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ESTIMATION OF PROTEIN METABOLITES DURING POSTHARVEST SHELF LIFE OF *TITHONIA ROTUNDIFOLIA* BLAKE

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ABSTRACT
Senescence has a specialized meaning in plant biology, which is part of a cloud of terms mentioning generally to the process or condition of growing old. Many physiological changes takes place during senescence like Chlorophyll degradation; change in pigmentation; decrease the starch content, RNA and protein; DNA molecules are degraded by the enzyme DNase; growth promoting hormones such as cytokinin decrease; the deteriorative hormones such as ethylene and abscisic acid (ABA) content are increases. Post harvest shelf life of cut flower is dependent on the water balance, level and supply of carbohydrates and susceptibility towards growth retarding hormone like ethylene which leads to senescence. Beside carbohydrate metabolism, protein metabolism is also known to be associated with the senescence process and programmed cell death (PCD). During senescence degradation of protein may occur and make free amino acids. Proteins play important role during senescence. During present study it was observed that the total protein content decreased during course of time under cut conditions of flower. This may be due to less reserve in cutcondition.

Keywords: *Tithonia rotundifolia Blake, Protein, Cut flower, Post-harvest, Senescence*

INTRODUCTION
India is bestowed with several agro-climatic zones conducive for production of sensitive and delicate floriculture products. During the decade after liberalization floriculture industries took giant steps in the export arena. This era has seen a dynamic shift from sustenance production to commercial production. *The important floricultural crops in the international cut flower trade are Rose, Carnation, Chrysanthemum, Garbera, Gladiolus, Gypsophila, Liastris, Orchids, Archilea, Anthurium, Tithonia, Tulip, and Lilies.* As flowers are highly perishable, they start losing their quality right after harvesting. Therefore, in cutflower production, post harvest qualityis a limiting factor. Irreversible complex changes occurring at the physiological and biochemical levels results into the termination of shelf life, hence it promotes the study of senescence and post harvest research. Plant senescence describe the spectrum of terminal events in plant vegetative and reproductive development connected with turnover and reutilization of cellular material from tissues and organs to be eliminated eventually followed by cell death (Pennell and Lamb, 1997). Senescence can be broadly defined as terminal stage of development leading to death of cells, tissues, or organ and is a deteriorative, irreversible process. Such a definition, applied to cut flowers, might include adverse water relations and floret abscission.

Post harvest shelf life of cut flower is dependent on the water balance, level and supply of carbohydrates and susceptibility towards growth retarding hormone like ethylene which leads to senescence (Kazemi, 2012). During senescence respiration rate increases and cell components are hydrolysed.

Beside carbohydrate metabolism, protein metabolism is also known to be associated with the senescence process and programmed cell death (PCD). During senescence degradation of protein may occur and make free amino acids. It occurs in the proteosomes, vacuoles, mitochondria, nucleus and plastids, but mass degradation occurs in the vacuoles. During

the course of petal aging, level of macromolecules like protein decreases (Borochov *et al.*, 1976; Parups, 1971 and Paulin, 1977), this reduction of protein content involved degradation to a mixture of smaller polypeptide and amino acid (Mayak and Halevy, 1974; Parups, 1971).

MATERIALS AND METHODS

In order to study the Protein metabolism and the changes in it during the senescence period in uncut *Tithonia rotundifolia* Blake flowers, biochemical estimation were done using dry flowers. The plants grown in the experimental plots of the botanical garden of the department served as the source of the material. In case of cut flowers of *Tithonia rotundifolia* Blake, a shelf life of 4 days was observed. The flowers were completely unacceptable on 5^{th} day, petals completely wilted and dried. Hence, in case of cut flowers 4 stages were defined as follows.

Stage 1: Day when the flowers were cut and placed in DW as holding solution (Day 1)Stage 2: After 24 hours (Day 2)
Stage 3: After 48 hours (Day 3)

Stage 4 (Senescent stage): After 72 hours (Day 4)

COLLECTION AND PREPARATION OF MATERIAL FOR BIOCHEMICAL ESTIMATIONS

In order to carry out the estimation from dry material, the ray florets were collected from the ray florets from every stage (every 24 hours) of flower starting from the day it opened till its senescence. Every day the field was surveyed in the morning and the flowers which had just opened were tagged. These flowers were considered as stage 1 (0 hr.) flowers. Ray florets from some of the stage 1 flowers were collected and packed separately with proper labels. Similarly, ray florets for Stage 2 (24 hrs.), Stage 3 (48 hrs.), stage 4 (96 hrs.) (Senescent stage) flowerswere also collected. These ray florets were then placed in the oven at 80° C for drying. In orderto study the changes in the Protein, the biochemical estimation was done from the 100 mg dry material of all stages of *Tithonia rotundifolia* Blake. Total Protein activity was estimated by the method of Lowry et al. (1951). For statistical analysis, means were based on ten replicates for each stage and the standard error was computed. It was also statistically examined by One-wayANOVA calculated at 0.05% level of significance.

RESULTS

Figure shows the total protein content in cut flower petals of *Tithonia*. It was observed that the protein content followed the declining trend till the senescent stage. The remobilization of amino acids due to degradation of proteins in developing tissues is a prominent process during senescence reported by many workers (Winkenbach, 1970a, 1970b; Parups, 1971; Baumgartneret al., 1975; Woodson and Handa, 1987; Huffaker, 1990; Gao and Wu, 1990; Lay-Yee *et al.*, 1992; Eason and Webster, 1995; Stephenson and Rubinstein, 1998; Solomon et al., 1999; Sugawara et al., 2002; Wagstaff *et al.*, 2002; Jones *et al.*, 2005; Pak and van Doom, 2005; Azeez et al., 2007). The decline trend of protein suggest that possibly the structural proteins involved in the synthesis process were being reduced. Weinstein (1951) reported that the onset of hydrolysis of structural cell components (including proteins) is initiated in response to the depletion of the free sugars used as respirable metabolites in order to supply alternative substrates for respiration. During enzyme protein estimation, it was found that amount of enzyme protein followed decreasing trend till the stage 3. Increase amount was observed in senescent stage i.e. stage 4 as shown in figure.
However, the values at the senescent stage were less as compared to the values at the initialstage. This indicates that synthetic activity was highly affected due to stre ss condition which leads to the reduction of enzyme protein. This pattern shows that probably during the developing stages flower was trying to combat the unfavorable condition and synthesis some enzyme.

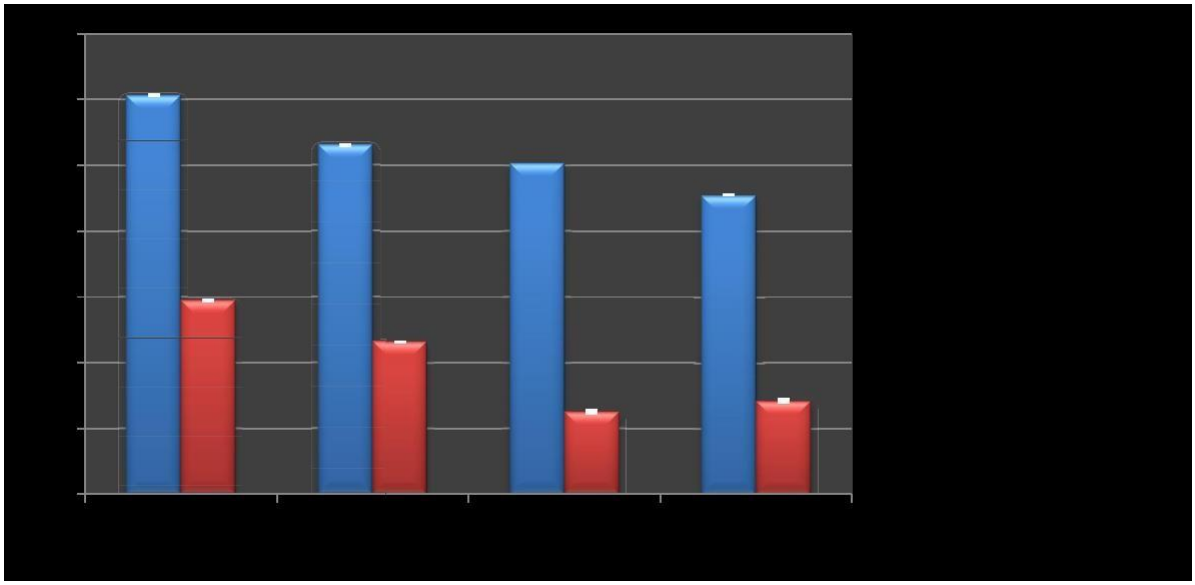

Figure: Total Protein and Enzyme Protein (mg / g fresh or dry petals) in cut flower petalsof *Tithonia rotundifolia* Blake.

CONCLUSION

During course of time the total protein content decreased undercut conditions of flower This may be due to less reserves in cut condition. While enzyme protein content showed decreasing trend till stage 3 and slight increase at senescent stage. This decreased amount indicates that probably more enzymes were not needed because of remobilization of materials.

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