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PETAL SENESCENCE IN CUT *Tagetes erecta* L. FLOWERS: ROLE OF PHENOLICS

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Abstract: Petals are an excellent model system for the study of fundamental aspects of senescence. The need of present study was felt with the aim to study the changes taking place during petal senescence in cut flowers of *Tagetes erecta* L. Estimation of total phenols was studied from first stage to senescent stage of *Tagetes erecta* L. The amount of total phenols had a decreasing trend with progressing stages. This reduction of phenols might have created an internal environment suitable for the senescent change which leads the flower towards senescence.
Key words: *Tagetes erecta* L., Total phenols, Senescence, Cut flower petals.

INTRODUCTION

Flowers are the wonderful creations of god that serve as the reproductive organs of flowering plant. It is in most cases the organ with the shortest period of longevity. Senescence of whole flower is very complex, so often researchers concentrate mainly on changes occurring during the senescence of petals. Petals seem to be an excellent model system for the study of fundamental aspects of senescence. The whole natural period from maturity to senescence and death is much shorter in petals than in leaves. It is thus possible to study senescence without applying artificial "senescence-including" treatments, as is used in studies of leaf senescence (Halevy and Mayak, 1979). Also, petal senescence is an irreversible process that leads to cellular breakdown and death (Sacher, 1973).

Tagetes erecta L. (African marigold) of Asteraceae is one of the most important commercial flower crops from all over the world and India accounting for more than half of total flower production. Marigold is an annual herb with large, solitary bright yellow, showy flowers for a considerably long period and excellent as cut flower as the blooms are long lasting and bloom profusely. The flowers are raised commercially for religious and social ceremonies, since they

have a long shelf life. Hence, there is need to study the changes taking place during petal senescence in cut flowers of *Tagetes erecta* L.

Increased recognition of the importance of phenolic compounds in plant metabolic activities is well known. Phenols such as *p* - coumaric acid with one - OH group strongly enhances IAA destruction (Nitsch and Nitsch, 1962). IAA oxidase and peroxidase decompose the IAA (Schaffer *et al*., 1967). Polyphenols can be oxidised by peroxidase and Polyphenol oxidase. Phenols are the antioxidants that have the ability to protect plant tissue against oxidative damage. Most of the metabolic abnormalities in living organisms are caused through the production of deleterious active oxygen species (AOS) such as singlet oxygen, superoxide radical, hydrogen peroxide, hydroxyl ion and free hydroxyl radical (1O2, •O−2, H_2O_2, OH− and •OH) which are invariably produced during normal metabolism and exposure to stresses (Singh *et al*., 2009a). The present study focuses on the estimation of phenolic compounds during senescence of petals of *Tagetes erecta* L.

MATERIALS & METHODS

The plants were grown in experimental plots of the department. It was observed that the time taken by flower to open was 6-8 days in *Tagetes erecta* L. which was considered as stage 1. For cut conditions, the fresh flowers of stage 1 were harvested and placed in test tubes with Distilled Water (DW). After 48 hours they were considered as stage 2 flowers. Data was recorded at the interval of 2 days till the end of their shelf life. In case of cut flowers of *Tagetes erecta* L. a shelf life of 18 Days were observed. The flower was completely unacceptable after stage 7 with the petals completely wilted and dried. Hence, in case of cut flowers 7 stages were defined as follows:

Stage 1: Flowers that had opened completely (Day 6)

Stage 2: Day 8

Stage 3: Day 10

Stage 4: Day 12

Stage 5: Day 14

Stage 6: Day 16

Stage 7 (Senescent stage): Day 18

In order to carry out the estimation of total phenols from dry material, the petals were collected from the plants according to stages mentioned and were collected and packed separately with proper labels. Then they were placed in oven at 80° C for drying for 24 hours till constant dry weight is achieved. 100 mg dry petals were homogenized with 10 ml ethanol and centrifuged for 20 minutes. Supernatant-1 was collected and residue was further centrifuged with 10 ml ethanol. The combined ethanolic extract (supernatant 1+2) was used extracts for estimation of total phenol.

Total Phenols content assay (Bray and Thorpe, 1954): 1 ml of ethanolic extract was taken and 1ml of 20% solution of Na_2CO_3 was added. Thereafter, 0.5 Folin - Ciocalteau reagent were added and the absorbance was measured on a spectrophotometer at a wavelength of 650 nm. The results were expressed as mg phenols per gram dry petals. The experiments was performed with ten replicates per stage.

Statistical Analysis: The data obtained were analyzed statistically by the means of ten replicates for each stage and the standard error was computed. It was also statistically examined by the one way Analysis of Variance (ANOVA) at 0.05% level of significance.

RESULTS AND DISCUSSION

Table 1(a) shows the mg total phenols per gm dry petals of cut *Tagetes* flower. It was found that the amount of total phenols had a decreasing trend till presenescent (stage 5) but at senescent stage (stage 6) the values were found to increase. The higher value of total phenols during flower opening has been suggested to be due to their antioxi-dant proprieties and the role scavengers play during senescence (Trivellini *et al.,* 2007). It was found that the content of Total phenols shows an initial increase as the flower opened and then decline during senescence in *Ranunculus asiaticus* L. flower (Wassem and Inajatullah, 2011). The decrease in the phenol content was detected in miniature rose “KORcrisett” (Valentina *et al.,* 2009). Total phenols tended to decrease during flower senescence in “Raktagangha” roses (Vidhyasankar, 2001 and Bhattacharjee, 2003).This decline in phenolics concentration at later stages of flower development may limit the role of the peroxidase/phenolics/ascorbic acid system in antioxidant defense and make the flower more vulnerable to oxidative stress (Takahama and Oniki, 1997).This reduction of phenols might have created an internal environment suitable for the senescent change which leads the flower towards senescence. At senescent stage an increase was

found in values which probably shows that the petals are trying to resist the changes leading to death of tissue but probably by stage 5 the internal environment of petal tissues had been so formed that even the increased values of total phenol could not revert the changes and ultimately senescence of petal starts at senescent stage.

The content of total phenols was found to be significantly different among all the stages (Table-1b). The values of total phenols were found to be highest for stage 1followed by stage 2 to 6.

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FIGURES AND TABLES

Figure-1 Shows Phenols (mg/g dry petals) in cut flower petals.

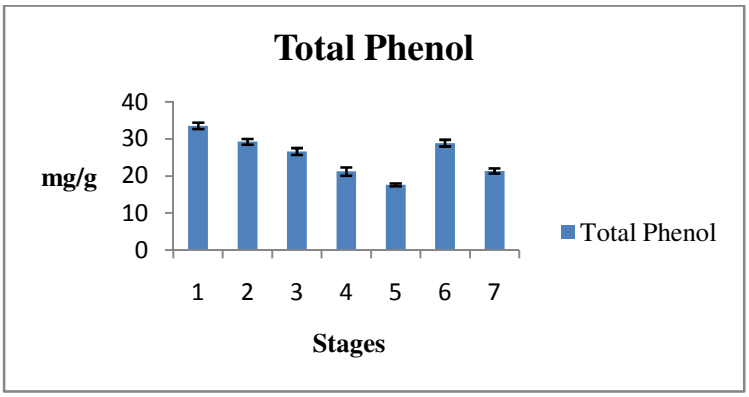

Table - 1(a) Phenols (mg/g dry petals) in cut flower petals.

Stages	Days	Total Phenols (mg/g)
1	6	33.59± 0.849
2	8	29.25± 0.763
3	10	26.63± 0.913
4	12	21.21 ±1.098
5	14	17.65± 0.387
6	16	28.89± 0.914
7	18	21.359± 0.687

Table- 1(b) ANOVA Summary Table for Total Phenols in cut flower petals.

Source of Variation	Sum of Squares (SS)	Degree of Freedom (DF)	Mean Squares (MS)	F ratio	Table value of F
Between groups	566.850	6	94.475	45.995	2.9*
Within groups	28.756	14	2.054		
Total	595.606	20	0.000		

*at 0.05 level of significance

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