

BIOCHEMICAL CHANGES INDUCED BY ANTHRACNOSE DISEASE IN BETELVINE

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RECEIVED : 30 December, 2019

Healthy and infected leaves from ten varieties of Piper betle were taken as the experimental material. The diseased spots, *i.e.* Central black necrotic zone, senescent yellow region and surroundings faded green region and the healthy leaves were analysed biochemically for chlorophyll, carbohydrate, protein, amino acids, phenols and vitamin contents. Comparison was made among contents of infected and healthy leaves in these ten varieties. (Key words : necrotic, senescent, chlorophyll)

INTRODUCTION

Betelvine (Piper betle *L.*) is attacked by a number of destructive diseases of which anthracnose, bacterial leaf spot complex *Colletotrichum capsici* (Syd.) Butler & Bisby + *Xanthomonas compestris* *P.V.betlicola* (Patel, Kulkarni; Dhande) Dye has been the most serious menace in betelvine growing tracts of the country.

Host pathogen interaction is a struggle for survival of both, which manifests in the development of visual symptoms. In order to study the chemical changes that occur following infection by anthracnose complex, the present studies were taken up.

MATERIALS AND METHODS

Fresh samples from infected leaves with conspicuous spots were taken and fractionized into (1) Necrotic zone, (2) Yellow zone surrounding the necrotic areas, and (3) Faded greenish area around by Yellow halo. Apparently healthy fresh leaves were taken for analysis and comparison. The samples were biochemically analysed for content of chlorophyll 'a' and chlorophyll 'b' and total chlorophyll (Arnon, 1949), total sugar and starch (Yoshida et al., 1972), reducing sugar (Nelson, 1944), total protein (Jackson, 1958), amino acids (Lee and Takahashi, 1966) and phenols (Bray and Thorpe, 1954), Vitamin 'C' was estimated following the method of Roe and Kuether (Mapson, 1961) and Vitamin 'A' according to Kimble, 1939. The data are presented in Tables – 1 to 4.

RESULTS AND DISCUSSION :

The biochemical analysis of diseased betel leaves showed the reduction in chlorophyll pigments, which is a characteristic feature of diseased plant tissues and chlorosis is one of the most common symptoms of fungal infection (Mathews, 1981). The present study has shown that the disease development drastically reduced chlorophyll content in black lesions. This effect was also seen in green and yellow regions. Reduction in chlorophyll content was reflected both in chlorophyll 'a' and chlorophyll 'b' fractions. While looking to total chlorophyll content of the healthy tissues, it was minimum with the variety Kanjale and maximum with Maghi.

Host plant is a living culture medium for the pathogen and sugar provides the major source of energy for the parasite. In the present study, disease development reduced the concentration of soluble carbohydrates both reducing and total sugars in necrotic zone as well as in the yellow region accompanied by a marked accumulation of starch in the healthy tissues and the effect of disease development in green tissues were pronounced only to a less extent. Chaurasia *et al.* (1987) studied the biochemical changes in betelvine leaves affected by bacterial disease and reported the maximum amount of total sugar as well as reducing and non-reducing sugars in the susceptible varieties in comparison to resistant varieties.

TABLE No. 1 : Estimation of chlorophyll – 'A' and chlorophyll – 'B' and the total chlorophyll (Mg/Gm. fresh weight) from the leaves of betelvine varieties under disease stress.

Variety	Healthy leaf			Infected leaf								
	CHL 'A'	CHL 'B'	TOTAL CHL	1*			2**			3***		
				CHL 'A'	CHL 'B'	TOTAL CHL	CHL 'A'	CHL 'B'	TOTAL CHL	CHL 'A'	CHL 'B'	TOTAL CHL
Awani (Assam)	0.421	0.532	0.953	0.081	0.082	0.163	0.136	0.135	0.271	0.341	0.272	0.613
Maghi	0.425	0.262	0.687	0.044	0.028	0.072	0.104	0.101	0.205	0.213	0.212	0.425
Ghanghate (Bangla)	0.258	0.224	0.472	0.049	0.029	0.078	0.038	0.084	0.122	0.125	0.137	0.252
Mahoba (Bangla)	0.375	0.523	0.898	0.052	0.041	0.093	0.080	0.029	0.109	0.380	0.218	0.598
Red stem (Bilhari)	0.321	0.201	0.522	0.083	0.082	0.165	0.072	0.021	0.093	0.132	0.231	0.363
Berhampuri (Sanchi)	0.437	0.682	1.119	0.062	0.088	0.150	0.213	0.128	0.331	0.424	0.392	0.816
Halisahar (Sanchi)	0.335	0.312	0.647	0.042	0.066	0.108	0.028	0.071	0.099	0.241	0.180	0.421

Kapuri	0.232	0.147	0.379	0.034	0.045	0.079	0.038	0.084	0.122	0.115	0.135	0.250
Ramtek (Bangla)	0.259	0.271	0.530	0.044	0.045	0.089	0.035	0.045	0.080	0.189	0.188	0.377
Dhob Mahata	0.225	0.262	0.487	0.036	0.034	0.070	0.061	0.025	0.086	0.183	0.168	0.351

1* : Necrotic central black region

2** : Senscent yellow region

3*** : Faded green region.

TABLE No. 2 : Estimation of starch, total sugar and reducing sugar (Gm/ 100Gm fresh weight) from the samples of betelvine varieties under disease stress.

Variety	Healthy leaf			Infected leaf								
				1*			2**			3***		
	Starch	Total Sugar	Redu c sugar	Starch	Total Sugar	Redu c sugar	Starch	Total Sugar	Redu c sugar	Starch	Total Sugar	Redu c sugar
Awani (Assam)	1.502	1.5	0.9	0.250	0.760	1.200	0.730	0.840	0.885	1.140	1.210	0.890
Maghi	1.475	2.35	1.225	0.486	1.160	2.008	0.750	1.050	1.130	1.110	2.360	1.190
Ghanghate (Bangla)	1.684	1.05	0.7	0.680	0.580	1.206	0.817	0.560	0.680	1.180	1.040	0.720
Mahoba (Bangla)	1.093	1.8	1.125	0.880	0.898	2.228	0.570	0.890	1.010	1.020	1.960	1.090
Red stem (Bilhari)	2.012	2.4	1.2	1.040	1.020	2.060	1.040	1.210	1.050	2.040	2.220	1.089
Berhampuri (Sanchi)	1.336	0.65	0.425	0.520	0.310	0.780	0.680	0.330	0.288	1.120	0.510	0.428
Halisahar (Sanchi)	1.275	0.7	0.46	0.680	0.389	0.986	0.656	0.360	0.388	1.160	0.648	0.350
Kapuri	1.366	2.6	1.7	0.588	1.236	2.430	0.600	1.250	1.340	1.226	2.300	1.510
Ramtek (Bangla)	1.548	1.05	0.9	0.798	0.560	1.880	0.750	0.500	0.821	1.250	1.000	0.970
Dhob Mahata	1.457	0.47	0.535	0.698	0.250	1.010	1.656	0.280	0.407	1.202	0.390	0.490

1* : Necrotic central black region

2** : Senscent yellow region

3*** : Faded green region.

(Bangla)	0.660	0.348	0.721	0.654	0.344	0.168	0.158	0.348	197.1	64.25	109.3	165.6
Dhob Mahata	0.63	0.394	0.998	0.680	0.235	0.108	0.121	0.244	175.0	58.33	126.3	172.9

1* : Necrotic central black region

2** : Senscent yellow region

3*** : Faded green region.

Any change in the enzymatic level of the host is directly reflected on the protein metabolism. This study revealed higher accumulation of protein in the necrotic lesions. On the other hand, its concentration decreased in yellow region and ten tended to normalize in green tissues. Accumulation or decrease of amino acids depend upon pathogens and it is related to the protein content and proteolytic activity on the tissues. Amino acids generally decreased in the necrotic lesions and yellow region of the infected tissues. The reduction in concentration of amino acids, particularly in the necrotic lesions corresponds with an increase in protein content. It is to note that the disease induced reduction in the amino acids strictly greater in varieties like Kapuri (Maharastra), Karpuri (T.N) Karielle, Ramtek banglad, Kanjale & Bihari. The denotes that these varieties might have suffered due to this disease.

In the present investigation, lowest level of phenols was observed in the diseased tissues but there was enhanced production of phenols in the adjoining yellowish zone and faded greenish zone over the healthy leaves.

Chaurasia reported the higher amount of phenols in resistant varieties (65 mg/g) than susceptible varieties (50 to 54 mg./g) on dry weight basis in diseased betelvine leaves. Maximum phenol accumulation was observed in Karielle, Mahoba Bangla and Bilhari with Karpuri (T.N) contributing the maximum resistance to the disease probably due to more of ascorbic oxidase as suggested by Mahadevan and Sridhar (1982) working on rice resistancxe to blast.

Betelvine varieties showed a good quantity of Vitamin 'A' (0.212 to 0.312 g./100g.) and Vitamin 'C' (152.3 to 214.0 mg./100g.) Vitamin 'A' increased with the colour of the pigments present in the plant and reached highest with yellow colour pigment. It waas seen that the percentage of Vitamin 'A' gradually decreased from the faded green region to the black lesions. This happened due to maximum accumulation of the pathogens in the black lesions. The yellowish zone showed lower content of Vitamin 'A', which might be due to toxic activity of pathogens.

Vitamin 'C' played an important role in metabolism of plants (Mapson, 1958) Varieties showed greater variation in ascorbic acid concentrations. There was a greater reduction in the ascorbic acid content in necrotic lesions compared to yellow regions. It progressed to normalize in the green tissues.

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