PHYSIOLOGICAL AND HORMONAL CHANGES IN RESPONSE TO BUNCHY TOP VIRUS (BBTV) INFECTION IN BANANA

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INTRODUCTION

- Virus infection can result in the alteration of physiological, biochemical and metabolic processes within plants leading to characteristic symptom development.
- Banana Bunchy Top Virus (BBTV) is one of the most destructive viral diseases in Tropical Asia, Pacific Indian Oceania (PIO) regions and Africa leading to 100% yield loss ion banana.
- However, information on physiological and hormonal changes during banana-BBTV interaction is still unexplained.

Therefore, the present investigation was conducted to find out the quantifiable changes in important physiological and biochemical parameters such as proteins, pigments and carbohydrate contents, phenolic compounds, polyphenol oxidase (PPO), peroxidase (POX), ascorbate peroxidase (APX), guaiacol peroxidase (GPX), catalase (CAT) and superoxide dismutase (SOD) activities in leaves of banana cultivars Grand Nain and Virupakshi

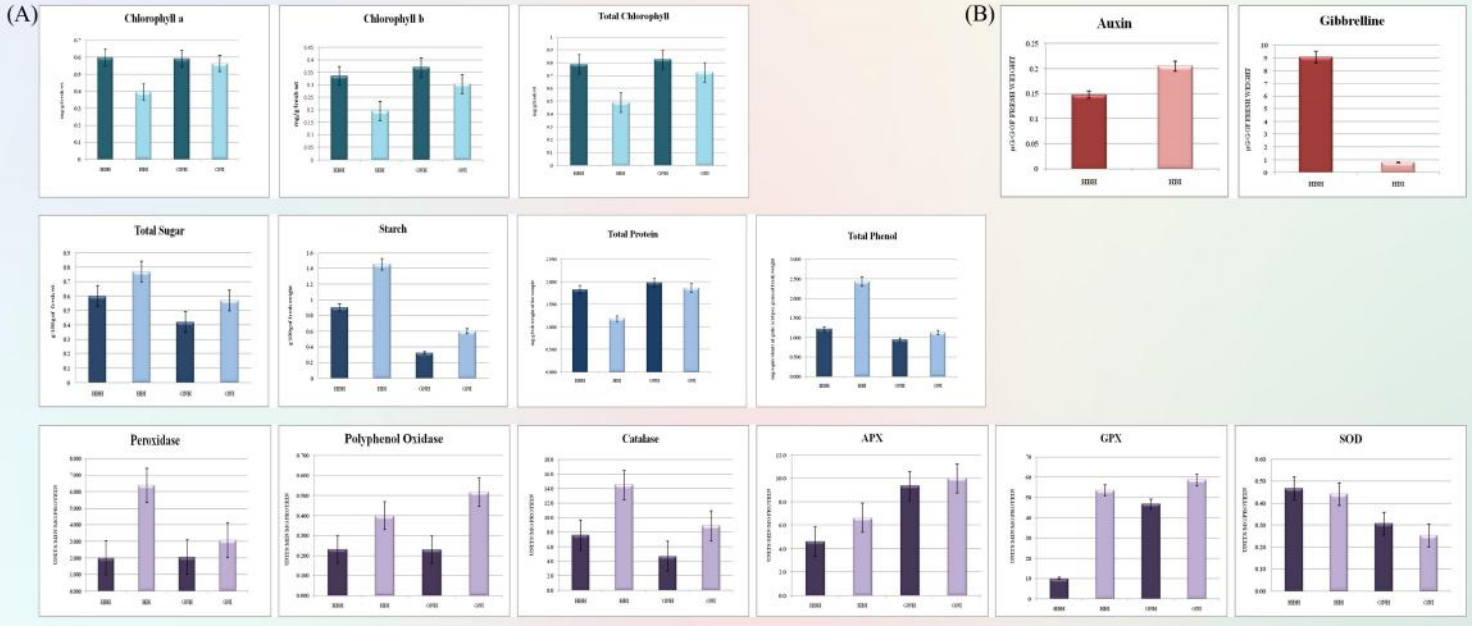
MATERIALS AND METHODS

- Total Chlorophyll, Chlorophyll 'a' and Chlorophyll 'b' contents of healthy and infected leaves were estimated as per the non-destructive DMSO method suggested by Hiscox and Israel Stam (1979)
- Estimation of total sugars was done according to the method of Dubois et al.,1956 and total starch content by method of Hedge et al.,1962.
- Total protein estimation - Bradford method (Bradford, 1976).
- Total phenol estimation - Folin-Ciocalteau reagent (Folin and Ciocalteau, 1927).
- PO and PPO activity were determined according to Putter et al. (1974) and Esterbaner et al. (1977), respectively.
- SOD activity was assayed by measuring its ability to inhibit the photochemical reduction of NBT using the method of Dhindsa et al. (1981).
- CAT activity was assayed by measuring the rate of disappearance of H_2O_2 using the method of Maehly and Chance (1959).
- APX and GPX activity were determined according to the method of Chen and Asada (1989) and Upadhyaya et al. (1985), respectively.
- Auxin and GA3 were estimated according to Mahadevan, 1984.

RESULT AND DISCUSSION

- The amount of carbohydrate contents, phenolic compounds, PO, PPO, APX, GPX, CAT and SOD were significantly higher in leaves of BBTV infected plants of both the cultivars over the healthy, whereas proteins, pigments and SOD activity showed reverse trend.
- Drastic reduction of chlorophyll a, chlorophyll b and total chlorophyll in infected Virupakshi and Grand Nain banana leaves were attributed to the disturbed physiological process like photosynthesis and utilization of plastid proteins or their precursors for the synthesis of virus protein
- The total carbohydrate contents (sugars and starch) were high in BBTV infected Virupakshi and Grand Nain leaves when compared to healthy may be due to decreased photosynthesis and increased respiration in virus infected tissues leading to altered concentration of carbohydrates or it may affect the activity of the enzyme systems controlling the interconversion of the different forms of carbohydrate
- Total protein was low as the infection might have caused denaturation or break down of proteins as well as polypeptide chains and bound amino acids.
- Increased level of phenolic in infected plants suggested an acceleration of phenols synthesizing pathway following infection with virus.
- Antioxidant enzymes were high in infected plants which may trigger various defense mechanisms against pathogens and may be directly involved in restricting pathogen spread and development, accelerating the cellular death of cells close to the infection site, preventing the spread of infection and/or by generating a toxic environment which will inhibit the growth of the pathogen inside the cells
- Among the GA3 was found to be higher in healthy plants than BBTV infected plants, whereas auxin showed reverse trend resulting in development of symptoms like morse code and bunchyness of the plants.

Fig. 1 (A) Estimation of chlorophyll , total sugar, starch, total protein, total phenol and anti-oxidant enzymes (PO, PPO, CAT, APX, GPX and SOD) in control and BBTV infected Virupakshi and Grand Nain leaves . (B) Estimation of Auxin and Gibbrellin content in healthy and BBTV infected Virupakshi banana leaves.



CONCLUSION (B)

- Early and elevated levels of expression of various defense enzymes in plants upon stresses is an important feature of plant resistance to any pathogen infection.
- Overall the results suggest that BBTV infection induces significant changes in enzymes and hormone levels leading to irreversible symptom development.
- Further studies with transcriptomic and proteomic analysis would lead to identification of biochemical marker for studying plant-virus compatible and incompatible interactions.