

CHANGES IN CARBOHYDRATE CONTENTS AND HYDROLYSING ENZYMES IN WHITE RUST OF *BRASSICA JUNCEA* (L.) CZERN. AND COSS. CAUSED BY *ALBUGO CANDIDA* *IN VIVO* AND *IN VITRO*.

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Changes in total soluble sugar, starch contents, alpha amylase and invertase activity in White rust of *Brassica juncea* (L.) caused by obligate fungus *Albugo candida* was investigated. An increase in total soluble sugars, alpha amylase and invertase activity was recorded in diseased tissues as compared to its normal counterparts, both *in vivo* and *in vitro*. However normal tissues showed high starch contents than diseased tissues and this could be co-related to high alpha amylase activity in the diseased tissues.

Keywords : *Albugo candida*; *Brassica juncea*, *in vitro*, *in vivo*.

Introduction

Indian mustard or Rai [*Brassica juncea* (L.) Czern. and Coss.] is one of the important oil yielding crop cultivated in about 6.8 million hectare of land. Many diseases occur to this crop of which White rust causes substantial degree of losses in seed yield¹. *Albugo candida* infections on mustard plants results in appearance of white coloured pustules on lower leaf surface whereas systemic infection results in distortion and hypertrophy of inflorescence. The present study was undertaken to work out the changes in total soluble sugars, starch contents, alpha amylase and invertase activity of diseased and normal tissues of mustard both *in vivo* and *in vitro* conditions.

Materials and Methods

Fresh normal and diseased tissues of *Brassica juncea* (L.) were obtained from fields of Agricultural Research Station, Durgapura and used for *in vivo* estimation. For *in vitro* estimation normal tissues and White rust infected diseased tissues of *Brassica juncea* (L.) were isolated and maintained on Murashige and Skoog's (MS) medium² supplemented with NAA (1 mg/l) and BAP

(1 mg/l). However the media for diseased tissue was supplemented with an additional amount of ascorbic acid (25 mg/l). Thirty days old normal and diseased tissue cultures were used for *in vitro* estimation.

Total soluble sugars and starch contents were estimated by the method of Dubois *et al.*³, and alpha amylase activity by the method of Schuster and Gifford⁴ with slight modification whereas invertase activity was measured by the method of Harris and Jaffcoat⁵.

Results and Discussion

Table 1 shows that high soluble sugar, high alpha amylase and invertase activity is present in diseased tissues (leaf, inflorescence axis, flower, fruit and callus) as compared to their normal counterparts both *in vivo* and *in vitro* conditions. However high starch contents were recorded in normal tissues of mustard. Highest content of soluble sugar was recorded in diseased leaf and lowest in normal fruit tissues while highest starch content was recorded in normal leaf and lowest in diseased fruit tissues. High alpha amylase and invertase activity was observed in diseased flower and fruit tissues whereas

Table 1. Carbohydrate and hydrolysing enzymes in normal and diseased tissues of mustard.

	In vivo										In Vitro	
	Leaf		Young inflorescence axis		Old Inflorescence axis		Flower		Fruit		Callus	
	N	D	N	D	N	D	N	D	N	D	N	D
Total soluble sugar (mg/g fresh wt. tissue)	5.4	9.2	5.1	5.9	5.0	5.1	4.4	9.07	3.3	6.6	6.20	9.1
Starch (mg/g fresh wt. tissues)	6.9	5.4	6.54	4.00	6.20	3.0	2.93	0.73	3.81	2.62	5.2	3.40
Alpha-amylase (mg starch hydrolyzed / hr./g fresh wt. tissue)	0.032	0.041	0.031	0.040	0.02	0.25	0.05	0.28	0.04	0.27	0.025	0.033
Invertase (mg glucose liberated/hr. / g fresh wt. tissue)	0.027	0.12	0.024	0.082	0.037	0.07	2.7	3.2	3.0	3.2	0.02	0.09

N = Normal D = Diseased

low activity of these enzymes were observed in normal inflorescence axis.

The increase in total soluble sugar may be due to its accumulation as a result of disruption of normal transport or its translocation from the neighbouring healthy tissues (source) to the physiological "sink"^{6,7}. Reduction in the starch content in the diseased tissues may be due to utilisation of these substances by the pathogen for its growth and development. Increased invertase activity may play a key role in the provision of substrate for the accumulation of starch at infection sites. The high amylase activity in diseased tissues can also be correlated with low starch contents. Similar results were also obtained earlier in various

host plants infected by obligate pathogen showing abnormal growth⁶⁻¹⁰.

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