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RESEARCH ARTICLE

BIOCHEMICAL CHANGES IN ZINGIBER OFFICINALE LEAF INFECTED WITH CARBENDAZIM RESISTANT OF PHYLOSTICTA ZINGIBERI IN WESTERN MAHARASHTRA.

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Abstract

Biochemical changes in the mycelia mat of *Phyllosticta Zingiberi* resistant to carbendazim with 21 parameters viz. starch, reducing sugar, total sugar, polyphenol, DNA, RNA, ash, moisture, nitrogen, phosphorus, potassium, calcium, manganese, sulphur, sodium, zinc, ferrous copper, manganese, molybdenum, and boron were found to be more in resistant isolates than in sensitive isolates. Thirteen *Phyllosticta Zingiberi* isolates were obtained from leaf spot of *Zingiber officinale* and showed 2% to 9% minimum Inhibitory Concentration against carbendazim. In vitro and In vivo. Infection of *Zingiber* leaves with resistant and sensitive isolates reduced the contents of all biochemical compounds, due to utilization by fungal pathogen for their growth and metabolism and causes deterioration of the nutrients present in the leaves.

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Introduction:-

Zingiber officinale (Roscoe) is a herbaceous rhizomatous plant of zingiberaceae. It is a perennial flowering plant, whose rhizome is widely used as spices or medicine. (Sood, 2002). *Zingiber* is the tropical plant. India is the largest producer of it in the world. But it suffers from many diseases and cause substantial yield loss to *zingiber* production. Leaf spot caused by *Phyllosticta Zingiberi* Ramkr. is one of the threatening foliar disease and was reported first time in India by Ramkrishnan (1941).

Materials And Methods:

Leaves of *Zingiber* infected by leaf spot diseases were collected from different *Zingiber* growing areas of Kolhapur districts of western Maharashtra state and the pathogen (*Phyllosticta Zingiberi*) was isolated by tissue isolation technique and pathogenicity test was confirmed through Koch's postulates, 1893. Baseline sensitivity of *Phyllosticta zingiberi* to carbendazim was tested by food poisoning technique suggested by (Dekker and Gleink, 1979), a total 13 isolates of *Phyllosticta* were isolated from *Zingiber* leaves, from these isolates Jaitpur Pz-11 selected as resistant and Muddal Titta Pz-1 as sensitive. (Table 1.) and used for further studies. For biochemical analysis healthy *Zingiber* leaves were used. The spore suspension made from actively growing mycelium of *Phyllosticta zingiberi* was inoculated on the ginger plants and these plants were covered with polythene bags to maintain the relative humidity and to avoid other contamination. After inoculation of 10 days leaves were dried in hot air oven and powder was obtained after crushing in grinder the samples were extracted in ethanol and were analyzed for biochemical estimations (Sindhan and prashar, 1996), Altogether twenty parameters were considered

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for analysis viz, Nitrogen(Bailey,1967),starch, sugars and total sugars(Sridhar and Du,1974),Nucleic acids DNA and RNA (Plummer 1975), Polyphenols (Swain and Hillis,1959),Ash, Moisture,Phosphorus, potassium, calcium, magnesium, sulphur, and sodium (A.O.A.C. ,1970), Zinc, Ferrous, Copper, Manganese, Molybdenum, and Boron (A.O.A.C., 1975)

Result and Discussion:-

Biochemical analysis of spore suspension of carbendazim resistant and sensitive *Phyllosticta zingiberi* strains are shown in Table 2. It was noted that the content of 21 parameters in the suspension varied in sensitive and resistant strains. Reducing sugar, total sugar, Polyphenols, were found to be higher in their quantity in carbendazim resistant strain when compared with the sensitive one. Nitrogen were found to be more in sensitive strain than in resistant one. Variations were observed in all biochemical studies in infected leaves with carbendazim resistant and sensitive strains and healthy Zingiber leaves. But amount of starch is more in sensitive than the resistant. The amount of Phosphorus is equal in healthy, sensitive and resistant strains. The results of remaining parameters are showed in (Table 2.) There are reports supporting the characteristics of resistant isolate. According to Rana and Sengupta (1976) there was increase in production of amino acids in the isolate of *Macrophomina phaseolina* resistant to captan and carbendazim. There are many reports indicating changes in the biochemical characteristic in host due to infection of various pathogens, (Gangawane and Datar, 1978), Salt et al., 1978), (Sindhan and Parashar, 1996. According to the concentration of total sugar, reducing sugars, non reducing sugars, reducing sugars and proteins were reduced due to infection of seed borne fungi of cowpea (Ushamalini et al., 1998).

Table 1. MIC (Minimum Inhibitory Concentration) of carbendazim against *Phyllosticta zingiberi* causing leaf spot of *Zingiber officinale*

Sr.No.	Locality	Isolate	In Vitro (% Carbendazim)	In Vivo (% Carbendazim)
1	*Mudal Titta	Pz-1	2	2
2	Majnal	Pz-2	4	4
3	Kolhapur	Pz-3	5	4
4	Mangnur	Pz-4	3	2
5	Mhalunge	Pz-5	6	5
6	Jambhli	Pz-6	6	4
7	Zelam	Pz-7	3	3
8	Islampur	Pz-8	5	3
9	Dahiwadi	Pz-9	7	5
10	Koregaon	Pz-10	4	3
11	*Jaitpur	Pz-11	9	8
12	Vadiye Raybag	Pz-12	5	4
13	Tandulwadi	Pz-13	8	5

*Jaitpur Pz-11 resistant isolate and *Mudal Titta Pz-1 sensitive isolate Table2.

Table2. Biochemical Characteristics of the ginger leaves infected with sensitive and resistant Isolates.

Sr.No.	Biochemical Constituents	Healthy Ginger leaves	Ginger leaves infected with Sensitive isolates	Ginger leaves infected with Resistant isolates
1	Starch (g/100gdry wt)	1.758	1.581	1.409
2	Reducing sugar (g/100gdry wt)	0.180	0.146	0.162
3	Total sugar (g/100gdry wt)	0.079	0.077	0.033
4	Polyphenol (g/100gdry wt)	0.406	0.508	0.538
5	DNA (mg/g)	0.189	0.152	0.145
6	RNA(mg/g)	0.043	0.140	0.135
7	Ash (%)	7.70	8.20	9.80
8	Moisture (%)	1.20	6.30	6.60
9	Nitrogen (%)	0.44	0.78	0.39
10	Phosphorous (%)	0.01	0.01	0.01
11	Potassium (%)	0.079	0.048	0.051
12	Calcium (%)	1.09	0.66	0.70
13	Magnesium (%)	2.65	1.60	1.70
14	Sulphur (%)	0.45	0.45	0.55
15	Sodium (%)	2.00	1.26	1.34
16	Zinc (ppm)	50.45	30.46	32.36
17	Ferrous (ppm)	54.06	32.64	34.60
18	Copper (ppm)	28.62	17.28	18.36
19	Manganese (ppm)	75.68	45.69	48.55

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