J. Indian bot. Soc. 65 : 17—21, 1986

EFFECT OF GA_3 ON LOCALIZATION OF NUCLEIC ACIDS AND PROTEIN IN SHOOT APICAL CELLS DURING TRANSITION FROM VEGETATIVE TO REPRODUCTIVE PHASE IN *SOLANUM MELONGENA* L.[1]

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ABSTRACT

The influence of gibberellic acid (GA_3) on the histochemical and morphological events bringing about transition from vegetative to reproductive phase in shoot apex has been studied in *Solanum melongea* L. Foliar treatment with 50 and 100 ppm (1.44×10^{-7} and 2.88×10^{-7} M) GA_3 promotes enhanced localization of DNA and RNA during transition from vegettive to reproductive phase due to increased cellularity as well as increased utilization of protein for organogenesis are the visible changes that accompany the increased ratification and volume changes in the treated shoot apex at the transition stage.

INTRODUCTION

Morphogenetic aspects of *Solanum melongena* have attracted attention of research workers in recent years. Shah and Patel (1970a, b) studied the ontogeny and development of vegetative and reproductive apices in *S. melongena*. Effect of gamma irradiation on germination and organisation of shot apex in *S. melongena* were also worked out by them (Patel and Shah, 1974). Shiedaeva (1973) studied the effect of GA_3 on *S. melongena* with respect to the free amino acids. To these reports one or more addition would be an investigation on the role of gibberellins on localization of protein and nucleic acids during the transition of vegetative shoot. apex to the reproductive in the plant. This would pay the way for a clearer interpretation of morphogenetic events in *S. melongena* shoot apex.

MATERIAL AND METHODS

Seeds of *S. melongena* were obtained from Pochas Seeds, Pune. The plan of study included foliar spraying of the plant with 1.44×10^{-7} and 2.88×10^{-7} M gibberellic acid (GA_3) of free acid form. Three sets of seeds were grown in 30 pots ; one treated with distilled water as control and two GA treated. Five to 10 seeds per pot were sown in each and were uniformly watered every day in the evening. The average seed germination was 55.5%. Thinning was done a week after germination, leaving two healthy plants per pot. The spraying of identical quantities of solutions was carried out at 6 PM on three alternate days with a hand sprayer after 10 days of growth. Sufficient number of vegetative and transitory apices were fixed in Carnoy's fixative and processed through TBA series. Serial

1 Accepted for publication on December 12, 1984

longi-and transverse sections were cut at 12 μm thickness. Following the method of Mazia *et al.* (1953) the staining for protein was done with mercuric bromo-phenol blue. Protein registered a deep blue colour. Control slides were run as per the method detailed in Jensen (1961). For the thchistochemical localization of nucleic acids, Flax and Himes (1952) pH_4 azure-B-Bromide method was employed. DNA appeared as greenish blue and RNA as dark blue. The slides were examined microscopically and arbitrary values of 10 slides each for protein (P), RNA (R) and DNA (N) were assigned depending upon the intensity of staining which would reflect the localization of the respective chemical component in the concerned cells. Increasing in staining itensity of protein, DNA and RNA were noted by assigning increasing order of numerals as prefixes to symbols (1P, 2P.....etc for protein ; 1N, 2N, ...etc for DNA and IR, 2R etc for RNA).

OBSERVATIONS

In the median longitudinal section of the control plant, the vegetative shoot apex appears slightly arched and its two tunica layers enclose the corpus sector (Fig. 1). The maximum width of the vegetative shoot apex ranges from 160 to 200 μm during the different stages of plastochron. The vegetative shoot apex exhibits only faint zonation (Fig. 1). The eumeristematic cells of early foliar bud meristem is distinct in the axil of the third or the fourth leaf primordium from the shoot apex. The bud meristem differentiates due to (i) multiplane division in its corpus sector and (ii) anticinal divisions in its tunica cells keeping pace with the former. There is no evidence of accessory bud meristem differentiation during the vegetative period. The cells seen in the longitudinal section of the 50 ppm GA treated shoot apices are smaller in size and thus give evidence of quciker cell division when compared to the control and 100 ppm GA treated apices (Figs. 2, 3). It also reveals 3-5 layered stratification in 100 ppm GA treated plants compared to the other two types (Fig. 3).

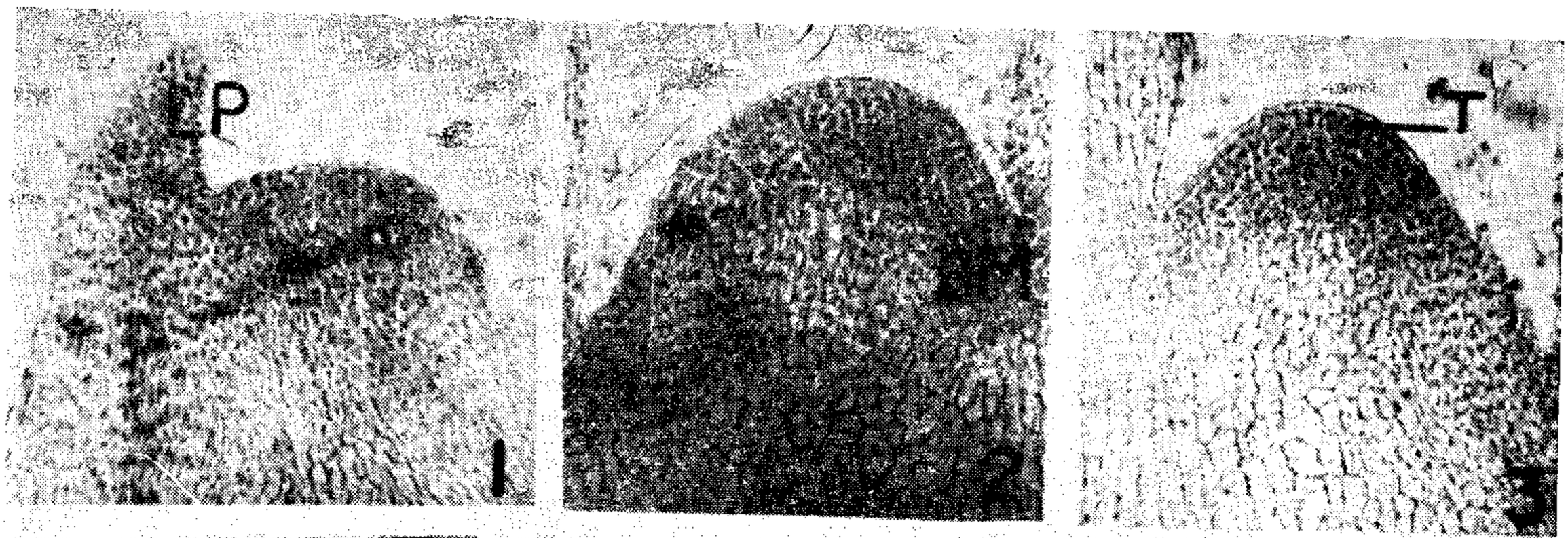
During the reproductive phase, the shoot apex differs from that of the vegetative period in the absence of a cytohistological zonation and assumes a dome shape in both control and treated (Figs. 4-6). Differentiation and development of the floral bud meristem is quicker in treated plants compared to the control buds. In the reproductive shoot apices, the treatment has promoted cell division and stratification which resulted earlier differentiation of flower primordia (Figs. 5, 6).

Protein

In the vegetative shoot apex of control plants protein localization is valued at 2.5 P (Fig. 1; Table I), and in the transitory apex 4P (Fig. 4 ; Table I). The vegetative shoot apex of 50 ppm GA treated plants also show the same intensity of the control vegetative apex (Fig. 2, Table I). The transitory apex of 50 ppm GA treatment shows more staining intensity. Its value is 4.5 P (Fig. 5 ; Table I). In 100 ppm GA treated vegetative and reproductive apices the staining intensity is more compared to that of the control and 50 ppm GA treatment. The value is 3.5 P in vegetative, and in the transitional shoot apex it is of 5 P (Figs. 3, 6 ; Table I).

Nucleic acids :

Treatment with 50 ppm GA in the vegetative apical meristem has affected localization of RNA, raising the value to three times and doubling the value of



Figs. 1-6. Vegetative and reproductive shoot apices (showing protein stainability) in *Solanum melongena* L.
Fig. 1. L. s. Vegetative apex, untreated. ×560
Figs. 2 & 3. L.s. Vegetative apices, 50 ppm and 100 ppm ×560
Fig. 4. L.s. Transitory apex, untreated. × 560
Figs. 5 & 6. L.s. Transitory apices, 50 ppm and 100 ppm × 560.

Abbreviations :—
BM—bud meristem; FP—Flower primordium;
LP—leaf primordium; PC—procambium; T—tunica

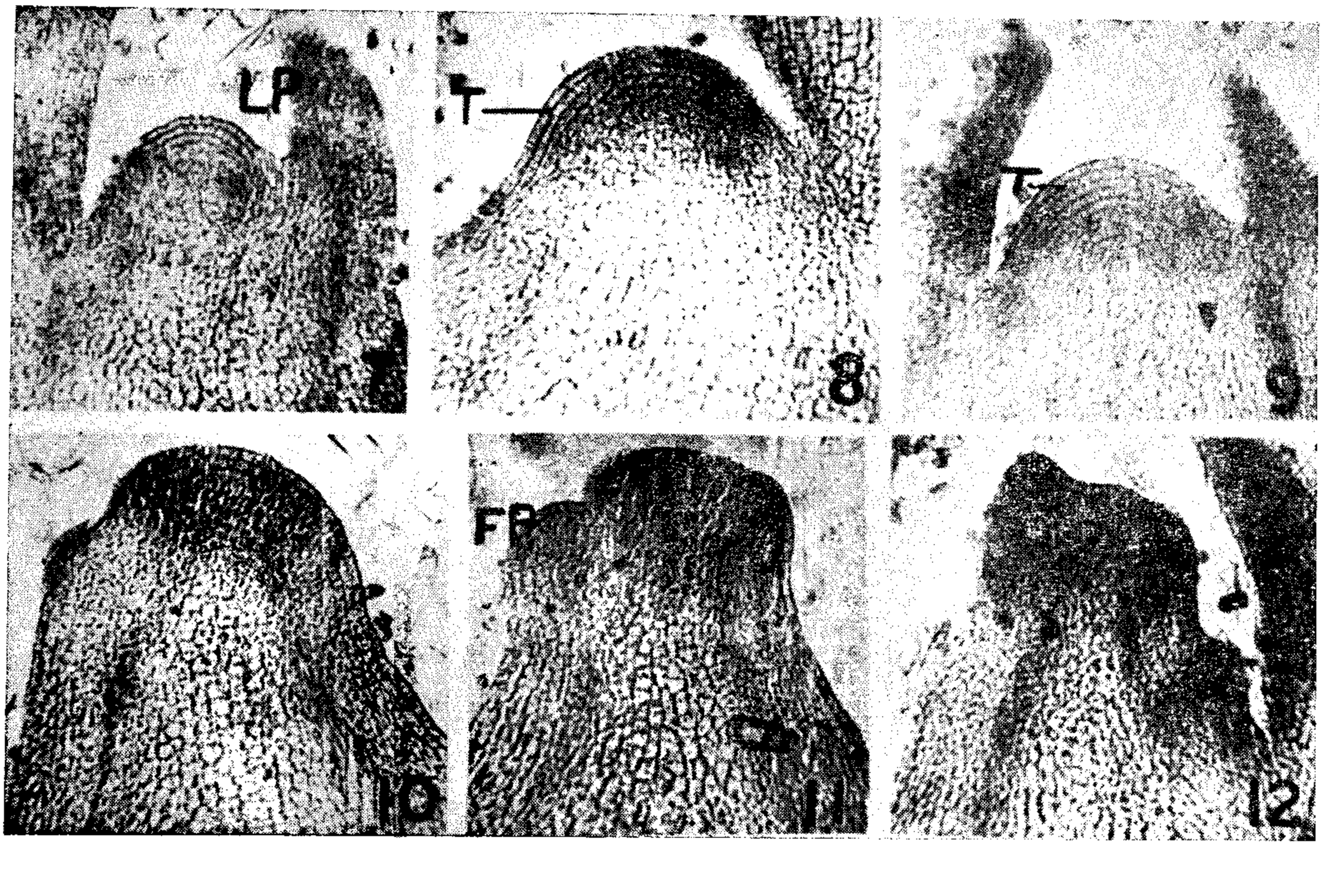
TABLE I

CHANGES IN NUCLEIC ACIDS AND PROTEIN DURING TRANSITORY PHASE IN *S. melongena* L.

control		treatments (GA_3)				
			50 ppm		100 ppm	
	Tra	Veg	Tra	Veg	Tra
1N	2N	2N	2N	1N	2N
1R	2R	3R	3R	2R	3R
2.5P	4P	2.5P	4.5P	3.5P	5P

N—DNA
R—RNA
Pro—Protein
Veg—Vegetative
Tra—Transitory

DNA localization compared to the control (Figs. 7, 8 ; Table 1). However, the 100 ppm GA treatment doubled the RNA value but did not alter the DNA value (Fig. 9 ; Table 1). The transitory shoot apex of the control shows a higher intensity of both DNA and RNA accumulation compared to the vegetative apex (Fig. 10; Table I). However, in 50 and 100 ppm GA treated transitory apices there is a three-fold increase in RNA accumulation compared to the control, but DNA values only doubled (Figs. 11, 12; Table I).



Figs. 7-12. Vegetative and reproductive shoot apices (showing nucleic acid stainability) in *Solanum melongena*

Fig. 7. L. s. Vegetative apex, untreated. × 560.
Figs. 8 & 9. L. s. Vegetative apex, 50 ppm and 100 ppm. × 560
Fig. 10. L. s. Transitory apex untreated, × 560
Figs 11 & 12. L. s. Transitory apices, 50 ppm and 100 ppm × 560
Abbreviations :—
FP—Flower primordium; LP—Leaf primordium;
T—Tunica

DISCUSSION

GA enhanced growth of *Avena* internode was found following the increase in localization of RNA and protein in the respective cells (Kaufman *et al.*, 1968). The observation by Harda and Vergara (1972) showed that GA application increased the height of the plant, length of the internodes and leaf blades and leaf sheaths. The present study indicated that the transition from vegetative to reproductive phase in the GA treated shoot apices of *S. melongena* was associated with increased cell proliferation, and localization of protein and nueleic acids. It also revealed that GA caused increase in cell division and internodal cell elongation, and affected earlier foliar induction. Recently Joseph *et al.*, (1979) observed that a single application of GA to young internode of *Xanthium* accelerated the rate of internodal growth and rate of leaf production. Present observation is in accordance with this in part, and in addition provides evidence for the preceding histochemical changes. There were reports on rapid rate of accu-

mulation of RNA and DNA prior to cell division in *Pisum sativum* (Beevers and Poulson, 1972 ; Poulson and Beevers, 1973). Key (1969) and Glasziou (1969) provided documentations for the effects of GA_3 on increase of nucleic acids and protein contents in tissues ; and they interpreted the same as to have relation to the nuclease and protease activities. The present work though deplet of enzyme studies, point out to the possible similar activities. However, it is an area for future investigation.

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*Original not seen