained the best result compared to other concentrations of sucrose (Elgimabi 2011)

Silver nitrate in holding solution may act as an antimicrobial agent and not as an inhibitor of ethylene synthesis (Ketsa et al., 1995). Beyer, (1976) showed that Ag+ is a potent inhibitor of the action of ethylene in plants. Microorganisms, which grow in vase water, include bacteria, yeasts and molds. These are harmful to cut flowers through their development and their consequent blockage of xylem

at cut ends, preventing the water absorption. They also produce ethylene and toxins, which accelerate flower senescence and reduce vase-life. Adding a suitable germicide in vase water can check the growth of microbes. Silver salts, mainly $AgNO_3$ is an effective bactericide, which is often added in vase water at a concentration of 10–200 ppm for the extension of vase-life (Nowak and Rundnicki, 1990).

In the flowers of *T. purpurea* the bud opening was highest in vase solution with 600 ppm and 800 ppm of silver nitrate solution respectively as compared to flowers treated with ethephon and 1% sucrose in vase solution. The beneficial effect of vase solutions containing Ag+ on the vase life of cut flower crops has widely been assumed to be the result of the powerful biocidal activity of the ion (Aarts, 1957).

The role of silver nitrate in the biosynthetic process of plants is experimentally evident. This chemical is a potent inhibitor of ethylene action and has a deep impact on the metabolic routine in the plant body. The ethylene produced by the application of silver nitrate has shown to affect the protoplast within the cell body. Production of ethylene due to silver nitrate seemed to be involved in growth differentiation and regeneration. The application of silver nitrate ($AgNO_3$) with different doses gave some positive results with respect to improved stem and leaf size, and the length of plantlets usually remained smaller, attributing to the absence of cells enlargement in the presence of profuse cell multiplication (Khalid et al., 1991 and Taylor et al., 1994).

Halevy et al., (1978) noted that the immersion of the inflorescence stalk base of bird-of-paradise in 1000 mg L^{-1} $AgNO_3$ for 15 minutes, caused reduction of longevity without affecting the final number of open florets. Bird-of-paradise behaves as other ethylene-insensitive flowers, such as *Sandersonia aurantiaca*, which also showed reduction of vase life when exposed to 1 mM silver thiosulfate for 6 hours (Eason et al., 1997).

Ketsa et al., (1995) investigated that $AgNO_3$ must be present alongwith 8-HOQ and glucose maximizes the water uptake and vase life of cut flowers of *Dendrobium Pompadour*. He also reported that foliar application of $AgNO_3$ to the whole inflorescence did not increase the vase life but $AgNO_3$ in the holding solution may act as an antimicrobial agent, and not as an inhibitor of ethylene synthesis. Frond (*Adiantum raddianum*) longevity was also increased more than five fold by holding in a vase solution containing 25 mg L^{-1} $AgNO_3$ but caused a brown discoloration of the pinnae veins (Fujino and Reid, 1983).

The improvement in vase-life of cut flowers of *T. purpurea* in different $AgNO_3$ solution might be due to the fact that it is a very effective biocide, which completely inhibits the microbial growth. It is in conformity with the findings of Ketsa et al., (1995) who opined that $AgNO_3$ prevented microbial occlusion of xylem vessels in *Dendrobium*, thereby enhancing water uptake and increasing longevity of flowers.

Awad et al., (1986) also attributed the beneficial effect of $AgNO_3$ in the vase-water to the production of Ag+ ions, which might inhibit the rise of ethylene precursor, thereby enhancing the longevity of cut flowers. Sucrose is widely used in floral preservatives, which acts as a food source or respiratory substrate and delays the degradation of proteins and improves the water balance of cut flowers.

Steinitz, (1982) reported that addition of sucrose to the solution increased the mechanical rigidity of the stem by inducing cell wall thickening and lignifications of vascular tissues. Sucrose antagonizes the effect of ABA, which promotes senescence (Halevy and Mayak, 1979). Sugars alone, however, tends to promote microbial growth. Hence, the combination of sugars and biocides might have extended the vase-life of cut flowers. $AgNO_3$ or sucrose alone was less effective as compared to their combinations with regard to vase-life. Similar results were also reported by Steinitz, (1982) and Awad et al., (1986) in *Gerbera* and *Zinnia*, respectively.

Pulsing with 10% sucrose for 12 or 24 hours extended the longevity of bird-of-paradise flowers when compared to untreated flowers by 29% and 31%, respectively. When the flowers were pulsed for 48 hours, there was 9% decrease in longevity, compared to unpulsed stalks. This deleterious effect of sucrose on flower longevity could be due to cell plasmolysis caused by excess sugar uptake by the stem (Markhart and Harper, 1995). The number of open florets, on the other hand, was not affected

by pulsing the flowers with 10% sucrose in any of the tested times. In contrast, Halevy et al., (1978) found that pulsing bird-of-paradise flowers with 10% sucrose for 48 or 72 hours mixed with 250 mg L^{-1} 8-hydroxyquinoline citrate and 150 mg L^{-1} citric acid improved the longevity and the number of open florets, compared to similar pulsing treatment for 24 hours.

Ethephon is lipophilic and upon entering the relatively more basic apoplastic environment it undergoes a degradation reaction releasing ethylene, chloride and phosphate ion. Ethephon induced flower abscission and petal senescence in the flowers of *T purpurea* and *C. decidua* at high concentration (780 ppm). Low concentration of ethephon in vase solution hastens bud opening but decreases the vase life of the flowers of both *T. purpurea*.

The inflorescence pulse treated for 24 hours in Ethephon (195 ppm) and then placed in $AgNO_3$ solution showed an increase in longevity of flowers of *T. pupurea* as compared to flowers with only ethephon solution (195, 360 and 780 ppm) in vase solution. The bud opening was high and the flower abscission was low in inflorescence with pulse treatment of 195 ppm ethephon and then placed in vase solution of 800ppm $AgNO_3$ as compared to inflorescence in 300 and 600 ppm $AgNO_3$ in vase solution.

Similar behaviour was observed in Gladiolus exposed to air containing different concentrations of ethylene (Serek et al., 1994). Cut inflorescences of several lupine species (*Lupinus cruickshankii, L. densiflorus, L. havardii, L. hartwegii, L. luteus and L. succulentus*) exhibited the highest sensitivity to CEPA (2-Chloroethyl phosphonic Acid) in the vase solution, while *L. densiflorus* and *L. luteus* inflorescenes were the least responsive. CEPA induced abscission of flowers in *L. cruickshankii, L. havardii and L. succulentus*, but not in *L. densiflorus and L. luteus*, although effects were apparent on flower senescence (Mackay et al., 2001).

Similarly as reported by Halevy et al., (1978) that the longevity of bird of paradise flowers were significantly reduced when sprayed with ethephon at a concentration of 1000 mg L^{-1} but, ethephon at 10 mg L^{-1} hastens bud opening but negatively affected vase life and other inflorescence characteristics of the cut flowers of *Nerin*e (Lukaszewska, 1997).

Pulse treatment of ethephon for 24 hrs in flowers of *T. purpurea* then placing in $AgNO_3$ solution increased bud opening and reduced flower abscission as compared to flowers treated with only ethephon in the vase solution. But the effect of pulse treatment with ethephon for 24 hrs and then placing cut flowers in D.W highly reduced its vase life as compared to pulse treatment with ethephon and then placing in sucrose solution which increased vase life as well as bud opening in both the cut flower of *T. purpurea*. .

Ethephon decreased longevity of flowers whereas the solution of glucose plus $AgNO_3$ increased longevity of cut dahlias cv. "Purple Gem". The joint use of ethephon and the preservative solution gave intermediate results (Abdel-Kader et al., 2004). Dipping in ethephon (500 or 1000 mg/L) failed to induce flower abscission in *V. chrysantha* or *V. plumosa*. Ethephon and ethylene both induced substantial flower, pedicel, and leaf abscission in *V. nitens* (Joyce and Poole, 1993).

Application of exogenous ABA to cut flowers from the cut stem end causes a rapid increase in ABA content in flower tissue and promoted ethylene production in flower (Onoue, 2000).

ABA in vase solutions when applied in high concentration (10 ppm), it increases flower abscission and decreases bud opening in flowers of *C. deciduas* and *T. purpurea.* The negative effect of ABA at high concentration may be due to its promotive effect on senescence of flowers. Addition of sucrose, mineral nutrients or plant growth regulators other than ABA to the water in which the cut buds were placed did not promote flower-opening under such conditions, but addition of ABA (10–100 μM) greatly promoted it (Kaihara and Takimoto, 1983).

Sucrose plus ABA treatment resulted in a greater reduction in solution uptake than did treatment with sucrose alone in flowers of *Eustoma*. Fresh weight and the number of open florets in flowers decreased more slowly in flowers treated with sucrose plus ABA than in flowers treated with sucrose alone. Both the sucrose and the sucrose plus ABA treatments extended flower vase-life compared to the control. Moreover, ABA and sucrose plus ABA treatments showed marked delays in leaf wilting.

These findings indicate that a pulse treatment with sucrose plus ABA suppresses leaf damage and improves the quality of cut *Eustoma* flowers (Yumoto and Ichimura 2006).

Kaihara and Takimoto, (1983) observed in *Pharbitis nil* that ABA alone or in combination with IAA suppressed flower opening completely. ABA in combination with sucrose increases the vase life of flowers. Sucrose plus ABA resulted in great reduction of solution uptake; it also decreases fresh weight and number of open florets and leaf wilting. Sucrose retarded and ABA promoted processes associated with senescense, wilting, and increase in pH and decrease in protein content of petals (Borochov et al., 2006) ABA plays a crucial role in induction of ethylene production during natural senescence in carnation flowers (Onoue, 2000).

Flowers of the plants studied showed that these are sensitive to exogenous application of ethylene (ex. ethephon), however no petal senescence from the flower suggests that endogenous level of ethylene during flowering stage is low.

The results suggests that cut flowers of *T. purpurea* has increased vase life in high concentration of sucrose solution as compared to $AgNO_3$, ethephon and ABA in vase solution. Sucrose also increased bud opening and longevity of flowers. Whereas, ethephon had deleterious effect on vase life of cut flowers studied in present investigation.

The beauty of the cut flowers lies with the freshness of the flowers for longer time without losing its aesthetic value. Most of the cut flowers are highly perishable due to high respiration rate and excessive weight loss. Enhancement of vase life of cut flowers is an important area in horticultural research. The vase life of cut flowers is limited by some factors such as senescence, weight loss, decay & air.

The results suggests that cut flowers of *T. purpurea* and *C. decidua* has increased vase life in high concentration of sucrose solution as compared to $AgNO_3$, ethephon and ABA in vase solution. Sucrose also increased bud opening and longevity of flowers. Whereas, ethephon had deleterious effect on vase life of cut flowers studied in present investigation.

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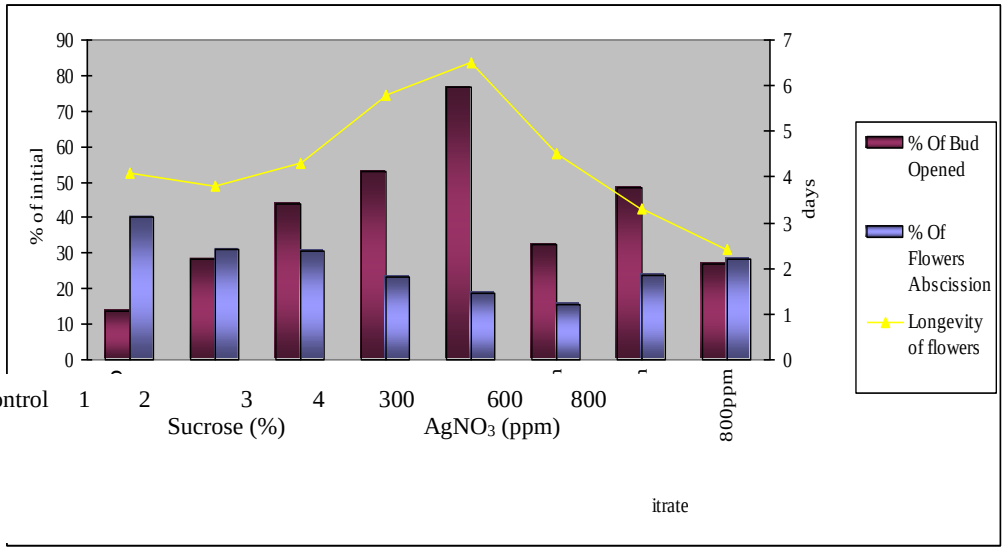

Figure 1- *Effect of Sucrose and Silver nitrate on shelf life /vase life of cut flowers of Tephrosia purpurea*

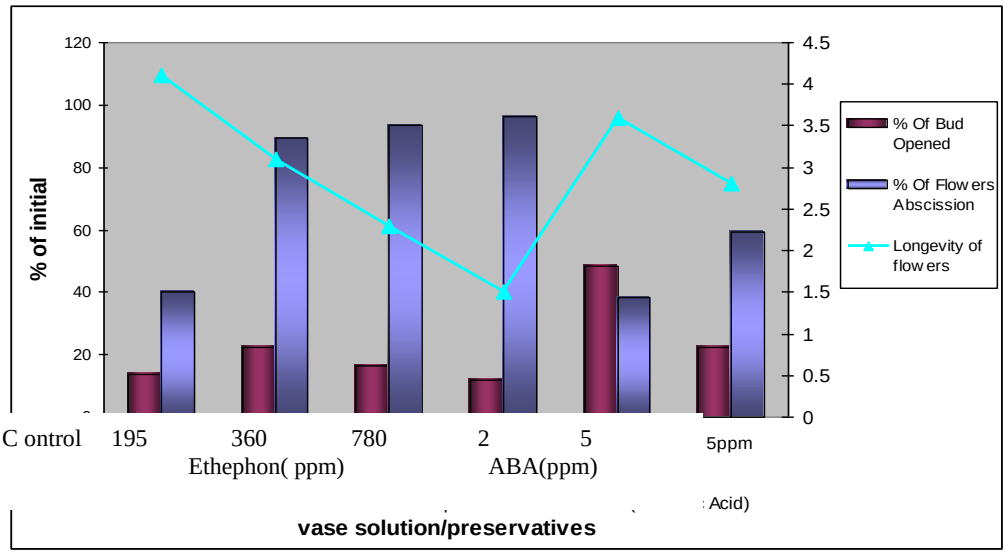

Figure 2- *Effect of Ethephon and ABA on shelf life /vase life of cut flowers of Tephrosia purpurea*

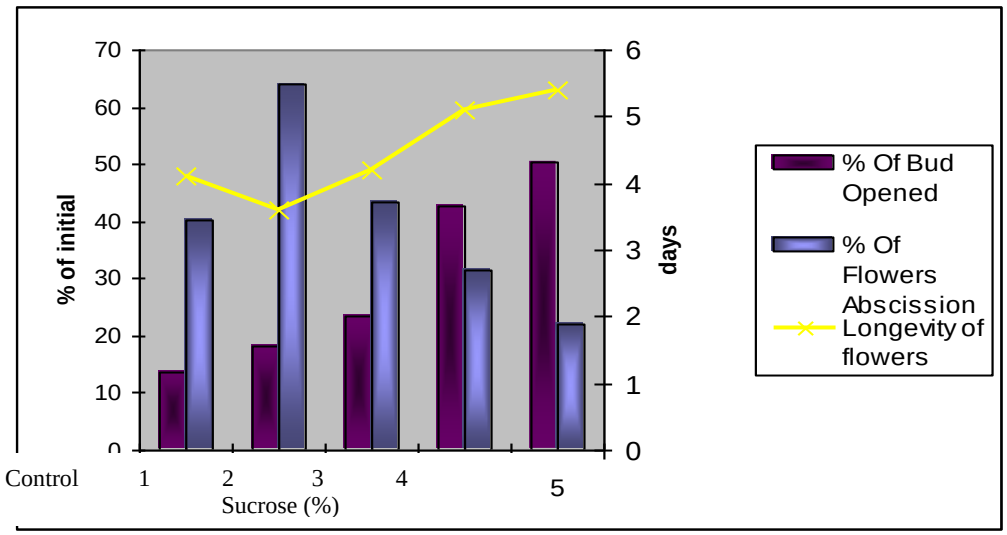

Figure 3- *Effect of different pulse treatments with sucrose on shelf life /vase life of cut flowers of Tephrosia pupurea*

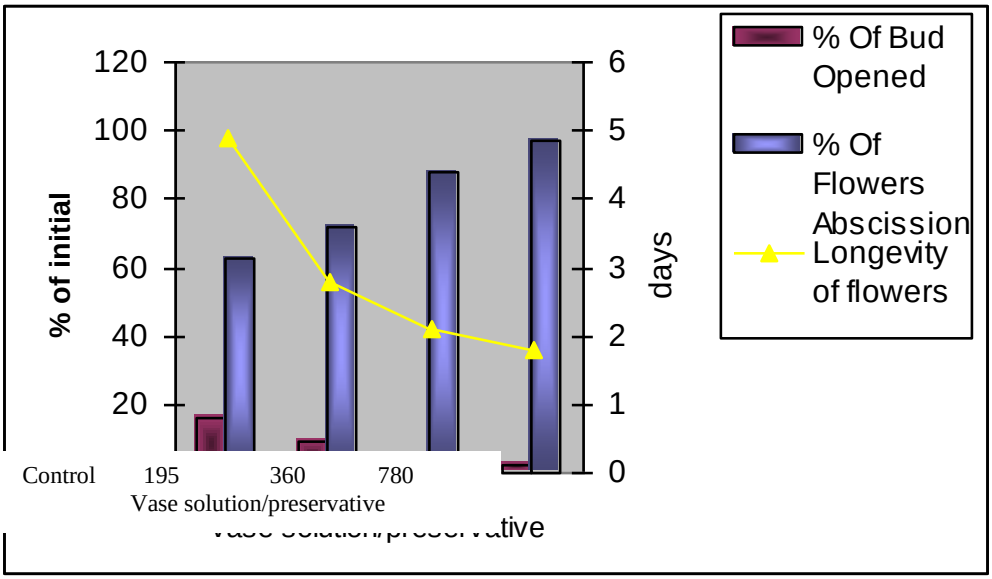

Figure 4- *Effect of different pulse treatments with ethephon on shelf life /vase life of cut flowers of Tephrosia pupurea*

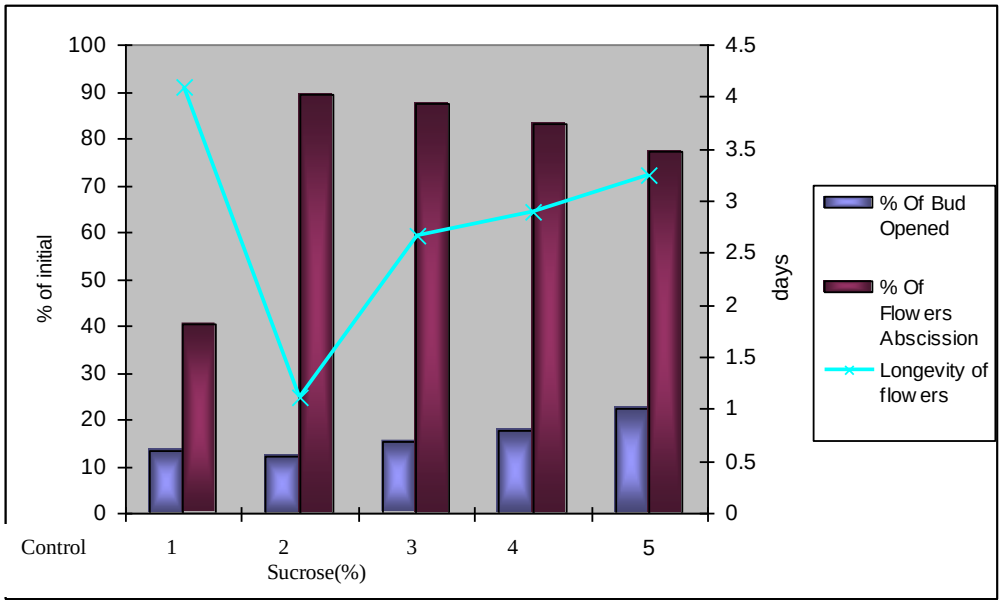

Figure 5- *Effect on shelf life /vase life of cut flowers of Tephrosia pupurea with pulse treatments of 195 ppm ethephon and then placed in sucrose solution*

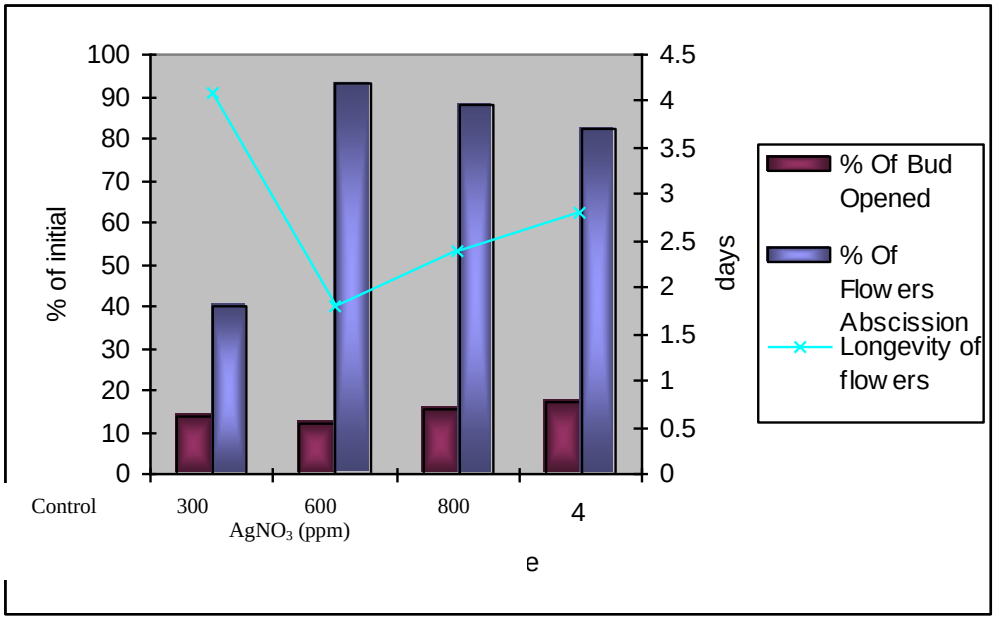

Figure 6- *Effect on shelf life /vase life of cut flowers of Tephrosia pupurea with pulse treatments of 195 ppm ethephon and then placed in different concentrations of $AgNO_3$ solution*

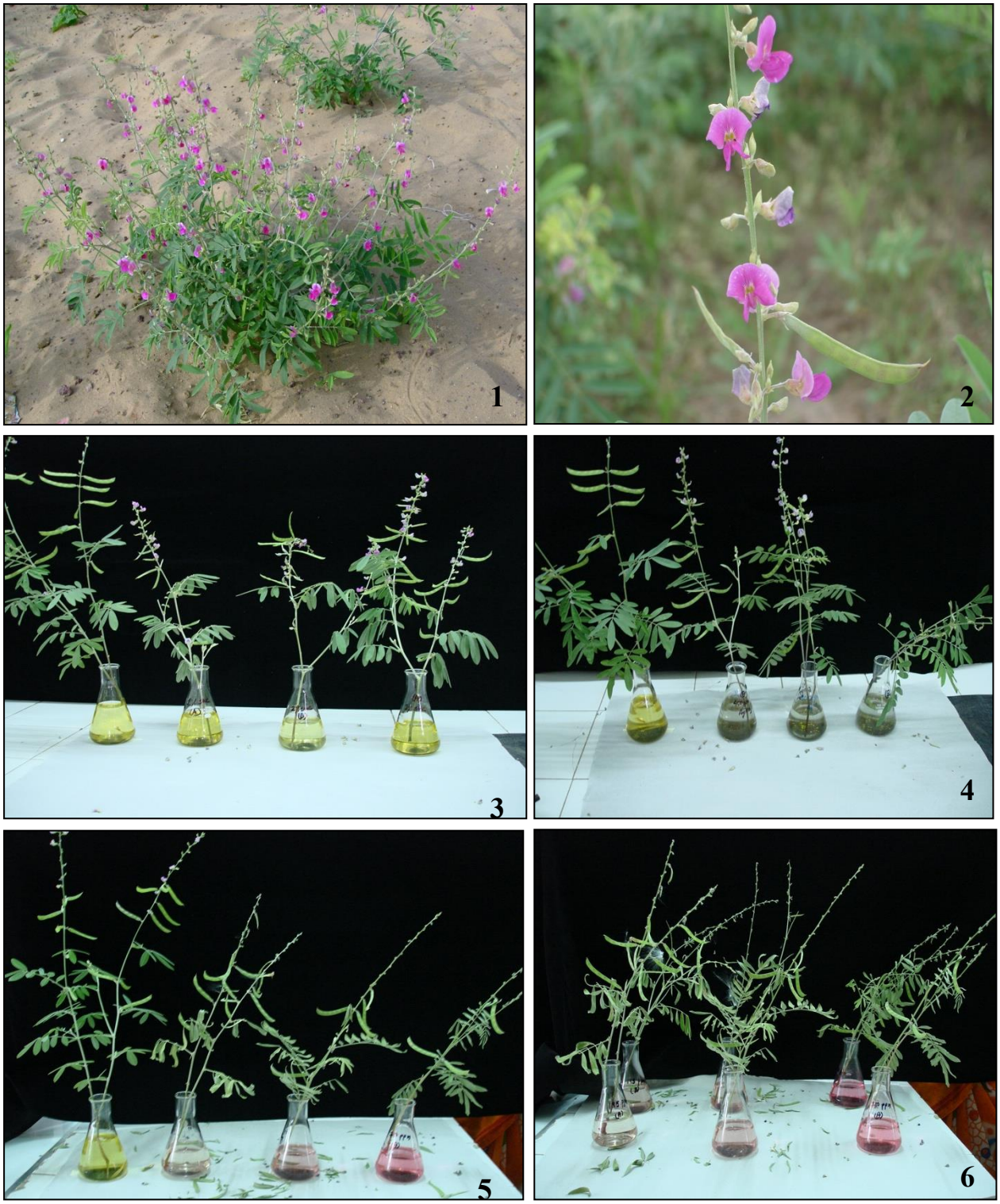

PLATE 1: Post harvest studies on cut flowers of *Tephrosia purpurea* 1.*T. purpurea* at flowering stage., 2. Inflorescence., 3. Effect of sucrose., 4. Effect of $AgNO_3$., 5. Effect of ethephon., 6. Pulse treatment with ethephon.