Research Paper

Volume : 3 | Issue : 9 | September 2014 • ISSN No 2277 - 8179

Protein Metabolism During Petal Senescence in Uncut Flowers of *Tagetes erecta L.*

Botany

KEYWORDS : Tagetes erecta L., Total Protein, Protease, Uncut flower petals.

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ABSTRACT

Flowering often associated with senescence and death. The senescence of flowers involves a coordinated series of complex physiological and biological events leading to eventual collapse and death of the petals. 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 uncut flowers of Tagetes erecta L. Estimation of total protein and protease activity was studied from first stage to senescent stage of Tagetes erecta L. Total protein content had a decreasing trend in Tagetes petals. This reduction of protein is due to the breakdown of the proteins might have created an internal environment suitable for the senescent change which leads the flower towards senescence. The protease activity registered a consistent increase with the simultaneous decrease in total protein content.

INTRODUCTION

The commercial life of a flower is typically determined by its perianths (petals or sepals) as such most of the studies related to flower senescence have focused on the perianths. Flower petals are ideal tissues for cell death studies as they are short lived. Tagetes erecta l. (Marigold) member of the Asteraceae is one of the most important floricultural crops all over the world and in India as well; accounting for more than half of whole loose flower production (Sreekanth et al., 2006). Senescence is a series of normally irreversible events is initiated that leads to cellular breakdown and death Sacher (1973). The life span of flowers is generally determined by the time to petal wilting or withering. During senescence many macromolecules in the petal cells are degraded to molecules that are suitable for phloem transport. These mobile molecules are transported to other parts of the plant (Winkenbach et al., 1970a, b). Two major metabolic events occur in senescing petals increase in respiration and hydrolysis of cell components. The enzymatic changes found during petal senescence are associated mainly with these two processes.

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. The uncut flowers of Tagetes erecta L. remained on the plant till 16 day after opening (stage 1). Data was recorded at by the interval of 2 days. Thus, 6 stages were defined as follows:

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

Stage 2: After 2 days (Day 9)

Stage 3: After 4 days (Day 12)

Stage 4: After 6 days (Day 15)

Stage 5: After 8 days (Day 18)

Stage 6 (Senescent stage): After 10 days (Day 21)

For estimation of total protein during petal senescence in uncut flowers, biochemical estimation was done from 100 mg dry petals where as the estimation for the activity of protease enzyme was done from the 100 mg fresh material of all the stages of Tagetes. Total protein was estimated by Lowry's methods (1951). The results are expressed as mg protein per gram petals. Protease activity was estimated by the methods of Penner and Ashton, (1967); modified by Cruz et. al., (1970) and the results were expressed as mg protein reduced per gram petals. For 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

Total proteins

Total protein content had a decreasing trend in Tagetes petals. It was found to decrease slightly at stage-2 (Figure-1). After which a decrease in content was also observed but on with the onset of senescent phase the values started decreasing with slight increase at senescent stage. However, the value at senescent stage was lower than the value of first stage. This is due to the breakdown of the proteins. This view is also supported by the increased activity of protease at senescent stage as compared to the activity at initial stage. During the course of petal aging there is a drop in the level of macromolecules like proteins (Borochov et al., 1976).The reduction in protein content (Carpenter, 1975; Mayak and Halvey, 1974) involved degradation to a mixure of smaller polypeptides and amino acids (Parups, 1971) and a significant increase in the level of ammonia was noted in senescing roses. Van Doorn and Woltering (2007) have reported that a decrease in over all protein levels can be due to a decrease in synthesis as well as increase in degradation. The onset of protein hydrolysis is initiated in response to depletion of the free sugars used as respirable metabolites in order to supply alternative substrates for respiration such as the carbon skeleton of amino acids (Coorts, 1975).

Protease activity

Protease activity in petals provides a possible mechanism for the breakdown of proteins. The enzyme protease cleaves protein into peptides. During the present investigation a pronounced increase in the protease activity as the flower progressed towards senescence was observed. The activity was commensurate with a drastic decrease in soluble proteins (Figure-1). A marked increase in the protease activity during petal senescence has also been reported in various flowers (Pak and Van Doorn, 2005; Shahri et al., 2011). At the stage 4 the higher value of protease activity was found, this indicates that possibly by stage 4 the onset of senescence might have taken place internally and as a result the proportion of catabolic processes would have increased. Thus as a part of it breakdown of proteins might have also started taking place.

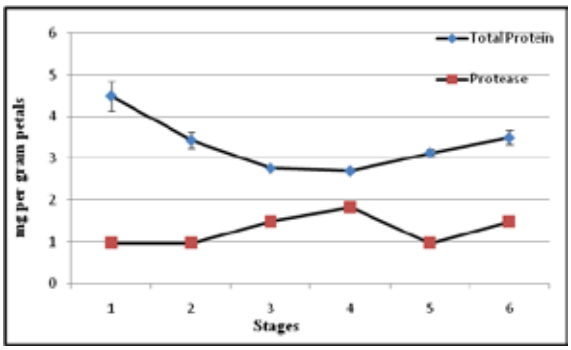
CONCLUSION

The amount of total protein was found to be decreased under uncut condition and signifies an early senescence. The protease activity registered a consistent increase with the simultaneous decrease in total protein content this suggests more production of free amino acids that signifies early senescence.

ACKNOWLEDGMENT

The authors thank to UGC for financial support for this project.

Figure- 1: Total Protein (in mg/g dry petals) and protease activity (mg/g total protein produced/g fresh petals) in uncut flower petals of Tagetes erecta L.



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