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A NOTE ON QUANTITATIVE VARIATION IN PATHOGENICITY OF *PYRICULARIA ORYZAE* IN THE GREENHOUSE

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ABSTRACT

Quantitative differences in pathogenicity of monoconidial subcultures of *Pyricularia oryzae* Cav. were examined. The subcultures had been isolated from a susceptible-(STL) and an intermediate type lesion (ITL), which originated from a single culture. The majority of the STL monoconidial subcultures produced more susceptible type lesions than did the ITL subcultures. The production of intermediate type lesions was similar in both groups of subcultures, whereas the ITL subcultures produced a high number of resistant type lesions. Within both groups, there was also some variation in numbers of lesions produced.

INTRODUCTION

Rice blast, caused by *Pyricularia oryzae* Cav., is one of the most destructive diseases of rice. Breeding for resistance to rice blast is complicated by thegreat race specialization in *P. oryzae*. Some workers have reported pathogenic variability in *P. oryzae* [2,3,4,8,9,10]. Contrary to the previous reports on the pathogenic variability, Latterell [5,6] indicated that even though cultural incompatibility was common, changes in races pattern were rare.

Although there is much information about qualitative variation in pathogenicity of *P. oryzae* with respect to physiological specialization, quantitative differences in pathegoniciy have been widely overlooked. During greenhouse selection of blast resistant rice cultivars, the range of variation in lesion type (susceptible, intermediate and resistant) is frequently present on the same leaf of a cultivar following infection by a single pathogenic race of the fungus; even susceptible cultivars exhibit all lesion types.

The aim of the present study was to determine if there are quantitative differences in pathogenicity among monoconidial subcultures of *P. oryzae* that originated from a susceptible and an intermediate type lesion produced in response to infection by a single isolate of the fungus. The authors thank Dr. J.B. Speakman for advice in preparing the manuscript.

MATERIALS AND METHODS

A typical susceptible-and intermediate type lesion was collected from a rice plant (cv. Jinheung) which had been inoculated with the isolate KA

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75-70 (N-2 race) of *P. oryzae* in the greenhouse. The lesions were placed onto potato sucrose agar and incubated at 28±1°C for 3 days. Following conidial production, monoconidial subcultures were made by inoculating single conidia onto 2% water agar with fine glass needles under a microscope.

Rice plants (cv. Jinheung) were inoculated at the 6-7leaf stage with a conidial suspension (10^5 conidia/m*l*) of each of the monoconidial subcultures from each of the 2 lesions. A hundred plants were uniformly sprayed with 50m*l* of each of the condial suspensions under the turntable rotation of plants. In the same time, the Japanese differential cultivars were inoculated at the 4-5 leaf stage with all the monoconidial subcultures. The inoculated plants were incubated at 26±2°C for 24 h in a moist chamber, and then maintained at 25±5°C in the greenhouse. The number of lesions on 5 randomly selected plants were counted 8 days after inoculation. The monoconidial subcultures from each of the 2 type lesions were differentiated according to the established criteria (7).

Table 1. Average number of lesions caused by monoconidial subcultures of *Pyricularia oryzae* from a susceptible type lesion[a] produced by the parental isolate KA75-70

Type of lesion	No. lesions[b] per plant produced by different monoconidial subcultures															
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	Mean
Susceptible	111	36	100	96	59	96	71	95	95	79	102	54	89	110	96	86
Intermediate	0	3	0	15	11	10	9	17	10	5	0	1	8	0	13	7
Resistant	0	11	0	52	96	45	58	66	33	17	0	7	40	0	29	30

[a]The susceptible type lesion was obtained by inoculating the isolate KA75-70 on the rice cultivar Jinheung. The monoconidial subcultures were inoculated onto the same cultivar.
[b]The number of lesions were counted on 5 randomly selected plants.

Table 2. Average number of lesions caused by monoconidial subcultures of *Pyricularia oryzae* from an intermediate type lesion[a] produced by the parental isolate KA75-70.

Type of lesion	No. lesions[b] per plant produced by different monoconidial subcultures															
	I_1	I_2	I_3	I_4	I_4	I_6	I_7	I_8	I_9	I_{10}	I_{11}	I_{12}	I_{13}	I_{14}	I_{15}	Mean
Susceptible	32	22	13	41	20	25	31	25	10	34	19	63	30	70	8	30
Intermediate	11	15	1	10	16	6	10	7	3	7	5	22	10	14	3	9
Resistant	27	16	7	209	93	75	26	54	7	49	12	94	39	67	38	54

[a]The intermediate type lesion was obtained by inoculating the isolate KA75-70 on the rice cultivar Jinheung. The monoconidial subcultures were inoculated onto the same cultivar.
[b]The number of lesions were counted on 5 randomly selected plants.

RESULTS AND DISCUSSION

The majority of the STL monoconidial subcultures produced more susceptible type lesions than did the ITL subcultures. The trend in the production of intermediate lesions by both subculture groups was similar. The ITL subcultures produced remarkably higher numbers of resistant type lesions (Table 1 and 2).

There was a great variation in numbers of lesions within the 2 groups of monoconidial subcultures. The STL subcultures, S_2, S_5 and S_{12}, showed low virulence, which was similar to many of the ITL subcultures. The ITL subcultures, I_{12},

and I_{14}, produced a abundant susceptible type lesions.

The results suggest that the virulence of. *P. oryzae* is likely to be changed quntitatively during the formation of the different lesion types. It seems possible that as *P. oryzae* is heterogenous, variation in pathogenicity is already present within the conidial populations of the subcultures, or that cultures of the fungus have an altered virulence resulting from host-pathogen-environment interaction. Caten (1) reported that quantitative variation in pathogenicity may interact with host genotype and/or with the environment permitting a fine tuning in pathogenicity of considerable evolutionary and practical significance.

The monoconidial subcultures isolated from a susceptible and an intermediate type lesion were differentiated on the basis of the Japanese differential set of twelve rice cultivars. In this test, 2 out of 30 monoconidial subcultures gave different reaction than the original parent culture. The two subcultures showed the same reactions on eleven of the cultivars, but were virulent on Chokoto in contrast to the parent culture which was not virulent on Chokoto. With respect to qualitative variation, it has been reported that conidia produced by single lesions consisted of many pathogenic races; even daughter conidia from a monoconidial culture could also be differentiated into different pathogenic races (3, 4, 8, 9). In contrast, Latterell (5, 6)found no changes in pathogenic specialization from that of parent cultures, after testing 600 single-spore isolates from both lesions and cultures. Our result indicated that *P. oryzae* may be not extremely labile with respect to pathogenic specialization.

The detection of quantitative variation requires careful measurement of the host-pathogen interaction under conditions where only the pathogen genotype is varied (1). Further studies based on rice cultivars and fungal isolates under different environmental conditions are necessary to determine which factors influence the quantitative variation n pathogenicity of *P. oryzae* in field.

溫室에서의 벼 稻熱病菌의 量的變異에 關한 小考

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摘 要

벼稻熱病菌의 한 菌株를 벼에 接種했을때 形成된 罹病性病斑 및 中度型病斑에서 얻어진 單胞子分離菌株間의 病原性의 量的差異를 溫室에서 조사하였다.

單一罹病性病斑에서 分離된 大部分의 單胞子分離菌은 單一中度型病斑에서 分離한 菌株보다 罹病性病斑 形成率이 현저히 높았고 中度型病斑 形成은 비슷하였다. 특히 中度型病斑에서 分離한 菌株가 抵抗性病斑을 더 많이 形成하였다. 이들 두 單胞子分離菌株內에서도 형성된 病斑數에 다소의 變異를 보였다.

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