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A COMPARATIVE STUDY OF INFECTED AND UNINFECTED CULMS OF *ZIZANIA*

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Zizania latifolia, a rare wild relative species of rice is often infected by the smut fungus, *Melanopsichium esculentum*,causing abnormal swelling of the apical culm. The infected culms are used as a vegetable having high protein content (15.2%). Due to the host-pathogen interaction between the two resulting in the formation of culm gall, some metabolites like nitrogen, amino acids, protein, etc. were increased. However, some particular metabolites like carbohydrates, fats, and ascorbic acid were depleted.

Keywords : Host-pathogen interaction; Hypertrophy; Inoculation; Metabolites; Wild rice.

Zizania latifolia Turcz. wild relative of rice grows luxuriantly in Loktak lake of Manipur. It also grows in the marshy places, ponds and water logged areas of Manipur. The spindle shaped hypertrophy formed with the infection of *Melanopsichium esculentum* P. Henn. is a favourite vegetable of the Manipuris. The infected culm is also used as a vegetable in other places like China, Taiwan, Japan[1]. A few reports on the study of biochemical aspects of infected culm are available[2-5], inoculation of the pathogen[6] and some aspects of host-pathogen interactions[7-12]. No studies have been made which deal with the effect of smut infection on some primary and secondary metabolites content, and food value of the host plant. Therefore, a detailed study on infection and analysis of both uninfected and infected culm plants were undertaken.

Five young buds from the uninfected plants were grown during the month of January 1994 in earthenware pots (32.5 cm diameter x 29.5 cm in height) in 3:1 mixture of sandy loam and farmyard manure. The pots were flooded with water at a depth of 4 cm. Plants were grown in the green house at 25±4°C under natural daylight. The pH of the water was adjusted at 7.0±0.6. Smut spores from the infected plant were collected and kept in a freeze at 4±1°C for 48 hours and 1 ml of sporidial mixture containing 10^5 teliospores per ml of sterilized distilled water was inoculated on ten day old seedlings, when plants had 3-4 unfolded leaves plus one half-unfolded leaf by wounding technique of Yang and Leu[6]. Some control plants were inoculated with sterilized distilled wate. Plant materials were collected from different growth stges of the plant for biochemical analysis. The biochemical analysis were performed following the methods of Singh[8].

The average percentage of protein increased from 8.75 in uninfected plants to 15.2 in infected plants (the stage when they were consumable) (Table 1). Average total nitrogen content also increased from 2.15 to 4.0 mg/g. Total amino acids increased with the maturation of the culm and with the degree of infection. There was decrease in carbohydrate content during infection

recording 32.2 mg/g against 57.1 mg/g in the uninfected culm. The amount of fat was also depleted from the severity of infection (from 18.73 to 5.86%). The amounts of some elements like Ca, Mg, K and P in the healthy culm were decreased from 0.09 to 0.06%, 0.588 to 0.462%, 0.69 to 0.11% and 0.125 to 0.095% in the diseased culm. However, the amount of ferric iron in the diseased plant increased significantly. The amount of L-ascorbic acid present in the uninfected flowering culm was maximum 2.1 mg/100g and in initial infection stage the least amount of ascorbic acid (0.71 mg/100g) was recorded.

The increase in the number of amino acids and the percentage of protein during infection might be due to the host-pathogen interaction[13,14]. The presence of high percentage of protein and a few of the essential amino acids in the infected hypertrophy of the *Zizania* plant befits the plant to be a good vegetable for consumption. The decrease of carbohydrate, fat, elements, ascorbic acid, during infection might be due to the consumption of the metabolites by the smut fungus and due to metabolic changes in the host plant. Artificial inoculation of the plant was successfully carried out under laboratory conditions. The technique can be practicable in field conditions.

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Table 1. Changes in the culm metabolites of *Zizania latifolia* infected by *Melanopsichium esculentum.*

Plant sample	Lipids %	Ascorbic acid mg/100g	Total Amino acids µg/g	Total available carbohy. (TAC) mg/g	Total Nitrogen mg/g	Protein Nitrogen mg/g	Protein %	Ca mg/g	Mg mg/g	K mg/g	P mg/g	Fe (Ferric) mg/g
*Healthy												
UPS	12.16	1.8	562.3	4.18	2.01	1.3	8.18	1.1	6.08	6.6	1.62	1.42
UFS	18.73	2.1	845.1	57.1	2.3	1.5	9.37	0.9	5.88	6.6	1.25	1.62
*Diseased												
IIS	11.9	0.71	516.2	29.5	2.8	1.8	11.25	0.87	5.23	5.3	1.18	1.71
NSS	8.53	1.7	938.2	34.1	4.0	2.4	15.00	0.8	5.08	2.7	0.87	1.9
SS	5.86	1.1	1352.2	33.2	5.2	3.1	19.37	0.6	4.62	1.1	0.95	2.2
C.D. at 5%	8.05	1.29	-	-	-	-	-	0.94	0.57	0.10	0.41	0.07

* Mean of three samples

UPS- Uninfected pre-flowering stage; UFS- Uninfected flowering stage; IIS- Initial infectin stage; NSS- Non-sporulating stage.; SS-Sporulating stage.

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