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Phenolics and Petal Senescence in Uncut Flower Petals of *Tithonia rotundifolia* Blake

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Abstract: ***Phenols are the antioxidants that have the ability to protect plant tissue against oxidative damage. During present study estimation of total phenol was done from the first stage to senescent stage of Tithonia rotundifolia Blake flower petals. Reduction in the total phenol was observed till the pre-senescent stage and at senescent stage the value was found increased but not more than first stage.***

Keywords: *Tithonia rotundifolia* Blake, Petal senescence, Phenols, cut flower

1. Introduction

Flowers are wonderful creation of nature and are one of the most beautiful gifts of nature. Besides serving as reproductive organ, flowers are of utmost importance in every sphere of human life. For many centuries, flowers are known to play a significant role in our life. The invigorating beauty of flowers have always fascinated and enthralled people around the globe over the ages. Their beauty lies in their suppleness, their pleasant aroma and their diverse colors. Flowering is controlled by the developmental age of the plant and environmental signals, including light, temperature, water and nutrients [1], [2]. During flower bud opening, various events take place in a well defined sequence, representing all aspects of plant development, such as cell division, cellular differentiation, cell elongation or expansion and a wide spectrum of gene expression. So, the complexity of flower bud opening illustrate that various biological mechanisms are involved at different stages. As the flower petals are often the plant organs with the shortest life span, they provide an excellent model system for the study of underlying mechanism and control of senescence that is generally rapid and predictable [3]. Also, petal senescence is an irreversible process that leads to cellular breakdown and death [4].

Tithonia rotundifolia Blake (Maxican sunflower) belongs to family Asteraceae and is one of the important commercial cut flower. *Tithonia* is an annual herb with large, solitary bright yellow, showy flowers for a considerably long period. All plants produce an amazing diversity of secondary metabolites. One of the most important groups of these metabolites is phenolic compounds. Phenolics are characterized by at least one aromatic ring bearing one or more hydroxyl groups. They are mainly synthesized from cinnamic acid, which is formed from phenylalanine by the action of L-phenylalanine ammonia-lyase PAL, the branch point enzyme between primary (shikimate pathway) and secondary (phenylopropanoid) metabolism [5]. Phenols are produced by plants mainly for protection against stress.

2. Material and Method

In order to study the status of phenols and the changes in it during the senescence period in uncut *Tithonia rotundifolia* Blake flowers, biochemical estimation were done using dry flower petals. The plants grown in the experimental plots of the botanical garden of the department served as the source of the material. It was observed that the uncut flowers of *Tithonia rotundifolia* Blake remained fresh on the plant for 3 days with 4th day as the senescent day at which the petals started abscising. Thus, 4 stages were defined as follows:
Stage 1: Flowers that had just opened (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)

In order to carry out the estimation from dry material, the ray florets were collected 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 (72 hrs.)(senescent stage) flowers were also collected. These ray florets were then placed in the oven at 80° C for drying. Total Phenol content was measured by the method of Bray and Thorpe, 1954 [6].

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-way ANOVA calculated at 0.05% level of significance.

3. Result and Discussion

Total phenols on the day flower opened were highest, while this amount gradually decreased as the flower began to senesce. At stage 1, when the flower had just opened enough total phenols suggest their positive impact on protecting the petals from oxidative damage. When flower is 24 hours old, a whole lot of biochemical changes happen creating a gradual stress in the petals. This is also due to gradual decline in total phenols as seen in petals of flowers in stage 2. The amount of total phenol reduces further in stage 3 which is also the presenescent stage. Lowered phenol levels result in lowered protection of petal tissue against oxidative stress and hence leads to progressive changes towards abscission in stage 4 (Table-1)

During statistical analysis it was found that, the contents of total phenols were significantly different among all the stages of *Tithonia rotundifolia* Blake (Fig-1).

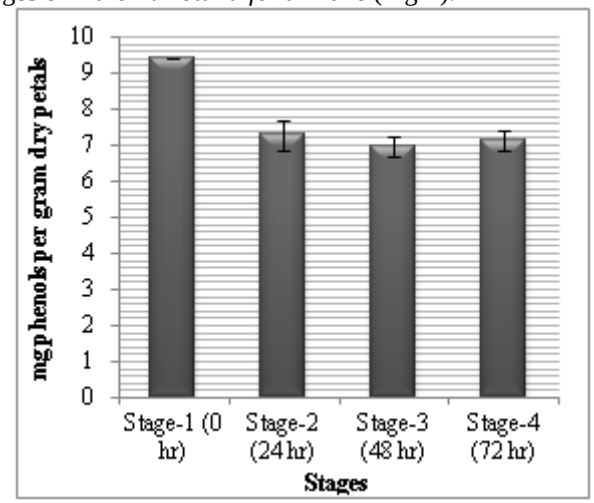

Figure 1: The total phenols in uncut flower petals

Table 1: ANOVA Summary Table for Total Phenols in uncut flower petals

Source of Variation	Sum of Squares (SS)	Degree of Freedom (DF)	Mean Squares (MS)	F Ratio	Table value of F
Between groups	9.903	3	3.301	4.443	4.07*
Within groups	5.944	8	0.743		
Total	15.848	11			

* at 0.05 level of significance

This reduction is presumably due to possible oxidation of phenolic compounds by the enzymes. The amount of total phenols had a decreasing trend with progressing stages in *Cosmos* [7] and *Tagetes erecta* L [8]. Due to their antioxidant proprieties and the role scavengers play during senescence, the higher value of total phenols during flower opening were found [9]. According tomany worker total phenols tended to decrease during flower senescence in 'Raktagandha" roses [10], [11]. The decrease in the values of total phenols might have created an intramural environment suitable for the senescent changes to lead the flower towards senescence. However, at senescent stage an increase was found in the values. Phenols could not default the changes and ultimately ending up with the start of abscission of petals at senescent stage. Decline in phenolics concentration make the flower more vulnerable to oxidative stress [12].

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