LEAF SURFACE CONSTITUENTS OF BRASSICA SPECIES IN RELATION TO ALTERNARIA LEAF BLIGHT /ALTERNARIA BRASSICAE /BERK/ SACC. AND A.BRASSICICOLA /SCHW/ WILTS./

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Abstract

The leaf surface constituents viz. wax, total phenols, soluble nitrogen, total soluble sugars and reducing sugars of Brassica species in relation to Alternaria leaf blight /Alternaria brassicae and A.Brassicicola/were determined. The species Brassica campestris CV. BSH-1 and YSPb-24, Brassica juncea CV.RH-30 were susceptible while Brassica napus CV. Tower and HNS-3, Brassica carinata CV. HC-2 and Brassica alba local cultivar were resistant to the disease. The leaf samples for analysis were collected at 30,50,70 and 90 days after sowing. Wax was obtained by washing the surface of the leaf with chloroform. Total phenols,soluble nitrogen, total soluble sugars and reducing sugars were obtained by washing the leaf with 75 per cent alcohol. Wax and soluble nitrogen level increased continuously except at the last stage under study in all the species. Total phenols after the initial increase were observed to drop at later stages. Total soluble and reducing sugars, however, increased continuously with the age of a plant. The concentrations of the wax and phenolic were markedly higher in resistant species as compared to susceptible ones at all the stages of plant growth. Total soluble sugars, reducing sugars and soluble nitrogen levels were, however, lower in resistant species. The presence of higher amount of wax and phenolics on the leaf surface of disease resistant species projects the possibility in claiming resistance to Alternaria leaf blight in Brassica.

Introduction

Wax present on the leaf surface plays an important role in the protection of plants against environmental conditions /Kolattukudy, 1970; Bengtson et.al., 1978/ pests /Allebone et.al., 1971/ and diseases /Blakeman and Sztejnberg, 1973; Jeffree, 1974/. There are also reports on the quantitative differences in wax content of disease resistant and susceptible genotypes of Brassica campestris /Sharma, 1984/ and Arachis hypogaea /Gupta et.al., 1985/. The total amounts of phenolics, soluble sugars and nitrogen of the plant tissue have also been related to disease resistance in different crops. /Farkas and Kirlay, 1962; Brahamchari and Kolte, 1983; Gupta et.al., 1984/, but the reports regarding the presence of these constituents on the leaf surface are lacking. Present investigation was, therefore, undertaken to study the quantitative differences in wax, total phenols, total soluble sugars, reducing sugars and soluble nitrogen on the leaf surface of brassica species, susceptible and tolerant to Alternaria leaf blight during plant development.

Materials and methods

Five brassica species, namely Brassica campestris CV. BSH-1 and YSPb-24, Brassica juncea CV. RH-30 susceptible while Brassica napus CV. Tower and HNS-3, Brassica carinata CV. HC-2 and Brassica alba local cultivar resistant to Alternaria leaf blight /Alternaria brassicae and A.brassicicola/were grown in the Experimental Farm of Haryana Agricultural University, Hisar, India. The leaves of the plant of each cultivar were collected at 30,50,70 and 90 days after sowing /DAS/. The wax from the leaf surface was obtained by washing the leaves with chloroform and was estimated according to the method of Ebercon et.al.,/1970/. Total phenols, total soluble sugars, reducing sugars and soluble nitrogen from leaf surface were obtained by washing the leaves with 75 per cent alcohol. From the washing, total phenols were determined by the method of Swain and Hills /1959/, total soluble and reducing sugars as per

method described by Hulme and Narain /1931/ and soluble nitrogen by conventional micro-Kjeldahl's method. The concentration of each of the constituent was expressed as $\mu g/cm^2$ surface of fresh leaf.

Results and discussion

The wax content was maximum /Table 1/ or the constituents estimated on the surface of leaf during plant development. It was observed to increase rapidly from 30 DAS to 50 DAS and then at a slower rate up to 70 DAS, thereafter it declined marginally irrespective of the cultivars. However, the content was appreciably higher in disease resistant species as compared to susceptible ones at all the stages of plant growth. These results indicate that the presence of higher amounts of wax on the leaf of disease resistant species may prevent the penetration and establishment of the pathogen. Blakeman and Sztejnberg /1973/ reported about 40-70 per cent reduction in germination of Botrytis cineria conidia when grown on varied concentrations of wax removed from surface of the leaves of beet root. Higher amount of leaf surface wax in resistant cultivars of Brassica campestris was also reported by Sharma /1984/.

The leaf of total phenols after an initial increase declined till the last date of sampling in all the species. The phenolic compounds play an important role in the defence of the plant against diseases /Farkas and Kirlay, 1962/. Their concentration also enhances in the plant tissue which is attacked by the pathogen /Nyerges et.al., 1975/ and their higher amount was found in the leaves of disease resistant genotypes of Brassica juncea /Gupta et. al., 1984/. In the present study, also total phenols on the leaf surface were markedly higher in disease resistant species than the susceptible ones during plant growth. This might be helpful in protecting the plant from primary infection by the pathogen.

The concentration of total as well as reducing sugars on the leaf surface was observed to increase consistently

with the age of the plant in all the species. Contrary to wax and phenols, both types of sugars were considerably higher in susceptible species than the resistant ones. Since, diseases have been classified into high and low sugar diseases /Horsfall and Dimond, 1957/, therefore the high amount of sugars in susceptible species indicate that Alternaria leaf blight pathogen might require high amount of sugars for its pathogenesis. As regards soluble nitrogen it was found to increase from 30 DAS to 70 DAS after which it dropped a little in all the species. In comparison to susceptible species, soluble nitrogen was less in resistant species at all the stages of plant growth. Low amount of nitrogen in a plant decreases the severity of the disease /Naidu et.al., 1979/. Similarly, low level of soluble nitrogen on leaf surface of resistant species of brassica might restrict the incidence of Alternaria leaf blight disease.

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Table 1. Changes in biochemical constituents on the surface of the leaf of brassica species in relation to Alternaria leaf blight.($\mu g/Cm^2$ fresh leaf).

Days after sowing(DAS)	Brassica species						
	Susceptible					Resistant	
	B. campestris		B. juncea	B.napus		B.carinata	B. alba
	BSH-1	YSPb-24	RH-30	Tower	HNS-3	HD-2	Local cultivar
				Wax			
30	8.10	7.91	8.35	12.25	16.63	12.35	10.16
50	16.86	17.01	16.80	26.04	31.10	25.06	22.07
70	21.12	19.95	21.66	31.93	34.33	31.10	27.66
90	17.08	17.68	18.36	27.91	29.75	27.63	24.95
				Phenols			
30	2.08	1.71	1.56	2.39	2.48	2.48	2.81
50	2.85	2.30	2.03	3.25	3.36	3.18	3.96
70	2.45	1.98	1.78	2.88	2.85	2.78	3.25
90	1.93	1.43	1.25	2.40	2.38	2.51	2.61
				Soluble Nitrogen			
30	5.41	5.55	6.13	4.83	3.81	4.66	5.16
50	10.61	10.51	11.38	8.56	8.11	8.75	9.12
70	12.10	12.53	12.33	9.68	9.55	10.21	10.33
90	9.26	9.71	10.26	7.81	8.40	8.78	8.73
				Reducing sugars			
30	6.16	5.53	7.51	4.18	2.11	4.75	4.95
50	9.78	9.26	8.05	7.45	6.11	7.81	8.18
70	10.95	10.45	13.51	8.81	7.51	8.95	9.38
90	11.81	11.58	14.26	9.26	8.45	9.51	10.06
				Total Soluble sugars			
30	7.61	7.08	8.90	5.26	4.48	6.35	6.06
50	11.38	11.18	15.93	8.01	7.83	8.93	9.16
70	12.88	12.41	16.95	9.05	9.01	9.81	10.75
90	13.43	13.25	17.11	9.85	9.60	10.31	11.21