# BIOCHEMICAL ALTERATION OF CELLULAR COMPONENTS OF ASH GOURD DUE TO INFECTION OF THREE DIFFERENT VIRUSES

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**ABSTRACT**

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An experiment was conducted to determine the changes in ash gourd (*Benincasa hispida*) due to infection of *Bottlegourd mosaic virus* (BgMV), *Watermelon mosaic virus 2* (WMV2) and *Papaya ringspot virus* (PRSV). Chlorophyll, β-carotene, organic carbon and DNA were found to be reduced in the infected leaves as compared to non infected ones. But total phosphorus and RNA contents were increased in the infected leaves. Ratio of chlorophyll a to b and RNA to DNA were higher in the virus infected leaves. Total nitrogen and protein was decreased due to BgMV and WMV2 infection while it was increased in case of PRSV.

**Key words**: BgMV, WMV2, PRSV, Biochemical change

## INTRODUCTION

Multiplication of virus particles in the infected plant cells alters biochemical compounds of cells such as chlorophyll, β-carotene, organic carbon, nucleic acids etc. (Fraser 1987). External manifestations of disease symptoms are the results of altered host metabolism. The extent of crop loss is mainly associated with severity of visible symptoms (Sreenivasulu *et al*. 1989). Greater understanding of these biochemical changes may increase the accuracy of disease loss assessment, which helps to know about the nature of the virus. In Bangladesh report on biochemical changes in the host plant due to virus diseases is scanty. The present study was undertaken to determine changes in concentration of chlorophyll, β-carotene, organic carbon, nitrogen, protein, phosphorus and nucleic acid in ash gourd due to infection of *Bottle gourd mosaic virus* (BgMV), *Watermelon mosaic virus 2* (WMV2) and *Papay ringspot virus* (PRSV) under natural condition.

## MATERIALS AND METHODS

An ash gourd line "CQ-90-10" was grown during summer (May to August) at the research farm of Bangabandhu Sheikh Mujibur Rahaman Agricultural University (BSMRAU). The seeds of the ash gourd line were obtained from department of Genetics of Plant Breeding, BSMRAU. At flowering stage, leaf samples of apparently healthy and diseased plants were collected when typical symptoms of BgMV, WMV2 and PRSV infection was developed. Young leaves were collected from identical position of the main stem for laboratory test. Modified dot immunobinding assay (DIBA) (Akanda *et al*. 1991) method was performed for the presence of virus. Chlorophyll and β-carotene contents were estimated according to Witham *et al*. (1986) and Shiraishi (1972) respectively using double beam spectrophotometer (model 1200-20 Hitachi) extracting with 80% acetone. Total nitrogen and protein was determined by Kjeldahl method as described by Jackson (1958). Organic carbon was determined by Tyurin (1980) method. Phosphorus and nucleic acid contents were estimated according to Hunter method (Anonymous 1975) and Spirin (1958) method respectively.

## RESULTS AND DISCUSSION

Chlorophyll contents of the infected plants in all cases were found to be decreased in comparison to healthy (Table 1). Drastic reduction of chlorophyll a (69.17%), chlorophyll b (85.66%) and total chlorophyll (76.79%) was observed in BgMV infected leaves. The ratio of chlorophyll a to b was observed to be higher in all the virus infected leaves as compared to healthy (Table 1). Reduction of β-carotene was common in all the three viruses. Highest reduction was observed in BgMV (78.59%) followed by PRSV (37.39%) and WMV2 (8.86%) (Table1). Haider and Hossain (1994) and Akanda *et al*. 1998 observed similar trend of reduction in chlorophyll and β-carotene in the Yellow Vein Mosaic Virus infected okra and CMV infected tomato leaves. High chlorophyll a to b ratio indicates more degradation or lower synthesis of chlorophyll b than a due to virus infection. Organic carbon was reduced in all the virus infected leaves. The highest reduction (22.31%) was observed in BgMV followed by PRSV (3.28%) and WMV2 (2.46%). Decrease in Photosynthesis might be responsible for less organic carbon in the infected leaves (Fraser 1987). Total nitrogen and protein was decreased in BgMV and WMV2 while it was increased in PRSV (Table 2). Similar observation was documented by Elberthagen (1958). Highest reduction (45.71%) was found in WMV2 followed by BgMV (2.6%). On the contrary PRSV induced 49% increase in total nitrogen. Total phosphorus level in the infected leaves was increased (Table 2). Highest increase was observed in PRSV (86.22%) followed by

BgMV (83.03%) and WMV2 (7.12%). Increased phosphorus content in the diseased leaves might be due to phosphorus containing polypeptide of the virus particles. Similar results were obtained by Matthews et al. (1963) and Haider and Hossain (1994). RNA contents in the diseased leaves were increased while that of DNA was reduced (Table 3). The ratio of RNA to DNA was increased in the infected leaves. Similar results were obtained by Hossain and Haider (1992). Higher content of RNA in the infected leaves might be due to predominant synthesis of viral RNA.

Table 1. Changes in chlorophyll and β-carotene in virus infected leaves of ash gourd (*Benincasa hispida*)

| Virus | Chlorophyll a (mg/100g fresh wt.) | Chlorophyll b (mg/100g fresh wt.) | Total Chlorophyll (mg/100g fresh wt.) | Chl a:b | B-carotene (mg/100g fresh wt.) |
|---|---|---|---|---|---|
| PRSV | 57.2 (-4.18) | 41.9 (-18.64) | 99.10 (-10.88) | 1.37 | 7.84 (-37.99) |
| WMV2 | 55.7 (-6.70) | 39.80 (-22.71) | 95.50 (-14.11) | 1.40 | 11.56 (-8.86) |
| BgMV | 18.4 (-69.17) | 7.40 (-85.66) | 25.80 (-76.79) | 2.48 | 2.71 (-78.59) |
| Healthy | 59.70 | 51.50 | 111.20 | 1.16 | 12.64 |

Figures in the parentheses indicate percent change over healthy leaves.

Table 2. Organic carbon, nitrogen, protein and phosphorus contents in apparently healthy and virus infected leaves of ash gourd (*Benincasa hispida*)

| Virus | Organic carbon (%) | Total Nitrogen (%) | Total Protein (%) | Phosphorus (ppm) |
|---|---|---|---|---|
| PRSV | 35.40 (-3.28) | 0.574 (49.09) | 3.58 (49.08) | 34.375 (86.22) |
| WMV2 | 35.70 (-2.46) | 0.209 (-45.71) | 1.306 (-45.72) | 19.774 (7.12) |
| BgMV | 28.5 (-22.31) | 0.375 (-2.60) | 2.343 (-2.62) | 33.785 (83.03) |
| Healthy | 36.60 | 51.50 | 111.20 | 18.459 |

Figures in the parentheses indicate percent change over healthy leaves.

Table 3. Changes in nucleic acid in virus infected leaves of ash gourd (*Benincasa hispida*)

| Virus | Nucleic acid content (mg/g) | | Ratio DNA:RNA |
|---|---|---|---|
| | RNA | DNA | |
| PRSV | 12.96 | 0.35 | 37.47 |
| WMV2 | 13.73 | 0.41 | 33.16 |
| BgMV | 10.78 | 0.45 | 24.16 |
| Healthy | 8.93 | 0.58 | 15.44 |

In most of the cases similar trend of reduction or increase in various cellular components due to virus infection were observed in the present investigation. But there is wide variation in the degree of change. This phenomenon suggests that extent of damage might not be the same by all the viruses. BgMV was found to reduce chlorophyll, β-carotene and organic carbon in greater degree than other viruses. So this virus might be more damaging in ash gourd than PRSV and WMV2. But this has to be confirmed by experimentation.

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