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TRANSMISSION OF RICE DISEASES BY SEEDS AND PRINCIPLES FOR THEIR CONTROL : 1-FUNGI ASSOCIATED WITH RICE SEED, AND SOME OBISERVATIONS ON SEED-BORNE INFECTIONS.

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Abstract

Sixteen fungi developed on blotter from 118 rice seed samples of 6 cultivars. All tested seed samples yielded *Drechslera oryzae*, whereas 84 samples showed infection with *Pyricularia oryzae*. Seeds of "Reiho" cultivar were heavily infected with the blast fungus(65%), although "Giza 171 and Giza 172" showed increase in percentage of seed infeetion in 1984 than usual. Seeds of cultivars IR 1626 and "IR 50" seem to be free from *Fusarium moniliforme, F.semitectum, Nigrospora oryzae, P. oryzae* and *Trichoconiella padwickii,*; however, they showed low seed infection with the brown spot fungus. *Gerlachia oryzae*, was observed in one sample of "Giza 171" at 0.50% which may be below the standard level of tolerance. The seed-borne fungi vary greatly according to the cultivar, locality and yearly variation of climatic conditions. Infection percentages with *D.oryzae* increase when seed were incubated for 5-6 days , whereas seed infection with *P.oryzae* increased on the fourth day of incubation using water agar plate method. There was an indication of direct relation between seed infection and seed rot or seedling decay in case of both fungi, i.e.*D. oryzae* and *P.oryzae*. Five fungi viz. *D. oryzae, F. moniliforme, F. semitectum, P.oryzae* and *T. padwickii* were detected in pericarp and endosperm of rice seed. *P.oryzae* was also observed in the embryo.

INTRODUCTION

Rice (*Oryzae sativa L.*) is an important cereal crop in Egypt. A number of fungi such as *Alternaria longissima* Deighton & MacGarive, *A.tenuis* Auct., *Ascochyta ory-*

zae Catt., *Cephalosporium* spp., *Cercospora oryzae* Miyake, *Curvularia lunata* (Wakker) Boed., *C.pallescens Boed.*, *Diplodia oryzae* Miyake, *Drechslera avenacea* (Curtis ex Cke.) *Shoemaker, D.halodes* (Drechsl.) Subram. & Jain, *D.hawaiiensis* (Bugnicour) Subram. & Jain, *D.oryzae* (Van Breda de Haan) Subram & Jain. Perf. st. *Cochliobolus miyabeanus* (Ito & kuribay.) Drechsl. ex Dast., *D.rostata* (Drechsl.) Richardson & Fraser, *D. Sorokiniana* (Sacc.) Subram., *D.tetramera* (Mckinney) Subram. & Jain, *Epicoccum purpurascens* Ehrenb. ex Schlecht, *Fusarium dimerum* Penz., *F.equiseti* (Corde) Sacc., *F. graminearum* Schwabe, perf. st. *Gibberella zeae* (Schw.) Petch., *F.moniliforme* Sheld., perf.st. *Gibberella fujikuroi* (Saw.) Wollenw., *F.semitectum* Berk & Ray, *F. solani* (Mart) Sacc. emend. Snyd. & Hans., *Gerlachia oryzae* (Hashi oka & Yakogi) Gams. (syn. *Rhynchosporum oryzae* Hashioka & Yakogi), *Nigrospora oryzae* (Berk & Br.) Patch., perf. st. khuskia oryzae Hudson, Phaeotrichoconis crotalaria (Salam & Rao) Subram. *Phoma glumarum* Ell. & Tr., *Pyrichoconis padwickii* Ganguly) *Ulocladium* spp. and *Verticillium* spp. were collectively reported associated with rice seed by Neergaard (1970) , Mathur and Neergaard (1970) , Ram Nath *et al* . (1970) , Agarwal *et al.* (1972), Guerrero *et al.* (1972), Kang *et al.* (1972), Mathru *et al.* (1985), Michail *et al.* (1985). *D.oryzae* , the brown spot fungus (the main reason for the Bengal famine of 1942-1943, Ghose *et al.* 1960) and *P.oryzae* the blast fungus were regarded as the two most serious biological menace to food rice production. *F.moniliforme* , the bakanae disease or foot root, *F.semitectum*, the dry rot of grains, Geralehia *oryzae*, the leaf scald *Trichoeoniella padwickii*, the stack burn disease, as well as other fungi causing major or minor diseases regarded as active or weak parasites or mere saprophytes such as *Nigrospora .oryzae*, producing grain spots of rice (Neergaard 1970).

The great majority of rice diseases, which seem to be seed-borne in nature, are disseminated from different sources and by means other than seed. Infection by *D.oryzae* can take place from soil, whereas positive soil-borne infection of *F.moniliforme* in rice has not been clearly demonstrated, although it is likely to occur commonly. *T.padwichkii* common in seed is also soil-borne (Neergaard 19970). Circumstantial evidence of the importance of seed transmission of *P.oryzae* is provided by the observations made in British Guiana (Kennard 1965).

The present study was planned to conduct a survey of seed-borne fungi of rice and to give observations on certain of those seed infections, in particular the brown spot and the blast fungi.

MATERIALS AND METHODS

The health condition of 118 rice seed samples belonging to six cultivars namely "Giza 171" , "Giza 172" , "IR 28", "IR 1626" , "IR50" and "Reiho" was investigated. Rice seed samples were collected from five main stations of different Governorates of Nile Delta, i.e., El-Beheira, El-Gharbia, Kafr El-Sheikh, El-Dakahlia and Damieta.

The samples from rice crop of 1983 were tested in late 1983, those of crop from 1984 were analysed in early 1985 and those of crop of 1986 were examined in January 1987 . The standard blotter method (ISTA 1966) with 12 hours of near ultra violet irradiation each day for seven days with two black light tubes was generally employed to find out the distribution of seed - borne fungi.

Another experiment was conducted using 400 unhulled or dehulled seeds of cultivars "Reiho" harvested in 1984 and "Giza 172" of lot No. 36 harvested in 1986 from kafr El-sheikh. This rice seed lot was chosen on the basis of having high percentage of infection with both *D.oryzae* and *P.oryzae*, i.e., 33 % and 19 % respectively. Seeds were examined using the water agar plate method (Neergaard 1970). One hundred seeds per treatment were tested in four replications. For daily detection, the seeds were placed on 1.2% water agar at 20 ^{o}C under 12 hours alternating cycles of light and darkness. The light source was a standard cool white fluorescent tube of 1,200 Lux. The examination was made using a stereoscopic microscope. The effect of incubation period was recorded. Each seed showing fungal sporulation of any of the major rice pathogens on water agar was transferred to a test tube containing water agar, and incubated as described before until symptoms of disease appeared on the coleoptile or radicle of the germinating seed. The percentage of infected seedlings was recorded. The lesions on seedlings were cut into 2 mm. portions, then separately plated and incubated for confirmation of the causal fungus. Ungerminated seeds were also cut and prepared in the same way for examination.

Moreover, further investigation was carried using rice seeds of variety "Reiho" known of their heavy infection of the blast fungus (A) as well as a combination of the 27 samples of rice seed lots collected in 1986 (B), to show possibilities of having a wide range of fungi to be considered for observations of their location in different parts of the seed. Seeds were then soaked in water for 20 hours, then dehulled and separated with an ethanol flamed dissecting knife under a magnifer (Singh *et al* .1980). The separated components of seed were incubated as previously described.

The possibility of embryo infection of *P.oryzae* was re-examined as follows : Four hundred seeds of "Reiho" sample were soaked in 5% sodium hydroxide solution for 20 hours at room temperature. Embryos were collected and rinsed in water, dehydrated in methyl alcohol for two minutes, and then stained with trypan blue in sodium hydroxide for five minutes. After rinsing the stained embryoes in water, they were boiled in lactophenol for few minutes until they became relatively clear. The embryoes in lactophenol were then poured into a Petri dish for examination (Shetty *et al.* 1978).

RESULTS AND DISCUSSION

(I) Seed-borne fungi:

a) Sixteen fungi, Viz. *A. tenuis, Cephalosporium* spp., *D.oryzae, D.rostrata; F.equiseti, F.graminearum, F. moniliforme, F.semitectum, F.solani, Gerlachia oryzae, N.oryzae, P.crotolaria, Phoma* spp., *P. oryzae, T.padwickii* and *Verticillium* spp. were isolated by blotter method, from 118 rice seed samples of 6 cultivars. These fungi, observed in the present investigation, are in accordance with findings recorded by a number of authors as stated in the introduction.

Chidambaram *et al.* (1973) reported many pathogenic species of the genus *Drechslera* on seed of rice to be seed-borne and seed transmitted. Although italics species of rice are considered to be seed-borne and be soil-borne pathogens, seed-borne inoculum is a very important source of primary infections (Ram Nath *et al.* 1970). Reduction in seed quality may be due to kernel discolouration produced by weak parasites or mere saprophytes revealed in the present study such as *A.tenuis, Phoma* spp. Discolouration, necrosis, kernel rot, or weakening leading to loss of viability may be caused by parasites such as *Fusarium* spp., *N.oryzae, T.padwickii.* Glume lesions and discoloration may be caused by most of these fungi.

b) Experimental data (Table 1) indicated the laboratory results of some fungi (6) encountered in seed health testing of rice cultivars. All tested seed samples (118) were found infected with the brown spot fungus. Chidambaram et al. (1973) tested seed samples of rice infected by various specis of Drechslera received from a number of countries by two incubation methods. The total of twenty samples received from Egypt during 1967-1971 were all found infected with D.oryzae. Mini-

Table 1 : Laboratory results of 6 fungi encountered in seed health testing of cultivars grwon in different Governorates in Egypt.

Cultivars	Locality where grown "Governorate"	Year of collection	Number of seed lots examined	Drechslera *orzae*			Fusarium moniliforme			F. Semitectum				Nigrospora oryzae			Pyricularia oryzae			Trichoconiella pedwickii		
				Number of infected seed lots	Range of infection %	Mean infection %	Unmber of infected seed lots	Range of infection %	Mean infection %	Unmber of infected seed lots	Range of infection %		Mean infection %	Unmber of infected seed lots	Range of infection %	Mean infection %	Unmber of infected seed lots	Range of infection %	Mean infection %	Number of infected seed lotsn %	Range of infection %	Mean infection %
Giza	Behera	1983	24 *	24	26-71	35	14	1-8	1.5	24	3-13	3-13	6	5	0.5-2	1	24	2-17	15	24	3-27	13
171	Behera	1986	1	1	5	5	1	0.5	0.5	1	21	21	21	1	3	3	1	9	9	1	2	2
	Gharbia	1983	35	35	24-60	40	15	0.5-2	1	35	2-31	2-31	11	11	0.5-13	2	34	11-19	12	34	3-29	18
	Gharbia	1986	2	2	21-19	20	1	2	2	2	17-19	17-19	18	1	5	5	2	2-4	3	2	2-8	5
	Dakahlia	1986	4	4	10-28	20	0	-	-	4	3-9	3-9	7	3	1-3	2	2	2-3	2.5	3	1-3	5
	Kafr El-Sheikh	1984	1	1	34	34	1	2	2	1	5	5	5	1	2	2	1	26	26	0	---	-
	Dakahlia	1983	21	21	41-78	63	7	0.5-2	1	21	2-12	2-12	4	4	0.5-2	1	3	1-7	3	21	25-48	40
	Dakahlia	1984	2	2	28-54	41	2	2-4	3	2	3-5	3-5	4	0	---	-	2	5-13	11	0	---	-
	Dakahlia	1986	5	5	3-24	21	1	4	4	2	7-11	7-11	9	2	3-7	5	2	3-9	6	3	3,5-5	4
Giza	Kafr El-Sheikh	1984	1	1	37	37	1	2	2	1	8	8	8	1	2	2	1	18	18	0	---	-
171	Kafr El-Sheikh	1986	2	2	25-33	29	0	---	-	2	11-23	11-23	17	1	4	4	2	13-19	16	2	4-16	10
	Gharbia	1984	2	2	22-40	36	2	4-8	6	2	2-4	2-4	3	0	---	-	2	14-32	28	0	---	-
	Beihera	1984	1	1	11	11	1	1	1	1	2	2	2	1	19	19	1	2	2	0	---	-
	Beihera	1986	4	4	2-10	5	1	0.5	0.5	4	1-10	1-10	2	4	1-7	3	2	1-1.5	1	4	3-15	9
	Gharbia	1984	1	1	10	10	0	---	-	1	2	2	4	1	13	13	1	4	4	1	5	5
IR 28	Gharbia	1986	1	1	3	3	0	---	-	1	4	4	2	0	---	-	0	---	-	0	---	-
	Domiata	1984	1	1	13	13	1	3	3	1	1	1	1	0	---	-	1	1	1	0	---	-
	Domiata	1986	1	1	2	2	0	---	-	1	1	1	1	0	---	-	0	---	-	1	0.5	0.5
	Dakahlia	1984	1	1	19	19	1	1	1	1	5	5	5	0	---	-	1	2	2	1	1	1
	Kafr El-Sheikh	1984	1	1	23	23	1	7	7	1	4	4	4	1	6	6	1	3	3	1	2	2

Table 1 : (Cont)

Cultivars	Locality where grown "Governorate"	Year of collection	Number of seed lots examined	*Drechslera orzae* Number of infected seed lots	Range of infection %	Mean infection %	*Fusarium moniliforme* Unmber of infected seed lots	Range of infection %	Mean infection %	*F. Semitectum* Unmber of infected seed lots	Range of infection %	Mean infection %	*Nigrospora oryzae* Unmber of infected seed lots	Range of infection %	Mean infection %	*Pyricularia oryzae* Unmber of infected seed lots	Range of infection %	Mean infection %	*Trichoconiella pedwickii* Number of infected seed lotsn %	Range of infection %	Mean infection %
IR 1626	Kafr El-Sheikh	1986	4	4	11-22	13	0	---	-	0	---	-	0	---	-	0	---	-	0	---	-
	Dakahlia	1986	1	1	12	12	0	---	-	0	---	-	0	---	-	0	---	-	0	---	-
IR 50	Gharbia	1968	1	1	5	5	0	---	-	0	---	-	0	---	-	0	---	-	0	---	-
Reiho	Kafr El-Sheikh	1984	1	1	20	20	0	---	-	0	---	-	1	1	1		65	65	98		
TOTAL			118	118			50			108			38			1 84					

* Gerlachia oryza 0.50 % in one sample of lot No. 68.

Phaeotrichoconis crotalaria 1 % in one sample of lot No. 82.

mum and maximum infection percentages were 1.8 and 35.5.

In the present investigation, mean infections ranged from 2% to 53 %. Cultivars "IR 28" "IR 1626" and "IR 50" showed low seed infection signs with the brown spot fungus except for one sample colleced from Kafr El-Sheikh in 1984. Mean infection percentages were 11,5,10,3,23,2,19,13,12 and 5.

F.moniliforme and *F.semitectum* were the most predominant species recorded in rice samples. Fifty samples (42%) carried *F.moniliforme* in low percentages and fluctuated from 0.5% to 8%, whereas range of infection was from 1% to 21%. Cultivars "IR 1626" and "IR 50", seem to be free from both species of *Fusarium*. Three samples from Nigeria representing three varieties, namely Sindano, D 99 and Makalioka-752, yielded high infection counts for both species of *Fusarium*. Ram Nath *et al.* (1970) found differences in percentage of infection among varieties. They also tested 10 seed samples of rice from Egypt . Eight samples were infected with *F. moniliforme* with ranges of percent infection of 1.0-4.3.

Thirty eight samples (32%) carried the weak parasite *N.oryzae*. Mean infection ranged from 1% to 19 %.

Eighty four samples (71%) showed seed infection with the blast fungus. Seed sample of cultivar "Reiho" was heavily infected with *P.oryzae* 65%. The cultivar "Reiho" was released for commercial production in 1984 and was grown on roughly one third of the total rice acreage of Egypt. A blast epidemic occurred primarily on "Reiho" in that year, although Giza 171 and Giza 172 suffered more damage than usual. In the present investigation, a regularly repeated arrangement was observed with regard to seed infection with the blast fungus. The cultivar "Giza 171" showed increase in percentage seed infection with the blast fungus in 1984 (26%), compared with 15% and 12% recorded in 1983. Also, percentages of seed infection were 11%, 18% and 28% in case of cultivar "Giza 172" collected 1984 against 3% in 1983. In fact, , "Giza 172" showed low mean seed infection percentage when tested in 1983 due to its field resistance to the blast fungus. The increase of seed-borne inocula of the fungus on these varieties in 1984 reflects reduction in its resistance or most probably due to the high load of spores found in the enviromment with the outbreak on Reiho. Samples of 1986 yielded the fungus in less counts than most of those harvested in other years . This may be due to the fungicidal spray applied to rice crop grown during 1985 and 1986 growing seasons, thus minimizing seed infection level of the fungus. Foor and Sinclair (1977) reported that foliar sprays on soybean can reduce the amount of seed-borne fungi that invade the seeds near the end of the growing season and after maturity, but does not guarantee that all seeds will be free of microorganisms. Seeds of cultivar "IR 50" again seem to be free from the blast fungus.

T. padwickii was associated with 99 of the tested samples (83%). The infection rate fluctuated from 0.5% to 40%. Giza 172, harvested in 1983 from Dakahlia indicated heavy infection percentage of this fungus reaching 40%. "IR 1626" and "IR 50" showed again disease free seed.

Mathur *et al.* (1972) found seed samples from different countries (Egypt, India, Korea, Nepal and Thailand) severely infected with *T.padwickii*. All tested samples from Egypt (8), yielded the fungus with ranges from 6% to 50%.

One sample of "Giza 171" from lot No. 82 was found associated with *P.crotolaria* in 1% . This fungus was isolated from rice seed in India without reference to pathogenicity (Vaidehi 1971).

G. oryzae was observed on the sample of "Giza 171" of lot No. 68 from Beheira in 1983. As the fungus is regarded to be seed transmitted (Mia *et al.* 1985), rice crop risen from this lot was followed up where grown for field inspection. Nevertheless, the fungus has not developed and no disease symptoms were observed. This may be ascribed to the trace amount of the seed infection, which may be under threshold level . This fungus reached epidemic level in Japan in 1967 (Matsuyama and Wakimot 1977) and in Bangladesh (Bakr and Miah 1975) estimated a yield loss of 20-30 % in high yielding dwarf cultivars. Forty five percent of rice seed samples tested by Mia *et al.* (1985) over the period 1977-1980 from 32 countries carried this fungus. 1 % of samples received from Europe, North and North Eash Africa and Near East were found infected, whereas 59%, 56% and 38 % of seed samples obtained from the Far East, Central and South America, North America, Central and South Africa and Indian sub-continent carried this fungus.

The seed-borne parasites and saprophytes of rice for sowing, vary greatly from cultivar to cultivar, from locality to locality and according to local and yearly variation of climatic conditions. The composition of these fungi detectable by laboratory seed health testing, could be correlated with the weather condition prevailing during the maturation and the harvesting of individual seed lots hence, the differences in seed infection figures among growing places and between years of seed harvest.

(II) The effect of incubation period (Table 2):

a) Sporulation of *D.oryzae* :

Sporulation of *D.oryzae*, on either unhulled or dehulled seeds of the cultivar "Giza 172", whether nontreated or pretreated gradually increased to 30.50%, 28.00% , 20.25% and 18% , respectively, on the fifth day of incubation indicating significant increase among all other incubation periods except the one detected after six days. Nevertheless, in case of the cultivar "Reiho", percentage of sporulation of the fungus counted after five days were 7.25%, 4.00 %, 3.50%, respectively. Although the difference in percentage seed-borne *D.oryzae* was insignificant between four, five and six days of incubation when seeds of "Reiho" were investigated, the maximum percentage of sporulation was significantly higher on the fifth and sixth days of incubation when seeds of " Giza 172" were examined. This observation is in accordance with results obtained by Kang *et al.* (1972) indicating that maximum infection (69% - 73 %) with *D. oryzae* was recorded within four to six days after incubation depending on the duration of light to which the seeds were exposed each day.

b) Detection of *P.oryzae* :

The growth of *P.oryzae* on seed was easily identified on the fourth day of incubation. The infection counts decreased significantly after five days of incubation. Percentage infection of *P.oryzae*, on either unhulled and dehulled seeds of both cultivars whether nontreated or pretreated and , recorded on the fourth day of incubation seem to be superior over all other periods under investigation. In case of cultivar "Giva 172", seed infection counts of the blast fungus were not significant after four and five days of incubation. On the other hand, the highest percentage of sporulation of the fungus when seeds of "Reiho" were investigated was recorded on the fourth day of incubation, i.e., 58%, 50%, 35% and 20% indicating significance over all other incubation periods including the one after five days. Insignificant differences were found when cultivar "Giza 172" was under test.

This result is in complete agreement with those of Kang *et al.* (1972) and Chung and Lee (1983). They reported that conidia revealed on seed surface being clearly visible without any material interference of saprophytic fungi after 4 days fo incubation. On the other hand, identification is somewhat difficult after 8 days because the conidial clusters become denser, the tips of conidia being difficult to observe. Fast growing saprophytes often overgrow and mask the growth of *Pyricular-*

Table (2) : Percentage infection of *D.oryzae* and *P. oryzae* in daily observations on rice seeds (cultivar "Giza 172" , Reiho").

Days	Unhulled seeds								Unhulled seeds							
	non-treated				pretreated				non-treated		pretreated					
	D.oryzae		*P. oryzae*		*D.oryzae*	*P. oryzae*			*D.oryzae*	*P. oryzae*			*D.oryzae*	*P. oryzae*		
	G. 172	Reiho	G. 172	Reiho	G. 172	Reiho	G. 172	Reiho	G. 172	Reiho	G. 172	Reiho	G. 172	Reiho	G. 172	Reiho
1	2.50	1.00	1.50	18.00	2.00	0.00	0.50	10.00	1.25	0.00	0.50	8.00	3.00	0.00	0.25	6.00
2	11.50	0.00	11.00	29.00	8.00	0.00	6.75	15.00	9.00	1.00	4.00	5.00	5.00	0.00	3.00	10.00
3	11.25	2.00	17.00	39.00	10.00	1.00	12.00	28.00	11.00	1.00	8.50	0.00	9.00	0.50	6.00	14.00
4	22.25	5.25	19.50	58.00	18.00	4.00	15.50	50.00	15.00	3.00	10.25	5.00	14.00	2.25	9.25	20.00
5	30.50	7.25	15.50	50.00	28.00	4.00	17.50	43.50	20.25	3.50	7.25	0.00	18.20	3.50	6.50	12.00
6	29.50	7.00	10.00	46.00	26.00	4.00	10.00	40.00	21.00	3.00	6.00	8.00	18.20	3.00	6.00	10.00
LDS																
5%	5.24	2.77	4.57	4.29	3.43	1.69	3.08	6.41	4.43	1.66	3.38	7.72	4.15	1.99	3.18	4.26
1%	7.25	3.83	6.32	5.94	4.73	2.35	4.26	9.02	6.23	2.30	4.69	10.69	5.76	2.76	5.09	5.87

ia. By this time the seeds turn around, changing their position due to germination, and also for this reason it is difficult to detect *P.oryzae,* which generally is confined to the embryonal end of the grain. Furthermore, recognition and recognition and recording is a little more difficult at 28 °C than at 20 °C.

(III) Development of fungi from infected seed :

a) *D. oryzae :*

Rice seed after five days of incubation, demonstrated light to heavy sporulation. There were seed rot and seedling mortality of 80% after the infected seeds were transferred to tubes (Table 3). Out of 50 seeds showing the above mentioned category, 10 seeds (20%) failed to germinate (Fig. 1-A), while which could germinate, 30 seeds produced weak seedlings with decay in shoot and root (Fig. 1.D) (60%) or abnormal seedling with twisted weak shoot and browning root (Fig. 1-E). Then , it died within few days of emergence.

In all cases, on examination of infected sections from such seedlings and or from ungerminated seeds observed characteristic growth of *D.oryzae.* Isolation from dead seeds and / or seedlings invariably yielded the fungus and confirmed its seed transmission.

b) *P. oryzae :*

The fungus was generally confined to the embryonal end of the grain. Data in table (3) showed that out of 50 infected seeds showing sporulation of the fungus, eight seeds (16%) failed to germinate, while 24 (48 %) gave rise to abnormal seedlings having no root while the shoot appeared pale and very weak (Fig. 1-C) .

Rice seed infected with both *F.semitectum* and *P.oryzae* together rotted after being transferred to tubes (Fig. 1-B).

Therefore, data presented herein, clearly showed that a direct relation between seed infection and seedling losses was observed in both cases of seed-borne infection of *D.oryzae* and *P.oryzae.* Guerrero *et al.* (1972) recorded nine categories of seedling abnormalities associated with *D.oryzae, P.oryae* and *T.padwickii.*

(IV) Location of seed-borne fungal inocula :

Data shown in Table (4) indicated that :

D.oryzae was carried in 4 % and 27 % of pericarps and was isolated from 1%

Table (3) : Percentage seed rot and seedlings mortality of rice .

Seed infection with	Infection sign					
	Unhulled seeds		Abnormal seedlings		Symptomless loking seedlings	
	%	No.	%	No.	%	No.
Drechslera oryzae	20	10	60	30	20	10
Pyricularia oryzae	20	10	60	30	20	10

Table (4) : Percentage of *Pyricularia oryzae* detected in different parts of rice seed .

Fungi	Percentage of fungi detected in different parts of rice seed					
	A			B		
	Pericarp	Endosperm	Embryo	Pericarp	Endosperm	Embryo
Drechslera oryzae	4.00	1.00	0.00	27.00	10.00	0.00
Fusarium moniliforme	0.00	0.00	0.00	1. 50	0. 75	0.00
Fusarium semitectum	0.00	0.00	0.00	16.00	0. 00	0.00
Pyricularia oryzae	38.00	26.00	8.00	15.00	10. 00	0.00
			2.00			
Trichoconiella padwickii	0.00	0.00	0.00	9.50	1.50	0.00

A = "Reiho" Variety rice seed sample (harvested 1984).
B = Combination of 27 seed samples of rice seed lots (harvested 1986).
* = Percentage of *P.oryzae* in embryo extraction observation.

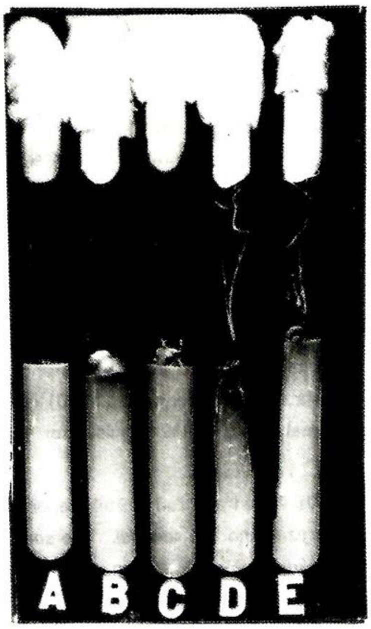

Fig 1. A - *D. oryzae* infected seed, failed to germinate.
B - *F. Semitectum* and *P. oryzae* infected seed, recorded as rotten.
C - *P. oryzae* infected seed, abnormal seedling.
D - *D. oryzae* infected seed, abnormal decay.
E - *D. oryzae* infected seed, abnormal seedling.

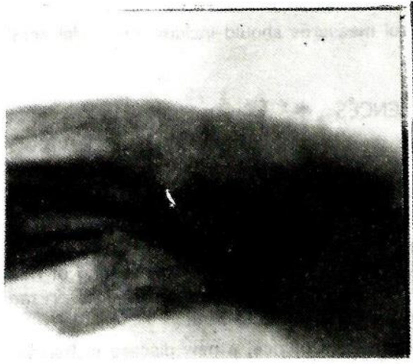

Fig. 2. *P. oryzae* developing from pericarp of rice seed.

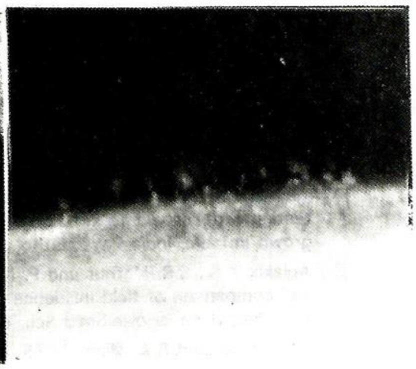

Fig. 3. *P. oryzae* developing from endosperm of rice seed .

and 10% of endosperms of rice seed of variety "Reiho" group (A) and of those combination of seed lots harvested 1986 (B) respectively, but not in the embryoes.

F.moniliforme and *F.semitectum* were observed in 1.50% and 16% of pericarps, respectively. They were also detected in 0.75% of endosperms.

P.oryzae was observed in different parts of the rice seed. The pericarps yielded the blast fungus (Fig . 2) in 38% and 15% in case of A and B respectively. The fungus was found in 26% and 10% of endosperms (Fig.3), as well as in 8% of embryoes. The embryo extraction method also confirmed this result as it showed the fungus associated with 2% of the tested embryos.

T.padwickii was also detected in pericarps and endosperms, at 9.50% and 1.50%, respectively. Mathur and Neergaard (1970) isolated the stack burn fungus from dehulled seeds treated with 0.1% Germisan for 45 minutes, suggesting deeply seated infection.

Neergaard (1970), Zakeri and Zad (1984) reported that pericarps yielded isolates of *D.oryzae, P.oryzae* and *T. padwickii.* The seed infection of *F.semitectum, D.oryzae* and *T.padwickii* was deeply seated within the endosperm. Zad and Zakeri (1983) found that *P.oryzae* was observed in the coat and embryo of rice seed and that infected seeds produce abnormal seedlings.

Such findings are in accordance with our observations. The location of *D.oryzae, F. moniliforme, F.semitectum, P.oryzae* and *T.padwickii* in rice seed were clarified in the present investigation. They were shown in pericarp and endosperm of the rice seed, whereas P.oryzae was also present in the embryo.

Since the inocula of those fungi were able to infect various parts of rice seed including endosperm and embryo, control measures should include fungicidal seed treatments for rice cultivars.

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دراسات علي انتقال أمراض الأرز بواسطة البذور وأساسيات المقاومة لها : (١) الفطريات المصاحبة لبذور الأرز وبعض الملاحظات علي البذور المصابة

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تم التعرف علي ١٦ فطر وجدت مصاحبة لعدد ١١٨ عينة من بذور الارز تمثل ٦ أصناف عند فحصها بطريقة ورق الترشيح . ووجد ان الفطر دريشليرا أوريزي مصاحبا لكل العينات المذكورة، بينما وجدت ٨٤ عينة مصابة بالفطر بيريكيولاريا أوريزي. وكان الصنف ريهو مصابا بشدة بفطر اللفحة حيث وصلت اصابته الي ٦٥٪ . أما صنفي جيزة ١٧١، جيزة ١٧٢ فقد زادت اصابتهما في عينات موسم ١٩٨٤ عن المعتاد. في حين ان بذور عينات صنفي أي آر ١٦٢٦ ، أي آر ٥٠ وجدتا خالية من الفطريات فيوازيوم مونيليفورم ، فيوزايوم سيميتكتم ، نيجروسبورا اوريزي ، بيريكيولاريا اوريزي وايضا الفطر ترايكوكنيلا بادويكي، كما اظهرت ايضا نسبة اصابة منخفضة بفطر التبقع البني. كما لوحظت عينة واحدة فقط من صنف جيزة ١٧١ مصابة بالفطر جيرالاكيا اوريزي بنسبة ٠,٥ ٪ والتي تعتبر اقل من الحد المسموح به لتلوث البذور.

وقد ثبت ايضا ان الفطريات المصاحبة للبذور تختلف اختلافا بينا تبعا للصنف ومكان الزراعة والاختلاف المناخي بين عام وآخر . ارتفعت نسبة الاصابة بالفطر دريشليرا اوريزي عندما تم تحضين البذور من ٥ - ٦ أيام بينما كانت اعلي نسبة اصابة بالفطر بيريكيولاريا اوريزي في اليوم الرابع من التحضين علي بيئة الآجار المائي.

وقد استدل الي وجود علاقة طردية مباشرة بين اصابة البذور بكل من الفطريات دريشليرا اوريزي وبيريكيولاريا اوريزي بأعفان البذور وموت البادرات . وبفحص اجزاء بذور الارز منفصلة وجدت الفطريات ديشليرا اوريزي، فيوزاريوم مونيليفورم ، فيوزاريوم سيميتكتم ، بيريكيولاريا اوريزي وايضا ترايكوكنيلا بادويكي داخل طبقتي البيريكارب والاندوسبرم في حين ان الفطر بيريكيولاريا اوريزي لوحظ تواجده ايضا داخل جنين البذرة.