

## SHORT COMMUNICATIONS

# Studies on mosaic disease of sunflower : Biochemical changes and growth parameters

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The mosaic disease of sunflower is one of the important diseases causing heavy losses in oil yield. In the present study, an attempt has been made to analyse certain biochemical changes and growth parameters in the mosaic disease.

Systemically infected sunflower (*Helianthus annuus* L.) leaves showing characteristic mosaic with light green areas were collected from commercial fields. The virus culture was maintained on sunflower plants. Leaf samples were collected and processed for biochemical studies. Three individual sampling was done for each experiment. The fresh sunflower leaf samples were collected and chlorophylls, proteins, sugars, starch and lipids were estimated. The growth and yield parameters were also studied in the healthy and infected plants.

### Chlorophylls

Chlorophyll estimation was done according to the method of Arnon (3). The total chlorophyll content was less in virus infected leaves when compared to healthy sunflower leaves. Chlorophyll a, chlorophyll b and chlorophyll a/b ratios were also low in virus infected leaves as compared to healthy leaves (Table 1). The reduction of chlorophyll might be due to the increased activity of chlorophyllase (Goodman *et al.*, 8). Altered ratio of chlorophyll due to virus has been observed in different virus-host interactions (9, 13, 5).

### Proteins

Total leaf soluble proteins were estimated by the method of Lowry *et al.*, (10). The proteins were high in virus infected leaves when compared to healthy leaves (Table 1).

### Sugar and Starch

Sugars estimation was done according to the method of Dubois *et al.*, (7) and the starch content was esti-

**Table 1.** Biochemical changes in healthy and diseased sunflower plants

Parameters (mg/g fresh leaves)	Per cent increase (+) or decrease (-) over healthy
<b>Chlorophylls</b>	
Total Chlorophyll	-27.55
Chlorophyll a	-22.31
Chlorophyll b	-17.20
Chlorophyll a/b	-6.20
<b>Proteins</b>	
Total soluble proteins	+56.25
<b>Sugar and Starch</b>	
Sugars	+60.00
Starch	+17.07
<b>Total Lipids</b>	
Leaves	-26.66
Seeds	-56.81

Values given in the above are an average of three individual experimental samples.

mated by the method of McCready *et al.*, (11). The sugars and starch concentration was high in infected leaves when compared to healthy leaves of sunflower (Table 1). The decreased photosynthesis and increased respiration occurs in virus infected tissues and lead to altered concentration of carbohydrates. Some viruses showed altered metabolism of carbohydrates are characteristic but in the present investigation with sunflower mosaic disease it was reversed. Increased accumulation of carbohydrates are known in different virus – host combinations (15,3,13).

### Lipids

Total lipids were extracted from the leaves, according to the method of Hoppe and Heitefus (1974).

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**Tables 2.** Growth and yield parameters in healthy and diseased sunflower plants

Parameters (mg/g fresh leaves)	Per cent increase (+) or decrease (-) over healthy
<b>Growth</b>	
Shoot length (cm / plant)	-29.16
Root length (cm / plant)	-58.33
Length (No. / Plant)	-23.07
Fruiting head (diameter in cm)	-54.54
<b>Dry weight</b>	
Shoot (g/plant)	-52.00
Root (g/plant)	-37.50
<b>100 Seeds weight and volume</b>	
Weight (g)	-51.80
Volume (ml)	-42.85

Values given in the above are an average of 25 plants.

The lipid content was determined gravimetrically. It was low in virus infected leaves and seeds when compared to healthy leaves and seeds of sunflower (Table 1). Reduced content of lipids in virus infected leaves may be either due to a lowered synthesis or enhanced degradation (1,12).

### Growth and Yield

Matured healthy and infected sunflower plants were harvested with their fruiting heads and used to study the growth and yield parameters. The virus infection decreased the overall growth and yield of sunflower. Length of root and shoot; the size of fruiting head and volume of 100 seeds; the number of leaves and dry weight of root, shoot and seeds were less in mosaic diseased plants when compared to corresponding healthy plants (Table 2). The effects of early virus infection and disease severity on plant growth and yield were reported by several workers (6, 14).

It is concluded that a virus causing mosaic disease in sunflower altered the concentrations of total chloro-

phyll + Chlorophyll a, b  $\pm$  a/b; protein; carbohydrates and lipids in leaves and seeds which intern probably contributed to the observed decrease in various growth parameters.

### REFERENCES

1. Adam, A., Gaborjanyi, R. Tobias, I. and Kiraly, Z. (1987). *Ann. appl. Biol.* **110**: 313-319.
2. Adomako, D. and Hutcheon, W.A. (1974). *Physiol. Plant.* **30** : 90-96.
3. Arnon, D.I. (1949). *Plant Physiology* **24**: 1-15.
4. Brunt, A.A., Cabtree, K., Dallwitz M.J., Gibbs A.J. and Watson L. (1996). CAB International, Wallingford, Oxon, UK, pp. 1484.
5. Dantre, R.K., Keshwal R.L. and Khar, M.N. (1996). *Indian J. Virol.* **12**: 47-49.
6. Demski, J.W., Reddy, D.V.R. Sowell, S.Jr. and Bays. D. (1984). *Ann. appl. Biol.*, **78**: 631-632.
7. Dubois, M., Gilles, K., Hamilton, J.K., Rebers, P.A. and Smith, F. (1951). *Nature* **168**: 167.
8. Goodman, R.N., Kirlyay, Z. and Zaitlin, M. (1967). D. Van Notttr and Comp. Inc., Princeton, New Jersey, pp. 334.
9. Leal, N. and Lastra R. (1984). *Physiol. Plant Pathol.* **24**: 1-8.
10. Lowry, H., Rosebrough, N.J., Far, A.L. and Randall, R.J. (1951). *J. Biol. Chem.* **193**: 265-275.
11. McCready, R.M., Goggole, J. Silvierra V. and Owens, H.S. (1950). *Analytical Chemistry* **29**: 1156-1158.
12. Saigopal, D.V.R., Sreenivasulu, P. and Nayudu, M.V. (1990). *Physiological and Molecular Plant Pathology* **37**: 1-8.
13. Shukla, U.S., Vijai Singh and Tripathi, (1992). *Indian J. Virol.* **8**: 115-117.
14. Sivaprasad, V. (1990). Ph. D. Thesis S.V. University, Tirupati.
15. Wynd, F.L. (1943). *Bot. Rev.* **9**: 395-465.

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