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Short Communication

Biochemical factors in powdery mildew resistance of *ber* (*Zizhyphus mauritiana* Lamk.) genotypes varying in ploidy levels

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The defence of a plant to a disease may not depend so much on its structural barriers as on the metabolic process before and after infection. The genetic constitution of the resistant host may be capable of producing or withholding a particular chemical substance or group of substances which interfere with the growth and multiplication of the pathogen [1]. There are two types of defence mechanisms viz., pre infectional and post infectional [2]. The pre infectional resistance is mainly governed by the level of certain metabolites and the post infectional resistance is induced as a result of infection by pathogen. Chemical constituents like total soluble solids [3], sugars [4] and chlorophyll [5, 6] are related with resistance to powdery mildew.

In the present investigation healthy unripe (infection stage) and ripe fruits of some powdery mildew resistant and susceptible *ber* (*Zizhyphus mauritiana* Lamk.) genotypes with different ploidy levels [7] were screened for some of the biochemical parameters to ascertain their possible role in resistance mechanism. Four separate fruit samples collected from each of the eleven accessions (Table 1) were analysed for total soluble solids (TSS) by hand refractometer, total carbo hydrates [8] ascorbic acid [9] and chlorophyll [10].

Total soluble solids (TSS) : Significant differences for TSS were not noticed between the resistant and susceptible genotypes both at the unripe and ripe stages of the fruit. It appears that the ploidy level did not have any effect on TSS content of the fruits. Kaul [11] reported that increase in TSS content of the apple fruits resulted in increased susceptibility of different apple fruits to fungal rots.

Reducing sugars : Resistant genotypes had higher content of reducing sugars in their unripe and ripe fruits than susceptible genotypes. Based on the observed trend it could be concluded that the higher amount of reducing sugars might be responsible for imparting resistance to PM in *ber*.

Non reducing sugars : Chhuhara, a susceptible type had significantly higher non reducing sugars in its ripe (3.04%) and unripe (6.38%) fruits while Kadaka (5.93%), another susceptible genotype had significantly higher non reducing sugar content in its ripe fruits only. Non reducing sugars in ripe fruits of tetraploid genotypes were higher than the diploid, pentaploid and octaploids. Negligible differences were found in unripe fruits of diploid and tetraploid cultivars. Other susceptible types viz., Kadaka, Kathaphal and Umran had lower content of non reducing sugars in their unripe fruits. Nema [12] also reported very little difference in the content of non reducing sugars of the resistant and susceptible cultivars of Betelvine to leaf spot disease.

Total sugars : Statistically significant variation was not observed for total sugars in unripe fruits of both resistant and susceptible genotypes. Similar trend was noticed with regard to mature fruits also except Kathaphal (Susceptible) which had significantly higher sugars. Kaul [11] too opined that higher levels of sugars in the fruits of various apple cultivars resulted in increased susceptibility to fungal pathogens.

Ascorbic acid : The genotypes Guli (82.35 mg/100 g pulp and 156.17 mg/100 g pulp) and Darakhi-2 (29.02 mg/100 g pulp and 192.37 mg/100 g pulp) from resistant group had significantly higher ascorbic acid content in their unripe and ripe fruits. Higher average ascorbic acid content (41.10 and 128.37 mg/100 g pulp) was found in resistant genotypes than the susceptible ones (37.61 and 66.13 mg/100 g pulp) at both unripe and ripe stages of the fruits. Higher average content of ascorbic acid in unripe and ripe fruits of resistant

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Table 1. Mean data for biochemical parameters of *ber* fruits

Sl. No.	Name of the genotype	Ploidy level	Disease Reaction	Total Soluble Solids (%)		Reducing sugars (%)		Non Reducing sugars (%)		Total sugars (%)		Ascorbic acid mg/100 g		Chlorophyll mg/g fr. wt.		
				Unripe	ripe	Unripe	ripe	Unripe	ripe	Unripe	ripe	Unripe	ripe	a	b	Total
Resistant types																
1.	Darakhi-1	2n	R	10.40	18.10	4.16	5.44	2.13	0.30	6.40	5.76	18.90	66.15	0.63	0.53	1.16
2.	Darakhi-2	2n	R	10.30	20.10	3.84	5.76	2.43	0.00	6.40	5.76	29.02	192.37	0.63	0.53	1.16
3.	Guli	2n	R	11.50	20.50	4.80	4.48	0.30	1.21	5.12	5.76	82.35	156.17	0.88	0.77	1.65
4.	Villaiti	2n	R	10.40	22.00	4.80	3.68	1.52	2.58	6.40	6.40	34.16	98.32	0.58	0.50	1.08
5.	Seedless*	8n	I	9.60	-	7.04	-	0.00	-	7.04	-	-	-	0.74	0.63	1.37
	Mean			10.44	20.17	4.93	4.84	1.59	1.02	6.27	5.92	41.10	128.37	0.69	0.59	1.28
Susceptible types																
6.	Chhuhara	4n	S	10.00	20.20	3.20	2.24	3.04	6.38	6.40	8.96	50.02	62.22	0.82	0.85	1.67
7.	Kadaka	4n	S	10.20	20.10	4.16	2.08	0.30	5.93	4.48	8.32	28.06	52.46	0.92	0.81	1.73
8.	Umran	4n	S	11.60	21.00	4.16	4.00	0.91	2.89	5.12	7.04	17.55	64.80	0.80	0.69	1.48
9.	Khathaphal	4n	S	18.60	22.50	2.88	6.70	2.13	7.60	5.12	14.72	52.46	65.88	0.68	0.70	1.38
10.	Dandan	5n	S	10.30	20.80	3.84	2.08	2.13	5.16	6.08	8.32	18.90	40.50	0.71	0.56	1.27
11.	Illaichi	8n	S	10.90	25.60	3.04	3.52	1.98	4.56	5.12	8.00	58.72	110.97	0.73	0.69	1.47
	Mean			11.93	21.70	2.85	3.43	1.75	5.42	5.38	9.22	37.61	66.13	0.78	0.72	1.50
General Mean				11.25	21.09	4.17	3.99	1.53	3.60	5.79	7.90	39.01	91.03	0.73	0.66	1.40
SE ±				0.79	0.63	0.34	0.51	0.30	0.84	0.81	0.84	6.43	15.56	0.01	0.02	0.07

*Fruits of seedless are very rarely formed and if formed do not grow upto maturity

genotypes observed in the present study is in conformity with the trend observed by Rattan and Saini [13] in tomato against fruit rot disease. The level of ascorbic acid content did not follow any definite trend with respect to ploidy levels of the genotypes.

Chlorophyll : In general, the chlorophyll pigments (a, b and total) were found to be higher in the susceptible genotypes as compared to the resistant ones, though no uniform trend was observed. In strawberry, Peries [6] and Scott and Lawrence [14] found an association between mildew resistance and dark green foliage.

The results indicate that the biochemical constituents such as total soluble solids, total carbohydrates, ascorbic acid and chlorophyll appear to have no significant role in imparting resistance to powdery mildew disease in *ber*. Similarly non significant differences between the genotypes of different ploidy levels for these biochemical parameters and absence of a certain trend also suggest that genotypes of higher ploidy are the spontaneous allopolyploids stabilized in the nature as a consequence of diploidization.

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