U Res. J. 1995. 21 (1) : 179-182

Biochemical Factors of Resistance in Little Leaf Disease in Egg Plant (*Solanum melongina* L.)

N. D. Vora, Y. M. Shukla and M. K. Chakraborty

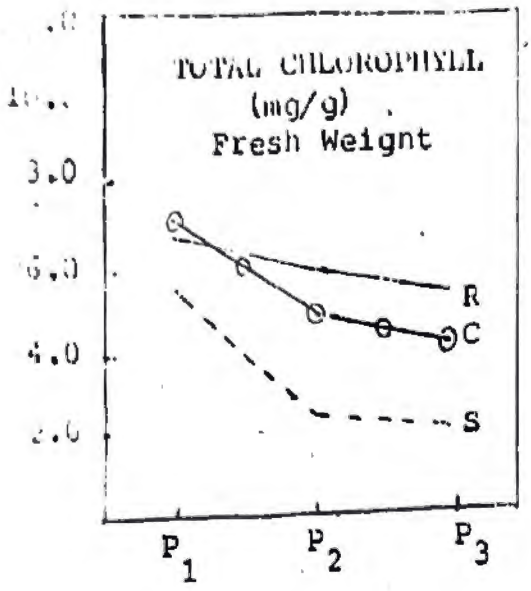
Department of Biochemistry, B. A. College of Agriculture, Gujarat Agricultural University, Anand Campus, Anand-388 110 (Gujarat)

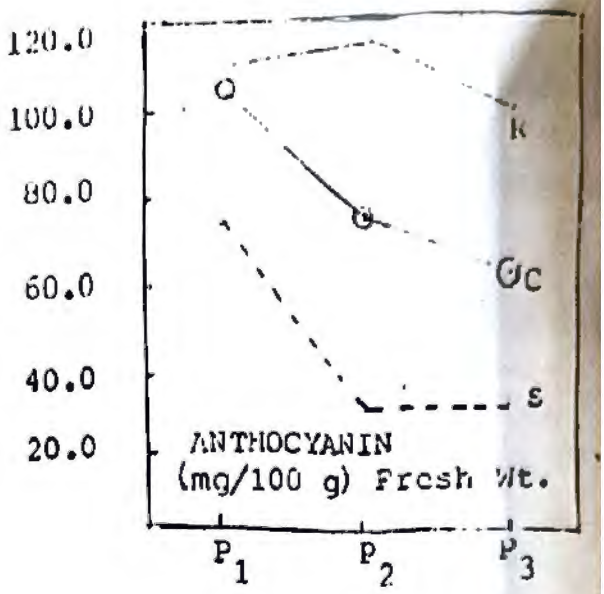
Egg plant (brinjal) is an important vegetable crop of India. The crop is affected by many pests and diseases of which little leaf disease is an important economic pest. It is caused by mycoplasma like organism (MLO) transmitted by leaf hoppers. Diseased plants show extreme reduction in size of their leaves and nodes giving a bushy appearance. In heavily infected plants flowers and fruit setting become negligible, seriously bringing down the productivity.

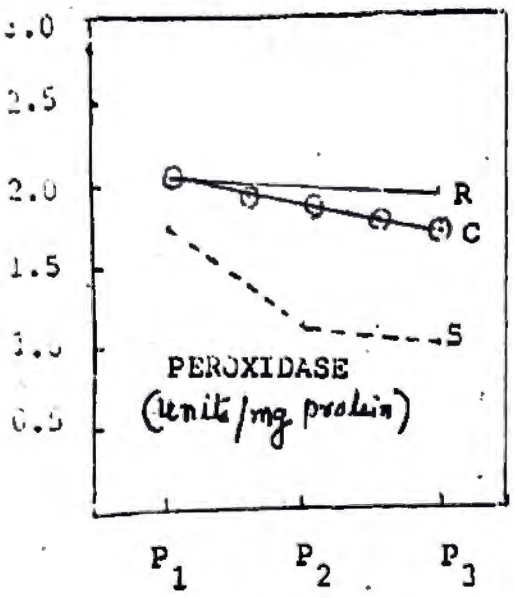
In order to elucidate the biochemical factors leading to resistance to this dreaded disease, leaf tissues of a resistant variety (PN-1), a susceptible variety (Morvi 4-2) and their F_1 cross were analysed from field crops grown in experimental field of the College Farm in 1990. Leaf samples were collected at three stages of development : (1) first flowering stage before the onset of disease, (b) at the peak disease period and (c) at the last stage of fruit harvest.

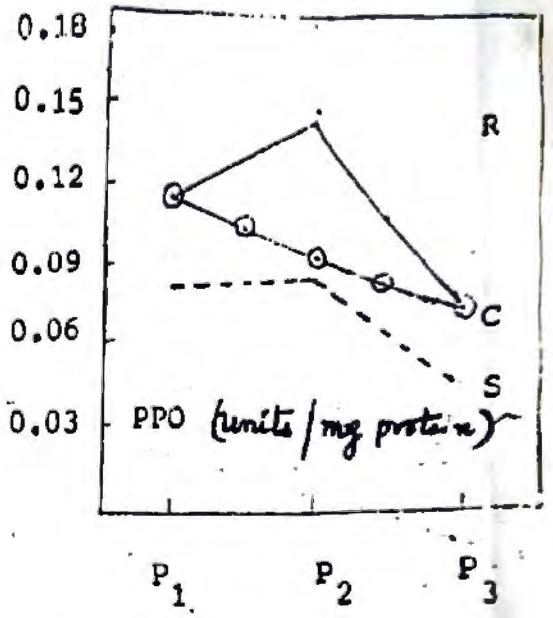
Tissue analyses were done for plant pigments; chlorophyll following the method of Holden (1976) and anthocynin by Ranganna (1976), enzymes like polyphenol oxidase (PPO) by Malik and Singh (1980) and peroxidase by Guibaults (1976), secondary metabolites like total phenols by Malik and Singh (1980) and glycoalkaloid by Curries and Kuc (1975). Protein for enzyme specific activity estimated from enzyme extract by Lowary *et al.* (1951) and expressed as units/mg protien (1 unit of enzyme = Change in O.D./min). The results are presented in Figure 1.

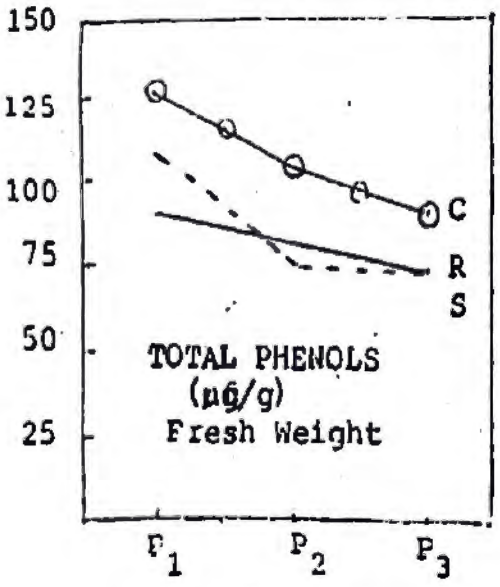
Ontogenic changes followed by the normal pattern of decrease except anthocyanin, PPO and glycoalkaloid content. PPO and glycoalkaloid increased significantly while anthocyanins remained unaltered in the peak period of disease in resistant plant PN-1. As illustrated in the figure, there was very marginal difference in chlorophyll and peroxidase activity in both the varieties before the onset of disease. With the advance in disease symptom, these constituents showed rapid decrease in infected variety as compared to resistant type. Reduction in chlorophyll in MLO infected plant may be due to inhibition of chloroplast development or stimulation of cell enzyme which attacks chlorophyll. Similar loss of chlorophyll pigments has been noted in chilles infected by CMV (Mishra

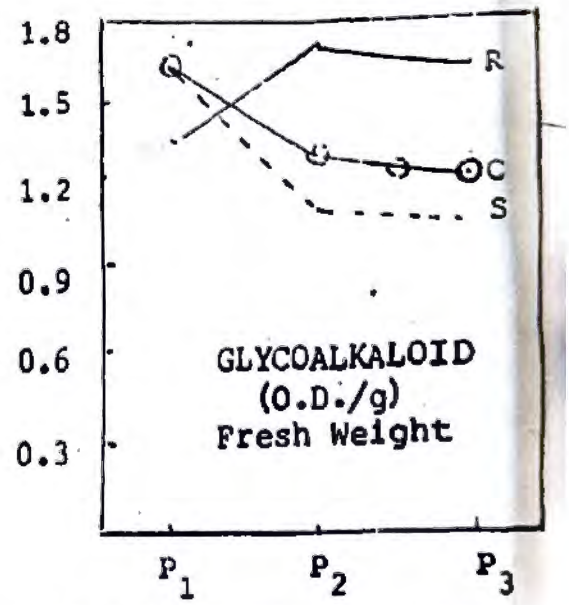












P_1 = Prior to disease; P_2 = Peak disease period; P_3 = After disease before harvest

PN - 1 (R) (Resistant) — F_1 - Cross (C) — MORVI 4-2 (S) (Susceptible)

and Jha, 1967; Joshi and Dubey, 1975). Sarkar and Joshi (1978) observed decrease in peroxidase activity at the later stage of infection in susceptible variety. Similar trend was observed in the present investigation. The pattern of change of total phenol was different, while the susceptible variety had higher content than the resistant type at the pre-infection stage. At post-infection stage, the varietal difference was negligible making the rate of change less rapid in resistant variety. Singh (1986) suggested production of common phenolics and their accumulation proceeds at a faster rate in resistant variety than in susceptible variety. Similar observation was recorded by Mitra and Mozumder (1978) in pusa purple long resistant variety of brinjal.

The changes in F_1–cross always showed intermediate behaviour signifying the potentiality of simple inheritance character of these chemical moieties except total phenols which had the maximum content at all three stages.

The most conspicuous change leading to the resistance character in PN-1 appear to be rapid accumulation of glycoalkaloid in leaf tissue at the peak disease period. The significance of glycoalkaloid against disease attack was noted by many scientists in potato which belongs to same solanaceae family as brinjal (Siden *et al.*, 1973; Mazurczyk and Kuzniewics, 1987). Although no works have been reported in literature on the role of glycoalkaloid in relation to little leaf disease occurrence in brinjal. The present investigation shows that glycoalkaloid increases significantly during the peak disease occurrence period in resistant variety PN-1 but decreases in susceptible variety Morvi 4-2 suggesting its most probable involvement in imparting resistant character. Antifeedant bio-activity of glycoalkaloid – Solanine present in potato tubers has been reported by Dahlman and Hibbs (1967). High level of anthocyanin may be another important factor imparting resistance to PN–1. There was a rapid reduction of anthocyanin content in susceptible variety Morvi 4-2 at peak period of disease infection stage; after that the change was negligible. In resistant variety, on the other hand, anthocyanin level was always high; slight decrease was observed at late stage of plant ontogeny. Anthocyanins are phenolic glycosides. The aglycone part consists of many phenolic compounds like phlorogucinol, p-hydroxy benzoic acid, protocatechuic acid and gallic acid. These phenolic compounds are probably further oxidised and polymerized due to the pre-existing high level of PPO and peroxidase

TABLE 1

Phenols and glycoalkaloid content in brinjal fruit.

on Fresh Wt. Basis

Variety	*Glycoalkaloid (O.D./g)*	*Phenols (ug/g)*
PN-1 (Resistant)	0.384	25.63
Morvi 4-2 (susceptible)	0.493	27.45

in resistant variety giving rise to highly lignified tissues unsuitable for the proliferation of mycoplasma.

Fruit analysis from the infected and resistant plants showed that phenols and glycoalkaloids were less in PN-1 and more in Morvi 4–2 (Table 1). Since phenols give discolouration of cut-fruit and glycoalkaloid imparts bitter taste in brinjal (Bajaj *et al.*, 1979), these two constituents comprise negative attributes to fruit. Viewed from the above quality standard, the resistant variety produced superior fruit quality in comparison with the infected susceptible variety.

(Received on 3rd Sept., 1994)

REFERENCES

Bajaj, K. L.; Gurdeep Kaur and M. L. Chadha, 1979. Glycoalkaloid content and other chemical constituents of the fruits of some egg plant varieties. *J. of Pl. Foods*, 3 : 163.

Curries, W. W. and Kuc, J. 1975. Effect of temperature on rishitin and steroid glycoalkaloid accumulation in potato tuber. *Phytopathology*, 65 : 1195-1197.

Dahlman, K. Lr and Hibbs, E. T. 1967. Responses of *Empoasca fabae* (Cicadellidae : Homoptera) to tomatine, solanine, leptin I : Tomatadine, solanidine and demissidine. *Ann. Ent. Soc. Amer.*, 60 : 732.

Guibaults, G. G 1976. Assay of enzymes. Peroxidase In. Handbook of Enzymes Methods of Analysis. Marcel Dekker Inc., New York, p. 147.

Holden, M. 1976. Chlorophylls. *In* Chemistry of Plant Pigments ed. by Goodwin, T. W., IInd edn., 2 : 2-32.

Joshi, R. D. and Dubey, L. N. 1975. Effect of cumumber mosaic virus on chlorophyll content in chille (*Capsicum* annum). *Indian J. of Myco. and Pl. Patho.*, 5 : 26 (Ab).

Lowary, O. H., Rosenbrough, N. J.; Fars, A. L. and Randall, R. J. 1951. Protein measurement with folin phenol reagent. *J. Boil. Chem., J. Biol. Chem.*, 193 : 265.

Malik, C. P. and Singh, M. B. 1980. Assay of polyphenol oxidase and estimation of total phenol. In Plant enzymology and histoenzymology. Kalyani Publishers, New Delhi. p. 54-55, 286.

Mazurczyk, Won; Kuzniewics, M. 1987. Relationship between gloycoalkaloid level and potato tuber infection by *Fusarium* during storage. *Bieuletyn Inslytutu Ziemniaka*, 35 : 78 (Fide : *Potato Abstr.*, 15 (5) : 1384).

Mishra, K. A. and Jha, A. 1967. Paper chromatography of leaf juice from healthy and mosaic infected chilli plant. *Indian Phytopath.*, 20 : 387.

Mitra, D. K. and Mozumder, M. 1978. Changes in total phenolic content and PPO activity in brinjal as a result of little leaf infection. Proc. *Indian Nat. Sci. Acd.* 43 (6) : 228- 231.

Ranganna, S. 1976. Total anthocyanin content. *In* Analysis of fruit and vegetable products. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, p. 87.

Sarkar, K. R. and Joshi, R. D. 1978. Peroxidase and catalase activity in MLO infected brinjal. *Indian Phytopath.*, 30 (4) : 518.

Siden, S. L.; Goel, R. W. and O'Brien, M. J. 1973. Effect of potato alkaloid on the growth of *A. solani* and their possible role as resistance factor in potato. *Phytopathology*, 63 : 303.

Singh, D. P. 1986. Concept in disease resistance. *In* Breeding for resistance to disease and insect pests. Narosa Publishing House, New Delhi, P 4-30.