

韓國에서의 새로운 稻熱病菌의 레이스

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New Races of *Pyricularia oryzae* in Korea*

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Abstract

Since Tongil has been cultivated widely in farmers' fields, the variety is known to be highly resistant to existing races of *Pyricularia oryzae* in Korea. However, Tongil and the sister lines were moderately susceptible to race IA-65, which was isolated from Tongil at the blast nursery of the College of Agriculture, Seoul National University, 1972. In field tests of 1973, pathogenic reactions of IR lines at the isolated nursery, where IA-65 had been inoculated, were significantly higher than those at the farm nursery. When seedlings of 196 IR lines were inoculated with IA-65, about 30% of the IR lines including IR667-98 were moderately susceptible. Among the 30 isolates of *P. oryzae* obtained mostly from indicas, 12 were also differentiated in 1973 as IA group known to be the most prevalent races at IRRI in the Philippines, where Tongil has been highly susceptible. This IA group was also pathogenic to Tongil in greenhouse experiments. The race group causing moderately susceptible to Tongil should be new in Korea, since no occurrences of the race IA have ever been reported previously from the areas where japonica types of rice are cultivated. Because some races of *P. oryzae* present in Korea are pathogenic to Tongil and because these races may become prevalent in the fields, the reaction of Tongil must be continuously monitored.

The variety Tongil also known to be IR667-98 bred from a cross between IR8x (Yukara x Taichung Native 1) is superior in yielding ability to the traditional japonicas largely because of a plant type which is highly responsive to nitrogen and highly resistant to existing races of *Pyricularia oryzae* in Korea. Tongil will be seeded to approximately 260,000ha which approaches 22% of the crop in 1974. Further substantial increases in hectarage are expected next year. While the average national yield of japonica

varieties in 1973 was 3.5t/ha, that of Tongil was 4.8t/ha.

Since Tongil has been cultivated widely in farmer's fields, no occurrences of blast lesions have been reported in Korea. However, Tongil and the sister lines were highly susceptible to blast at the blast nursery at IRRI⁽¹⁾. Recently, Tongil and some other IR lines of rice were moderately susceptible to the races IA group known to be the most prevalent group at IRRI⁽⁶⁾ both in the greenhouse and in the blast

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1972, 1973年度 科學技術處研究開發事業費의 一部로 이루어졌음. 1974年 4月 22-25日, 國際米作研究所 主催 國際米作研究會議에서 發表하였음.

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本 研究 遂行에 協力한 安商元, 黃炳國 兩碩士에게 誠心으로 謝意를 드림.

nursery of the College of Agriculture, Seoul National University. The races of *Pyricularia oryzae* in Korea with special reference to Tongil will be discussed.

The Races Pathogenic to Tongil in 1972⁵⁾

The procedures for both the blast nursery test and the seedling test in the greenhouse were followed by the ordinary test methods^{14,17)}. In the nursery, however, 3 border rows were planted the varieties known to have different resistance genes²⁾ surrounding the testing rows in order to obtain diverse race groups of *Pyricularia oryzae*. Then the races, IC-3, IC-4, G-1, IH-1 and others obtained from ORD (N-1, N-2, N-3, N-4, C-3, C-8, T-2, T-3) were inoculated twice to the seedlings of more than 1000 IR lines including IR667-98.

Pathogenic races of *P. oryzae* obtained from the nursery were differentiated based on the international set in order to forecast blast epidemics of Tongil as well as to obtain the virulent isolates to be used for the screening of the varieties with stable resistance to blast disease.

In 1972, two of each of IR667-98 and IR1317 were moderately susceptible, whereas most of the IR lines were resistant. Among the 30 isolates of *P. oryzae* obtained mostly from IR lines including IR667, one of IA-65 and 7 of IC group known to be prevalent in indica type varieties^{14,17)} were found (Table 1).

Table 1. Number of pathogenic races of *Pyricularia oryzae* obtained from the blast nursery based on the international differential varieties at COA, SNU, 1972.

Isolate obtained from	No. of isolates	IA-65	IC-19	ID-15	IE-3	IF-3	IH-1	IJ-1
IR 667-98	6	1	1	1			2	1
IR 1317	3		1	1		1		
Other IR	9		1				8	
Indica	4		1		1	2		
Japonica	8		3				5	
Total	30	1	7	2	1	3	15	1

The Races Pathogenic to Tongil in 1973⁶⁾

Among more than 1,600 IR lines including IR667-

98 tested, when crop residues infected with *P. oryzae* were scattered over the farm blast nursery, considerably more the disease occurred on IR667-98 and the sister lines than that on these lines in 1972.

Pathogenic reactions of IR lines at the isolated nursery, where IA-65 of *P. oryzae* obtained from Tongil had been inoculated, were significantly higher than

Table 2. Pathogenic reactions of some IR lines and WX126F₃ lines of rice to *Pyricularia oryzae* at the isolated and the farm nursery, COA, SNU, 1973.

Line	No. of lines with reaction							
	HR		R		MR		MS	
	Isol.	Farm	Isol.	Farm	Isol.	Farm	Isol.	Farm
IR667-98-1	3	4						1
IR667-98-2	3	10		1	6			2
IR1317-316-2	1	5			2			2
IR1317-316-3		5	1		4			
IR1317-316-5	2	2						
WX126-12	9	11	1	1	1			1
WX126-14	1	5	2		2			
WX126-48	2	9	2		4			1
Total	21	51	6	2	19			7

* Isol.: Isolated nursery inoculated with IA-65 of *P. oryzae*
Farm: Farm nursery infected with crop residues.

Table 3. Pathogenic reactions of Tongil and some IR lines to IA-65 of *Pyricularia oryzae* at the seedling stage, at COA, SNU, 1973.

Line, Variety	No. with reaction					Total
	HR	R	MR	MS	S	
Tongil						
Suwon 213	1					1
Suwon 213-1		1	1	2		4
Suwon 214	1	1		1		3
Suwon 215		2		1		3
Suwon 217		1		1		2
Suwon 218		1				1
IR line						
IR 667-98	11	12	15	22		60
IR 781	17	7	15	11		50
IR 1317	27	11	9	14		61
IR 2061	4	6	1			11
Kimmaze				1	3	4
Mankyung				2	2	4
Total	61	42	41	55	5	204

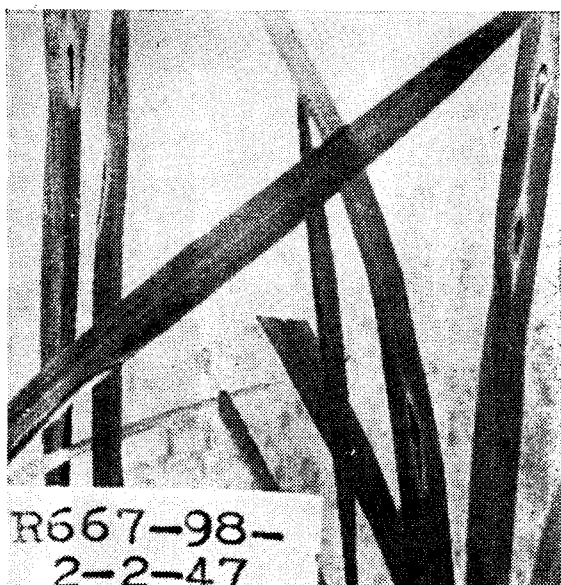


Fig. 1. Moderately susceptible lesions on the sister line of Tongil with IA 65 of *P. oryzae*.

Table 4. Pathogenic reactions of Tongil and other IR lines of rice to IA 65 of *Pyriculariaoryzae* isolated from blast nursery at COA, SNU, 1972.

Line or Variety	Reaction
Tongil Suwon 213-1 (IR667-98)	4
Nongbaek	1
Jinheung	2
Suwon 225 Congo x Suwon 82	1(3)
228 IR 8/2x (Yukara x TNI)	4
230 Jinheung x IR 262/2	4
235 Jinheung x Shimokita	4
236 Paldal x Tongil	4
237 Norin 29x Tongil	2(3)
238 Tongil x IR 1317-392	4
239 Tongil x IR 1317-392	4
240 IR 1317 x IR 781	4
241 IR8x (Yukara x TNI)	4
Chulwon 1 Shimokita x Senshuraku	3
SR 3-1-68 Jinheung x Shimokita	2
IR 1325131-11-B-48	
Jinheung x IR 262x IR 781	4
Tetep	3

1: Highly resistant 2: Resistant
3: Moderately resistant 4: Moderately susceptible

those at the farm nursery (Table 2). When seedlings of 196 IR lines were inoculated with IA-65, about 30% of the lines including IR667-98 tested were

moderately susceptible (Table 3, Fig. 1). Breeding lines of Crop Experiment Station with Tongil also resulted in moderately susceptible to IA-65 (Table 4). Again, whereas Tongil was moderately susceptible to IA-65 in other experiment none of the races, T and N, were pathogenic to Tongil (Table 5).

Table 5. Pathogenic reactions of MR 515-17 and other rice varieties or lines to 4 races of *Pyricularia oryzae* at COA, SNU, 1973.

Line or Variety	Races			
	N-2	N-3	T-1	IA-65
*MR 515-17	1(4)	1	1	1
Palkweng	5	4	5	5
Milyang 10	3	1(2)	5	3
Jinheung	1(4)	1(2)	5	3
Kinmaze	4	4	5	4
Nongbaek	1	1	4	1
S 214 (IR667-98)	1	1	1	4
S 213-1 (IR667-98)	1	1	1	4

* A mutant from Palkweng induced by thermoneutron.

1: Highly resistant 2: Resistant
3: Moderately resistant 4: Moderately susceptible
5: Susceptible

Among the 30 isolates of *P. oryzae* obtained mostly from indicas including IR667-98, 12 of IA group, 6 of each of IG-1, IH-1, and others were found (Table 6). IA group was also pathogenic to Tongil in the greenhouse tests of two different experiments.

Table 6. Number of pathogenic races of *Pyricularia oryzae* obtained from the blast nursery based on the international differential varieties, at COA, SNU, 1973.

Isolate obtained from	IA	IC	IF-3	G-I1	IH-1	II-1	Total
IR 667-98	2	1			2	1	6
IR 1317-316	1			2	1		4
Other IR	5	1	1	1	3	2	13
Indica	2			2			4
Japonica				1			1
Nongbaek	2						2
Total	12	2	1	6	6	3	30

Discussion

Moderately susceptible reactions of Tongil to the races IA-65 and IA group which have never been

reported both in Korea and in Japan¹¹⁾ were proved in several different experiments both at the greenhouse and at the blast nursery. Since the differential varieties have varied from one country to another, earlier reports^{1,7,10)} of pathogenic races may not be comparable to the international race. Informations on the subject in Korea are fragmentary.

Japan-US coworkers¹⁷⁾ reported that 6 isolates of *P. oryzae* from Korea were one of each of ID-8, ID-10, and IG-1 and 3 of IH-1. During the 1970 and 1971 seasons at 5 locations, Park¹⁵⁾ found that Suwon 213-1 (Tongil) was resistant and pathogenic reactions of the differential varieties seeded in the same nursery were known to be IF, IC, ID, IE, in that order of the frequencies concerned. In 1971, Chung and Ahn³⁾ differentiated 10 isolates into 5 of IG-1, 3 of IH-1, and one of each of IC-3 and IC-4. Pathogenic reactions of Tongil and the sister lines to both the above races and the 9 major races in Korea^{7,10,12)} namely T, C, N obtained from the Office of Rural Development, were all resistant in the same experiment. Cho and Kiyosawa²⁾ also found no susceptible reactions to Tongil and the sister lines with 7 "strains", namely one of each of N-1, N-3, N-4, C-3, T-1 and two of N-2. Similarly, 7 isolates obtained from Tongil, belonging to the race T or C, were not pathogenic to Tongil¹³⁾.

It is probable, therefore, that the races IA group causing moderately susceptible to Tongil should be new in Korea. Furthermore, the race IA group has only been reported from the areas widely such as Vietnam, India, Taiwan, Philippines, Ceylon, and Thailand where indica types are cultivated¹¹⁾. Another evidence is that international different variety, Raminad Str. 3 was resistant to 10 major races of Japan, which was claimed to be similar to those in Korea^{8,71)}.

Recently, however, Kwon et al.⁹⁾ reported that Tongil was susceptible to the races C-5, T-1 and IE-67, mutants of X-ray irradiated N-1 when they were inoculated to the leaves by punch method. Institute of Agricultural Sciences, ORD also found that two isolates similar to race T obtained probably from japonica varieties were also pathogenic to Tongil¹³⁾.

Thus, Tongil has become susceptible to the races

IA group, T and others with artificial inoculations to the seedlings either in the greenhouse, in the nursery, or both. It is noteworthy that a number of the race IA group have been drastically increased in 1973 as compared with that obtained from limited studies in 1972. The race group IA is known to be the most prevalent group at IRRI in the Philippines¹⁶⁾, where Tongil has been highly susceptible¹¹⁾. Because some races of *P. oryzae* present in Korea are pathogenic to Tongil, and because these races may become prevalent in farmer's fields, the reaction of Tongil must be continuously monitored. Pathologists and breeders are emphasizing the development of varieties with even broader spectrum of resistance to blast than that of Tongil.

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摘 要

全國적으로 널리栽培되고 있는 통일(IR667-98)이 우리나라의 현존 稻熱病菌 Race에 대하여 高度로 抵抗性을 유지하고 있다. 그러나 통일과 그 자매系統은 1972년 서울大學校 稻熱病檢定밭못자리에서 통일에서 分離한 Race IA-65에 대해 中度感受性이었다.

1973년에는 IA-65를 接種한 隔離밭못자리에서 통일을 비롯한 IR 系統은 이 Race를 接種하지 않은 農場밭자리보다 현저히 病原性이 높았다. 또한 IA-65에 대한 196 IR 系統의 유묘검정반응은 통일을 포함한 약 30%가 中度感受性이었다. 1973년에 다시 통일을 비롯한 印度型 系統에서 주로 分離한 30菌株중 12개는 통일이 高度感受性이었던 필리핀 國際米作研究所의 優占 Race 群으로 알려진 IA群으로 判別되었다. Race IA 群도 유묘검정에서 통일에 病原性이 있었다. 이와같이 통일 및 IR 系統에 病原性인 Race IA 65 및 IA 群은 한국을 비롯한 日本型 벼栽培地帶에서 報告된 바 없는 새로운 것으로 생각된다. 우리나라에 현존하는 몇가지 Race가 통일에 病原性을 보이고 있고 더 나아가서 이들 Race가 일반 농가포장에서 蔓延될지도 모르므로 통일에 대한 稻熱病의 反應이 계속 추구되어야 한다.