

MORPHOLOGICAL AND BIOCHEMICAL STUDIES IN HEALTHY AND INFECTED PLANT PARTS OF *ORYZA SATIVA*

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Abstract: Pollen morphology is a very minute structure encloses in it the entire body of plant. It contains all genetic information for a complete plant. It has great significance particularly in plant taxonomy. Results of present investigation revealed the effect of infection on the uptake rates of total N and P and its distribution in selected plant parts clearly define the nutritional aspects and role of macronutrients and pigments in growth and development. Our observation indicates that non-acetolysed pollen grains of *Oryza sativa* show reduction in size as compared than that of acetolysed pollen grains. Likewise total N, P and chlorophyll content uptake and its distribution in plant parts decline in infected plant parts as compared to healthy plant parts as in stem, leaf, anther & pollen grains.

Keywords: Acetolysis, Fungal infection, Pollen grain, Rice, Total N .P., Chlorophyll development

INTRODUCTION

Oryza sativa (Rice), of family Poaceae is cultivated during the month of July to August as kharif crop and flowering appear at 80th days. Pollen morphology is of great significance particularly in plant taxonomy. Man has been always interested to find out air quality, microorganism, pollen grains and fungal spores in air. Pollen is a very minute structure encloses in it the entire body of plant. It contains all genetic information for a complete plant. The ultimate aim of pollen grains is pollination leading to fertilization and seed production. Some contribution to study of pollen grains has been done in the past (Nagy, 1962, Bamzai and Randhawa, 1965). Sharma (1967) worked on pollen morphology of Indian monocot plant. Vishnu Mitra and Gupta (1966) worked on maize pollen morphology. Nair (1963) did several studies on pollen morphology and pollen analysis of certain socio-economical important families of Angiosperms such as Liliaceae (1965), Fabaceae (Nair & Sharma, 1962). Information regarding to pollen flora of Hospital, Medical colleges and nursing home areas are not sufficiently available, therefore, present investigation was carried on morphological and biochemical studies of cultivated rice plant in and around the Maharaj Singh degree college, Saharanpur (UP).

MATERIAL AND METHOD

For study of pollen morphology, anther and pollen grains of *Oryza sativa* were collected on glycerine jelly coated microslides during flowering season at 80th days from the experimental crop field just before anthesis. The collected anthers were fixed in 70% FAA (Formaline acetic acid) for 24 hours (Nair,

1960). The pollen preparation were made through acetolysis method proposed by Erdmaan (1952) and modified by Nair (1960) was employed. Certain parameters related to pollen shape and size was determined on the basis of studies done with technique micrometry by using ocular micrometer and stage micrometer. Apart from this, pore diameter, annulus diameter and exine thickness was also studied.

Biochemical analysis was carried in healthy and infected plant parts of *Oryza sativa*. Nitrogen and Phosphate are universally occurring element in all living being and major component of protein. For investigations on total N and P uptake and distribution in the dried samples of healthy and infected vegetative and floral parts particularly anther & pollen grains collected from the crop field at Saharanpur (UP). The plants were dissected into different plant parts (stem, leaf, anthers & pollen grains), dried samples were subjected to total N and total P analysis. Side by side soil samples from healthy and infected experimental plant sites were also analysed for total N and total P. Chlorophyll development studies was also carried in the leaf disc in healthy and infected plant.

For investigation of total N and P uptake and its distribution in healthy and fungal infected plant, samples (Stem, leaf, anther and pollen grains) were taken at 40th days and 80th days of seeding emergence. Soil samples from healthy and infected experimental plant sites were also analysed for total N and total P content.

Total N content of Stem, leaf, anther and pollen grains was done according to Snell and Snell method (1954). While the total P content was done according to Allen (1960) method. For estimation of chlorophyll development in healthy and infected leaf

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disc of rice plant the amount of chlorophyll- a and chlorophyll-b was estimated according to Arnon (1949) formulae which are shown below-

Chl-a mg / l = 12.83 A₆₄₅ - 2.58 A₆₆₅
 Chl-b mg / l = 22.87 A₆₄₅ - 4.67 A₆₆₅
 Chl-a + chl-b mg / l = 8.05A₆₆₅ + 20.29 A₆₄₅

OBSERVATIONS

Result of all different parameters are given in table- 1,2,3,4 and figure 1-9.

Table 1. Size of pollen grains in (µm).

Acetolysed Diameter (µm)	Non-Acetolysed Diameter (µm)	Pore diameter (µm)	Annulus diameter (µm)	Exine thickness (µm)
38.50 ±2.48	35.10 ±1.26	4.20 ±0.38	10.50 ±0.30	1.80 ±0.32

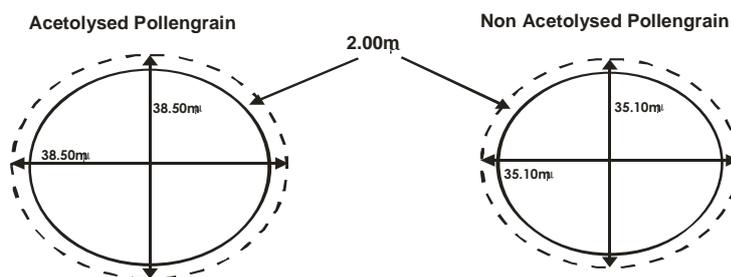


Fig.1 : Size of pollengrains in (µm)

Table 2. Total nitrogen (per gram dry weight) uptake and distribution in healthy and infected plant parts in *Oryza sativa*

Days from emergence	Soil with plant (Blank) mg/kg	Soil with plant mg/kg	Total nitrogen level in			
			Stem	Leaf	Anther	Pollen grains
			mg/gm dry wt.			
Plant without infection (Control)						
0	575.0	575.0	.....	.....	.....	.....
40	565.0	560.0	30.50	22.80	.....	.....
80	550.0	550.0	28.90	20.30	14.50	18.50
Plant with infection						
0	575.0	575.0	.....	.....	.....	.....
40	570.0	560.0	28.80	20.00	.....	.....
80	562.0	560.0	26.50	18.00	11.80	13.60

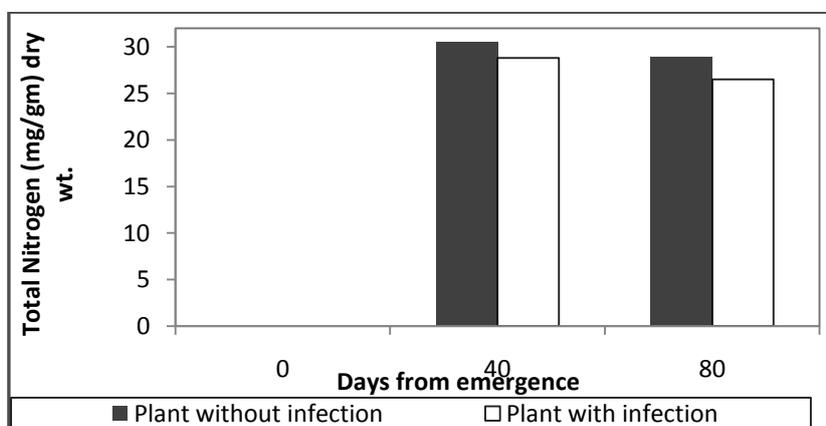


Figure 2. Total nitrogen (mg/gm) dry wt. of stem in *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.



Figure 3. Total nitrogen (mg/gm) dry wt. of leaf in *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.

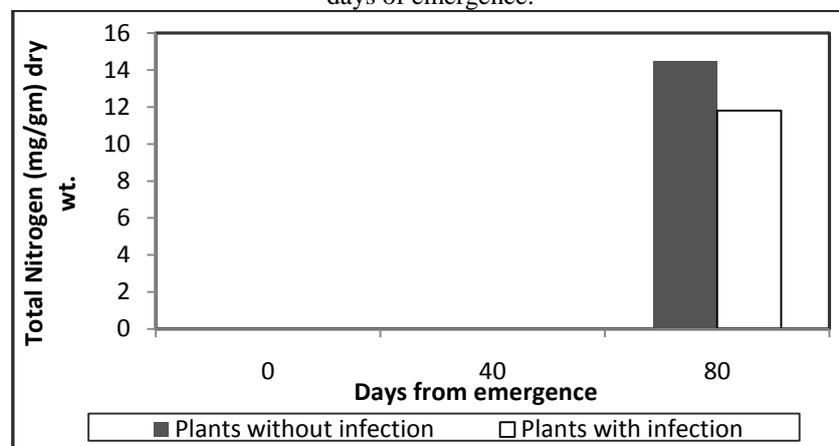


Figure 4. Total nitrogen (mg/gm) dry wt. of anthers in *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.

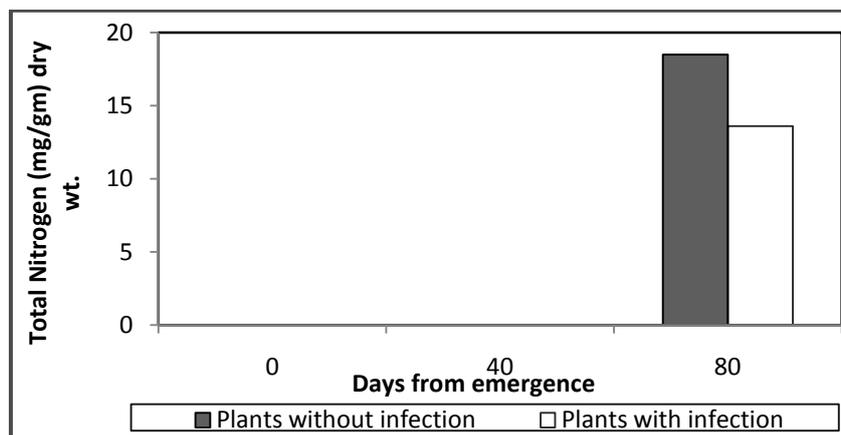


Figure 5. Total nitrogen (mg/gm) dry wt. of pollen grains in *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.

Table 3. Total Phosphate (per gram dry weight) uptake and distribution in healthy and infected plant parts of *Oryza sativa*

Days from emergence	Soil with plant (Blank) mg/kg	Soil with plant mg/kg	Total phosphate level in			
			Stem	Leaf	Anther	Pollen rains
			mg/gm dry wt.			
Plant without infection (Control)						
0	280.0	280.0	.....	.....	.....	.....

40	275.0	275.0	13.80	16.10	.....	.....
80	270.0	270.0	15.10	16.60	17.50	14.60
Plant with infection						
0	280.0	280.0	....	....	.....	.....
40	276.0	274.0	12.00	14.00	.....	.....
80	269.0	268.0	13.50	15.00	15.80	12.70

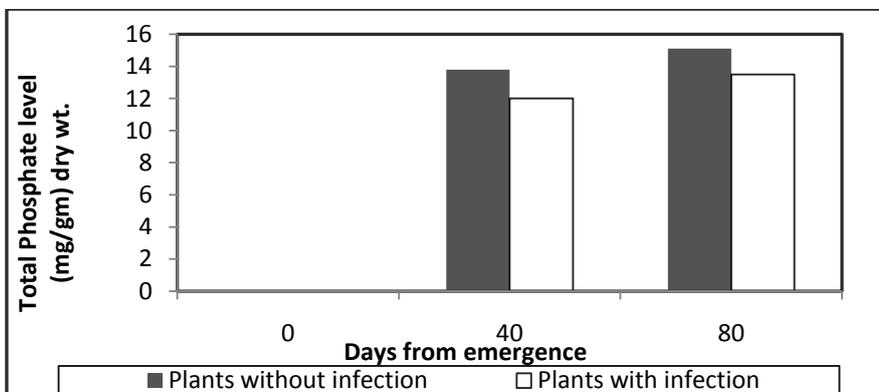


Figure 6. Total phosphate (mg/gm) dry wt. of stem in *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.

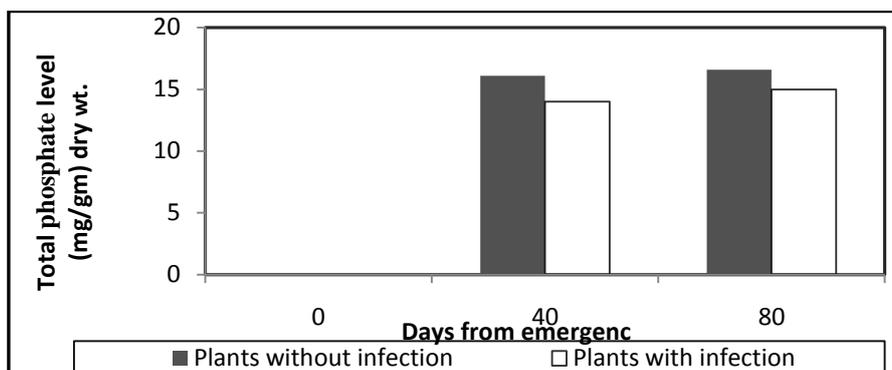


Figure 7. Total phosphate (mg/gm) dry wt. of leaf in *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.

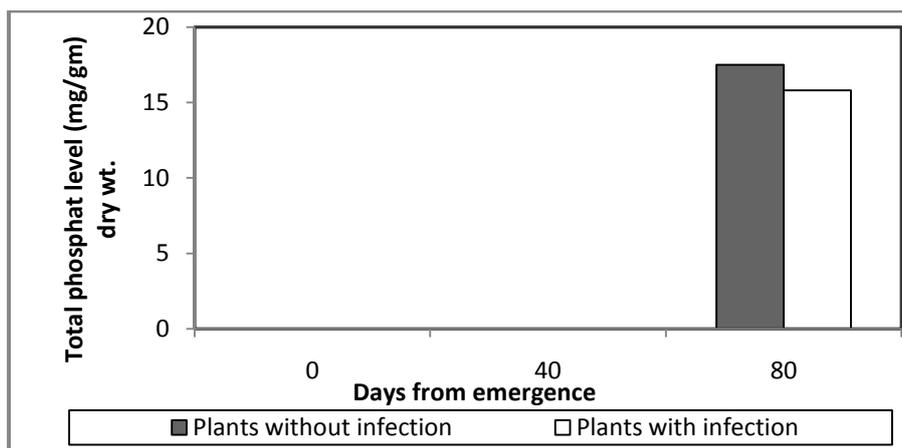


Figure 8. Total phosphate (mg/gm) dry wt. of anthers in *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.

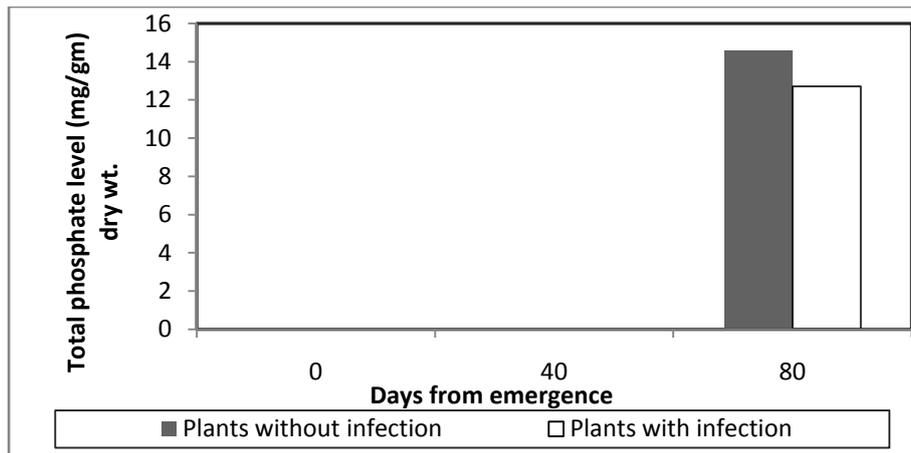


Figure 9. Total phosphate (mg/gm) dry wt. of pollen grains *Oryza sativa* with and without infection after 0, 40 and 80 days of emergence.

Table 4. Chlorophyll development in healthy and infected leaf disc in *Oryza sativa*

Treatment	Leaf disc		Chlorophyll content in healthy and infected plant							
	Fresh weight mg, leaf disc ⁻¹	Dry weight mg, leaf disc ⁻¹	mg/g fw ⁻¹				mg/g dw ⁻¹			
			chl-a	chl-b	chl-a+b	chl-a/b	chl-a	chl-b	chl-a+b	chl-a/b
Healthy plant	19.75	6.30	0.22	0.25	0.47	0.88	1.30	1.35	2.65	0.96
Infected plant	19.70	6.31	0.20	0.23	0.43	0.86	1.22	1.30	2.52	0.93

RESULT AND DISCUSSION

Observation indicates that non-acetolysed pollen grains of *Oryza sativa* show reduction in size. This decrease in size was found 12.5 % in non-acetolysed pollen grains, while it was increased under acetolysed pollen grains (Table 1 & fig.1). Our results are in agreement with the result of Sampat & Ramanathan (1957), Sheeba & Vijyavalli (1998), Rawat *et al.* (2004), Bhat *et al.* (2006). Table-2, fig-2-5 show decline of total N content in infected plant parts as compared to healthy plant parts. At 80th days anther and pollen grains of infected plant contain 81.3% and 73.5% of total N as compared to pollen grains of healthy (control) plant. Similarly total N content of infected leaf was 87.7% and 88.6% respectively at 40th days and 80th days as compared to healthy plant leaf. Total N per plant organ is suppressed in infected plant. In case of soil without plant the total N content per kg decline from 0- 80th days in both healthy and infected plant (Table-2). Our finding of total N in various plant parts of healthy and infected plant are agreement with previous work done by Vasil (1987) Dhingra & Verghese (1990), Singh (2002), Divya (2003), Pridhi (2004), Bhargava (2006) and Reshu (2006). Total P uptake and its distribution was found decreased in fungal infected plant parts which also inhibited the growth rate of plants. It was 86.9 % and 90.3 % in the infected leaf at 40th and 80th days respectively as compared to non- infected (control) leaf. Translocation of P from vegetative part to

pollen grains is much affected in the infected (86.9%) plant as compared to healthy (control) plant pollen grains. (Table 3 & fig-6-9). Decline in total P content in stem, leaf in infected plant might be due to fungal infection. In case of soil the decline in total P content per kg was noticed from 0-80th days in without plant crop field, however this decline is more in the soil with infected plant. Our finding with total P in healthy and infected plant parts of experimental plant are in agreement with previous work done by Jensen (1962), Singh (2002), Divya (2003), Bhargava (2006) and Reshu (2006). Result shows that there is an increase in chlorophyll development in healthy leaf disc as compared to infected leaf disc. In healthy plant leaf disc total chlorophyll development is promoted by 9% as compared to infected leaf disc on mg/ g fresh weight, in which it was found retarded. Total chlorophyll on g fw- 1 basis was 91% in healthy plant leaf disc (Table -4). Likewise development of chlorophyll-a and chlorophyll-b are also affected by fungal infection in plant. Thus a comparison of chl-a and chl -b development indicates that in general chl-a development is more as compared to chl-b in healthy plant leaf disc. Our present studies with chlorophyll development in leaf disc of both healthy and infected plant are in agreement with the work done by Vasil (1987), Datta & Sharma (1990), Sheoran & Singh (1996).

CONCLUSION

Results of all observations revealing the effects of infection on the uptake rates of total N and P and its distribution in selected plant parts clearly define the nutritional aspects and role of macronutrients and pigments in growth and development. Our observation indicates that non-acetolysed pollen grains of *Oryza sativa* show reduction in size as compared than that of acetolysed pollen grains. Likewise total N, P and chlorophyll content uptake and its distribution in plant parts decline in infected plant parts as compared to healthy plant parts as in stem, leaf, anther & pollen grains.

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