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Effect of Predisposing Temperatures on The Histopathology of The Rice Blast Fungus, *Pyricularia oryzae*

Ⅱ. Effect of Four Predisposing Temperature Regimes on The Symptom Development

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ABSTRACT

In the present study, it was found that the susceptible variety Khao-tah-haeng 17, at all four predisposing temperature regimes, produced more typical lesions than hypersensitive lesions when inoculated with most of the blast fungus isolates. Tetep, Carreon, IR36 and Sensho produced more hypersensitive lesions than typical lesions at all four predisposing temperature regimes.

Highly significant differences among predisposing temperature regimes and rice varieties for number of hypersensitive lesions and number of typical lesions were found. Symptom occurrence on a specific variety, as measured by the number of typical lesions, was more affected by predisposition temperature or blast isolate than by temperature and isolate combined. Symptom occurrence on a speicfic variety, as measured by the number of hypersensitive lesions, was more affected by blast isolate than by predisposition temperature.

INTRODUCTION

Two types of lesions produced on the rice plant by the blast fungus are known to be important in blast epidemics. These are referred to as typical or acute lesions and hypersensitive lesions or pinhead brwon spots. Hypersensitive lesions dc

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not result in sporulation of the fungus after infection and such lesions are not considered important with regard to the development of blast epidemics. Hypersensitive lesions are considered to represent a resistant reaction by the rice plant to *Pyricularia oryzae*. The typical or acute lesions are characterized by abundant spore production of the fungus after infection which results in adequate inoculum for the creation or maintenance of an epidemic. Such lesions are considered to represent a susceptible reaction by the rice plant to *Pyricularia oryzae*.

Ono (1953) classified blast lesions into four types brown spot, white spot, chronic and acute. Each lesion type could indicate a difference in the rice plant's resistance to blast. Under conditions of natural infection as well as artificial inoculation, the characteristic symptoms of leaf blast include both chronic and acute lesion types. The hypersensitive or pinhead brown spots are considered to represent a resistance reaction and they are apt to be ignored in the epidemiology of blast disease while the typical or acute types appear on the susceptible varieties and are considered as an important source of inoculum for the succeeding blast epidemics (Ono, 1953).

In the present study typical and hypersensitive lesions were counted separately in order to study the relationship between the two types of lesions and percent penetration under different predisposing temperature regimes.

MATERIALS AND METHODS

Two sets of the six varieties Tetep, IR36, Carreon, Sensho, KTH and Peta with eight pre-germinated seedlings per 10 cm row were sown in one plastic tray (25×32×12 cm). Each plastic tray contained 8kg of soil mixed with 2g of $NH_4(SO_4)_2$, 0.4g of calcium phosphate and 0.4g of KCl.

Potted seedlings were grwon in the Phytotron with controlled temperatures and 70% relative humidity. The different temperature conditions were 29/21C (high daytime temperature from 9 : 00 a.m. to 5 : 00 p.m. and low night temperature from 5 : 00 p.m to 9 : 00 a.m.), 32/24C and 35/27 C. Other sets of potted seedlings were grown in the greehouse where temperature, relative humidity and light intensity were uncontrolled and variable.

Wooden frame boxes (90×75×140cm) covered with plastic sheets and cloth linings were used as inoculation chambers (Ahn, 1977). A few hours prior to inoculation, the inside of the chamber was sprayed with an adequate amount of water to maintain free water on the plants during inoculation. One plastic tray of seedlings which was grown under each of the different temperature conditions was placed in one chamber and inoculated with 50m*l* of spore suspension using an electric motor sprayer to insure an even and uniform distribution of spores. The concentration of spores was $1.5-2.0\times10^5$ spores/m*l*. Six isolates, 2017, 4702, L-1441, 750678-1, 1509 and 2137 were inoculated separately in each chamber. The plants were maintained for 24 hours inside the inoculation chamber at a temperature of 25±1C and then were transferred to a separate greenhouse incubation room with humidifier and fan cooling system for six days at which time lesions were counted.

RESULTS AND DISCUSSION

Among the predisposing temperature regimes evaluated in this study, 29/21C and Greenhouse conditions appeared to be more favorable for disease devolopment (Table 1). Highly significant differences among predisposing temperature regimes for total number of lesions were found. Even with the relatively wide range of temperatures (10~36C) reported as suitable for the blast fungus development *in vitro* (Hashioka, 1965), the predisposing temperature regimes studied were apparently adequate to detect significant differences.

Sadasivan et. al. (1965) found that neither resistant nor susceptible rice phenotypes were infected by the blast fungus when the plants were grown with night temperatures above 20C. At night temperatures of 20C, however, both resistant and susceptible varieties succumbed to infection

Table 1. Total average number of lesions produced by six *P.oryzae* isolates on six rice varieties under four different predisposing temperature regimes at seven days after inoculation.

Predisposing Temperature Regime[a]	Variety	Isolates					
		2137	L-1441	2017	4702	1509	750678-1
GH	Carreon	1.4 c[b]	0.9 cd	0.5 bc	0.8 b	1.5 c	1.1 c
	IR36	0.4 c	11.2 b	0.1 bc	1.2 ab	0.7 c	7.7 b
	KTH	25.1 a	43.1 a	7.4 a	11.4 a	36.0 a	30.2 a
	Peta	11.0 b	5.7 bc	3.3 ab	2.9 ab	19.0 b	11.0 b
	Sensho	1.5 c	0 d	0 c	0.1 b	1.9 c	16.2 ab
	Tetep	0.8 c	0 d	2.2 abc	0 b	0.9 c	0.7 c
29/21 C	Carreon	1.8 c	0.8 b	0.8 a	1.0 a	1.8 c	1.1 d
	IR36	1.1 c	1.0 b	0.3 a	0.4 a	1.0 c	3.4 d
	KTH	25.9 a	28.4 a	3.4 a	4.7 a	34.7 a	54.2 a
	Peta	10.3 b	2.4 b	1.9 a	1.6 a	20.7 b	28.9 b
	Sensho	0.2 c	0.6 b	0.1 a	0.8 a	1.2 c	14.5 c
	Tetep	0.6 c	0.1 b	1.7 a	0.5 a	0.9 c	2.6 d
32/24 C	Carreon	0.9 b	0.6 c	0.8 a	0.5 a	0.5 b	1.0 c
	IR36	0 b	7.0 b	0.3 a	0 a	0 b	2.5 c
	KTH	8.1 a	18.8 a	2.2 a	2.5 a	24.0 a	27.7 a
	Peta	2.7 ab	5.0 bc	0.7 a	1.5 a	15.8 a	14.2 ab
	Sensho	0	0.4 c	0.4 a	0.4 a	0.3 b	5.2 bc
	Tetep	0.4 b	0.3 c	3.1 a	0.1 a	0.5 b	1.6 c
35/27 C	Carreon	1.2 a	1.0 a	0.8 a	1.0 a	1.4 b	1.1 c
	IR36	1.1 a	0.6 a	0.6 a	0.2 a	0.3 b	0.9 c
	KTH	3.9 a	3.2 a	1.5 a	1.4 a	8.9 a	9.2 a
	Peta	1.5 a	0.5 a	1.4 a	1.0 a	6.9 a	7.9 ab
	Sensho	1.0 a	0.4 a	0.5 a	0.6 a	0.5 b	1.7 bc
	Tetep	0.9 a	0.1 a	1.1 a	1.1 a	1.1 b	0.1 c

[a]GH refers to greenhouse where temperatures were variable and fluctuated from 33 to 23C. The first number refers to a constant day temperature and the second to a constant night temperature, each 8 and 16 hours in duration.
[b]In a column, means followed by a common letter are not significantly different at the .05 level by DMRT.

although the resistant plants produced smaller, dark brown lesions. Despite the general acceptance that low night temperatures are favorable for the occurrence of blast in the field (Sadasivan et. al., 1965; Chiba et. al., 1975), there have been blast epidemics in the Philippines when the monthly minimum temperature exceeded 20C. In this study, night temperatures ranged from 21-27C and typical blast lesions were observed on resistant varieties such as Carreon and Tetep when they were predisposed to 27C night temperatures (Table 3). High night temperatures did reduce disease development to some extent but did not prevent the occurrence of blast. The interaction between blast isolate by predisposition temperature for total number of lesions was not significant (Table 4) while highly significant differences were observed for the varieties KTH and Peta in the temperature by variety interaction (Table 5).

Symptoms were produced by all six isolates on all six varieties at both the 29/21C and 35/27C predisposing temperature regimes (Table 1). All six isolates produced symptoms on Carreon, KTH and Peta at all predisposing temperature regimes.

Table 2. Percent penetration of six *Pyricularia oryzae* isolates on six rice varieties under four different predisposing temperature regimes at 72 hours after inoculation and maintenance at 25C temperature.[a]

Predisposing Temperature Regime[b]	Variety	Isolates					
		2137	L-1441	2017	4702	1509	750678-1
GH	Carreon	0.725 bc[c]	0.497 c	0.295 b	0 b	1.234 cd	0.275 d
	IR36	0.535 c	2.042 ab	0 c	0.468 a	1.179 bc	0.814 c
	KTH	3.210 a	1.001 bc	2.010 a	1.408 a	4.528 a	3.946 a
	Peta	1.660 b	2.475 a	1.280 a	0.789 a	2.008 b	2.286 b
	Sensho	0.558 c	0.091 d	0 c	1.022 a	0.493 cd	1.164 bc
	Tetep	0.074 d	0 d	0.997 ab	0 b	0.201 d	0.294 d
29/21 C	Carreon	0.415 cd	0.199 b	0.663 ab	0.268 bc	0.505 b	1.485 b
	IR36	0.582 bc	0.514 b	0.201 b	0.100 c	0.253 b	2.453 b
	KTH	2.112 a	4.120 a	1.215 a	1.461 a	2.701 a	5.875 a
	Peta	1.342 ab	2.061 a	1.168 a	1.137 a	2.122 a	5.251 a
	Sensho	0.075 d	0.196 b	0.210 b	0.676 ab	0.332 b	2.759 b
	Tetep	0.108 d	0.146 b	0.804 ab	0.097 c	0.283 b	0.501 c
32/24C	Carreon	0.335 b	0.196 b	0.100 c	0.241 bc	0 b	0.159 d
	IR36	0 b	1.583 a	0 c	0.111 bc	0 b	1.232 bc
	KTH	1.926 a	3.037 a	0.672 ab	0.587 a	2.081 a	3.658 a
	Peta	1.067 a	2.652 a	0.199 bc	0.412 ab	1.227 a	1.617 b
	Sensho	0 b	0 b	0.101 c	0.095 bc	0.087 b	1.343 bc
	Tetep	0.132 b	0 b	1.027 a	0 c	0.099 b	0.613 cd
36/27C	Carreon	0.253 bc	0.097 b	0 b	0.095 a	0.097 b	0.149 c
	IR36	0.183 bc	0.647 a	0 b	0 a	0 b	0.580 bc
	KTH	1.311 a	1.370 a	0.190 ab	0.108 a	1.551 a	1.819 a
	Peta	0.324 b	0.746 a	0.312 a	0 a	1.286 a	1.330 ab
	Sensho	0.098 bc	0 b	0.097 ab	0.102 a	0 b	0.297 c
	Tetep	0 c	0 b	0.542 a	0 a	0.103 b	0.097 c

[a]The plants were maintained 24 hours inside the inoculation chamber at a temperature of 25 ±1C and transferred to a separate incubation room.

[b]GH=refers to greenhouse where temperatures were variable and fluctated from 33 to 23C. The first number refers to a constant day temperature and the second to a constant night temperature, each 8 and 16 hours in duration.

[c]In a column, means followed by a common letter are not significantly different at the .05 level by DMRT.

I-2137 did not penetrate IR36 and Sensho at 32/24C or Tetep at 35/27C (Table 2), although symptoms developed on Tetep at 35/27C (Table 1). I-L-1441 did not penetrate Tetep except at 29/21C or Sensho at 32/24C and 35/27C but symptoms occurred at all predisposing temperature regimes except in the greehouse. I-2017 penetrated IR36 only at the 29/21C regime but did not penetrate Sensho at GH and Carreon at 35/27C regime. I-2017 incited symptom development on all varieties at all predisposing temperature regimes except for Sensho in the GH regime. On the contrary, I-4702 did not penetrate Tetep except at 29/21C but symptoms occurred at all temperature regimes except GH. I-1509 did not penetrate IR36 at 32/24C or 35/27C and no symptoms developed at 32/24

Table 3. Mean number of hypersensitive and typical blast lesions produced by six *P. oryzae* isolates on six rice varieties under four different predisposing temperature regimes at seven days after inoculation.

Predisposing Temperature Regime[a]	Variety	Isolates											
		2137		L-1441		2017		4702		1509		750678-1	
		R[b]	S	R	S	R	S	R	S	R	S	R	S
GH	Carreon	0.7 b[c]	0.7 c	0.7 bc	0.2 b	0.3 abc	0.2 b	0.5 a	0.3 b	1.3 b	0.2 c	1.0 bc	0.1 c
	IR36	0.1 b	0.3 c	10.9 a	0.3 b	0.1 bc	0 b	1.0 a	0.2 b	0.6 b	0.1 c	5.1 bc	2.6 bc
	KTH	8.5 a	16.6 a	1.7 abc	41.4 a	3.6 a	3.8 a	3.6 a	7.8 a	0.9 b	35.1 a	4.0 b	26.2 a
	Peta	5.6 a	5.4 b	3.0 ab	2.7 b	3.0 ab	0.3 b	2.1 a	0.8 b	9.1 a	9.9 b	4.0 b	7.0 b
	Sensho	0.1 b	0.4 c	0 c	0 b	0 c	0 b	0.1 a	0 b	1.6 b	0.3 c	15.1 a	1.1 c
	Tetep	0.7 b	0.1 c	0 c	0 b	1.2 abc	1.0 ab	0 a	0 b	0.4 b	0.5 c	0.2 c	0.5 c
29/21C	Carreon	0.9 c	0.9 b	0.4 b	0.4 b	0.6 a	0.2 ab	0.4 a	0.6 ab	1.6 b	0.2 c	1.0 b	0.1 c
	IR36	0.4 c	0.4 b	0.4 b	0.4 b	0.3 a	0 b	0.3 a	0.1 a	0.9 b	0.1 c	2.0 b	1.4 c
	KTH	12.7 a	13.2 a	7.0 a	21.4 a	1.4 a	2.0 a	1.6 a	3.1 a	5.1 ab	29.6 a	18.5 a	35.7 a
	Peta	4.7 b	5.6 a	0.6 b	1.8 b	0.9 a	1.0 ab	1.0 a	0.6 ab	6.8 a	13.9 b	19.0 a	9.9 b
	Sensho	0.1 c	0.1 b	0.4 b	0.2 b	0.1 a	0 b	0.4 a	0.4 ab	0.6 b	0.6 c	13.8 a	0.7 c
	Tetep	0.5 c	0.1 b	0.1 b	0 b	1.2 a	0.5 ab	0.2 a	0.3 ab	0.8 b	0.1 c	2.4 b	0.2 c
32/24C	Carreon	0.5 a	0.4 b	0.5 b	0.1 b	0.7 a	0.1 b	0.4 a	0.1 a	0.5 b	0 b	0.8 c	0.2 c
	IR36	0 a	0 b	0.6 a	1.0 a	0.3 a	0 b	0 a	0 a	0 b	0 b	1.2 abc	1.3 c
	KTH	0.9 a	7.2 a	0 b	18.8 a	0.9 a	1.3 ab	1.3 a	1.2 a	6.3 a	17.7 a	4.1 abc	23.6 a
	Peta	1.2 a	1.5 ab	2.8 ab	2.2 b	0.3 a	0.4 ab	0.8 a	0.7 a	5.2 a	10.6 a	6.4 a	7.8 b
	Sensho	0 a	0 b	0.3 b	0.1 b	0.3 a	0.1 ab	0.4 a	0 a	0.2 b	0.1 b	5.1 ab	0.1 c
	Tetep	0.3 a	0.1 b	0.3 b	0 b	0.8 a	2.3 a	0 a	0.1 a	0.4 b	0.1 b	1.5 bc	0.1 c
35/27C	Carreon	0.8 a	0.4 a	0.6 a	0.4 a	0.8 a	0 a	0.8 a	0.2 a	1.0 a	0.4 b	0.7 bc	0.4 bc
	IR36	1.0 a	0.1 a	0.3 a	0.6 a	0.6 a	0 a	0.2 a	0 a	0.3 a	0 b	0.5 bc	0.4 bc
	KTH	2.5 a	1.4 a	1.2 a	2.0 a	1.2 a	0.3 a	1.3 a	0.1 a	2.7 a	6.2 a	3.8 ab	5.4 a
	Peta	1.0 a	0.5 a	0.4 a	0.1 a	1.0 a	0.4 a	1.0 a	0 a	3.5 a	3.4 a	5.3 a	2.6 ab
	Sensho	0.6 a	0.4 a	0.4 a	0 a	0.2 a	0.3 a	0.5 a	0.1 a	0.5 a	0 b	1.6 abc	0.1 c
	Tetep	0.8 a	0.1 a	0.1 a	0 a	0.6 a	0.5 a	1.1 a	0 a	0.9 a	0.2 b	0 c	0.1 c

[a]GH refers to greenhouse where temperatures were variable and fluctuated from 33 to 23C. The first number refers to a constant day temperature and the second to a constant night temperature, each 8 and 16 hours in duration.

[b]R : Hypersensitive lesions or pinhead brown spots.
S : Typical leaf blast lesion.

[c]In a column, means followed by a common letter are not significantly different at the .05 level by DMRT.

Table 4. Interaction between four predisposing temperature regimes and six *P. oryzae* isolates for total number of lesions.

Isolate	Correlation Coefficient
2137	$-.130^{ns}$a[a]
L-1441	$-.122^{ns}$a
2017	$-.012^{ns}$a
4702	$-.031^{ns}$a
1509	$-.151^{ns}$a
750678-1	$-.320^{ns}$a

[a]ns : Not significantly different.

Table 5. Interaction between four predisposing temperature regimes and six rice varieties for total number of lesions.

Varieties	Correlation Coefficient
KTH	$-.432^{**}$a[a]
Peta	$-.209^{**}$a
Carreon	$-.005^{ns}$b
IR36	$-.046^{ns}$b
Sensho	$-.059^{ns}$b
Tetep	$-.014^{ns}$b

[a]** : Significantly different at 1% level.
ns : Not significantly different.

C. I-750678-1 penetrated all varieties and symptoms developed at all predisposing temperature regimes (Table 1 and Table 2). In contrast, Sensho was penetrated by I-L-1441 at GH and IR36 by I-4702 at 32/24C, but symptoms did not develop.

Two apparent sources of error are readily obvious from these observations. First, the appearance of symptoms on plants 7 days after inoculation without microscopically detecting evidence of penetration on detached leaves at 72 hours after inoculation and second, the occurrence of penetration, but failure to defect symptoms. Such conflicts can probably be attributed to sampling error. Support for this contention has been offered by Yoshino(1975), who documented that the occurrence of symptoms and number of lesions was more affected by the numbe of microscopic view field observed with the presence of appressoria than percent peretration. Furthermore, Suzuki et. al. (1977) found that blast development approached 100% when the rice plant was inoculated with more than 14 conidia per spot. In the present study, penetration was studied as observations from a single appressorium within a microscopic view field and not all of the penetration pegs succeeded in producing lesion development. Furthermore, delayed conidia germination or appressorias formation with all isolates at all temperatures wes obseved to approach 100%at 72 hours after inoculation indicating this was not a factor.

Significant differences were found among predisposing temperature regimes and varieties for the total number of lesions produced as well as predisposition temperature by variety and isolate by

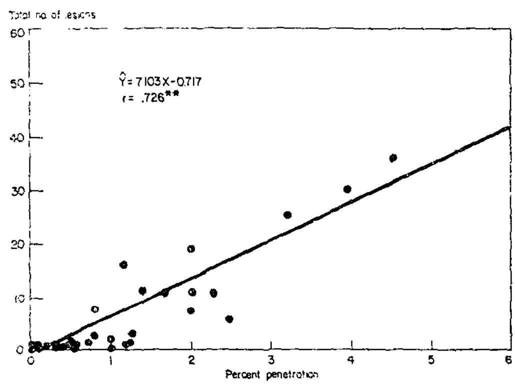

Fig. 1. The relationship between percent penetration and total number of lesions produced by six blast fungus isolates on six rice varieties predisposed in the greenhouse.

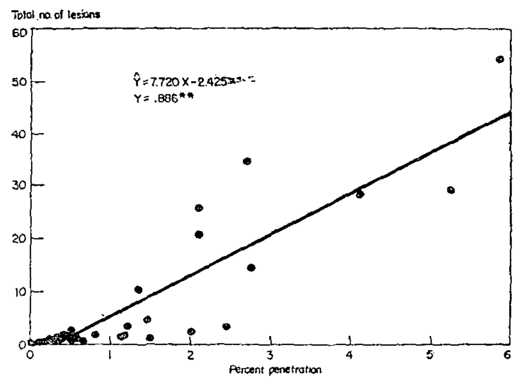

Fig. 2. The relationship between percent penetration and total number of lesions produced by six blast isolates on six rice varieties at the 29/21C (day/night)predisposing temperature regime.

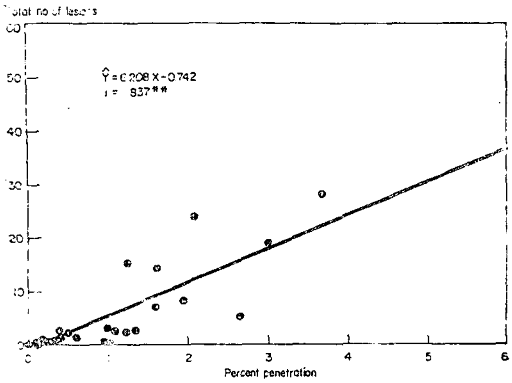

Fig. 3. The relationship between percent penetration and total number of lesions produced by six blast isolates on six rice varieties at the 32/24C (day/night) predisposing temperature regime.

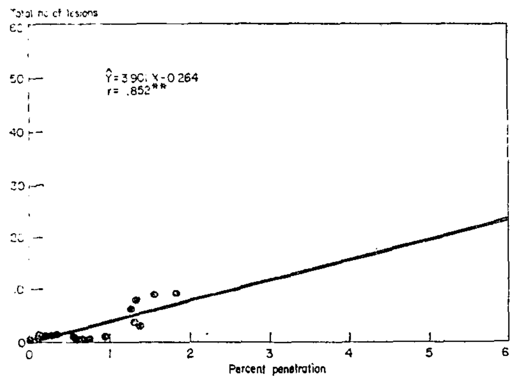

Fig. 4. The relationship between percent penetration and total number of lesions produced by six blast isolates on six rice varieties at the 35/27C (day/night) predisposing temperature regime.

variety interactions while no significant differences were found among isolates. The temperature by isolate by variety interaction was not significant. More lesions were produced at all predisposing temperature regimes on the susceptible varieties KTH and Peta by all isolates (Table 1). There appeared to be a positive relationship between percent penetration and total number of lesions (Figure 1~4).

At 29/21C, the most favorable predisposition temperature for infection in this study, I-L-1441 did not incite typical lesions on Tetep nor did I-2017 on IR36 and Sensho (Table 3), although penetration was observed in all three instances (Table 2). I-L-1441 did not produce typical lesions on Tetep at any of the predisposing temperature regimes but hypersensitive lesions were formed at all temperature regimes except in the greenhouse. I-750678-1 produced typical lesions on all varieties at all temperature regimes. The pattern of various isolates in production of the two types of lesions was different for variety and for predisposing temperature regime. For example, the susceptible variety KTH produced more typical than hypersensitive lesions with all isolates at the 29/21C and 32/24C regimes and more at GH except for I-4702. Isolates 2137, 2017 and 4702 produced more hypersensitive than typical lesions on KTH at 35/27C. The number of hypersensitive lesions was affected by both isolates and temperature regimes (Table 6) while the number of typical lesions was more affected by predisposing temperature regimes than by isolates. I-2017 penetrated IR36 only at 29/21C but hypersenstive lesions were formed at all pre-

Table 6. Analysis of variance for the number of hypersensitive lesions of pinhead brown spots produced by six blast isolates on six rice varieties at four predisposing temperature regimes seven days after inoculation.

SV	DF	MS	F-VALUE
Replication	1	11.1749	
Isolate	5	7.3747	8.13*[b]
Error(A)	5	0.9072	
Temperature	3	2.8344	4.34*
Isolate×Temperature	15	0.8064	1.24ns
Error(B)	18	0.6527	
Variety	5	13.7970	29.37**
Isolate×Variety	25	1.9317	4.11**
Temperature×Variety	15	0.7026	1.50ns
Isolate×Temperature×Variety	75	0.4490	<1
Error(C)	120	0.4697	
Total	287		

CV(A)=96.9%
CV(B)=82.2%
CV(C)=69.8%

[a]Analysis based on values transformed to square root.

[b]**=Significantly different at 1% level.
*=Significantly different at 5% level.
ns=Not significantly different.

Table 7. Analysis of variance for number of typical lesions produced by six blast isolates on six rice varieties at four predisposing temprature regimess seven days after inoculation.

SV	DF	MS	F-VALUE
Replication	1	6.7369	
Isolate	5	8.9890	3.09[ns,b]
Error(A)	5	2.9084	
Temperature	3	7.8096	9.65**
Isolate×Temperature	15	0.3833	<1
Error(B)	18		
Variety	5	58.7818	148.95**
Isolate×Variety	25	3.8936	9.87**
Temperature×Variety	15	2.7941	7.08**
Isolate×Temperature×Variety	75	0.2068	<1
Error(C)	120	0.3946	
Total	397		

CV(A)=175.0%
CV(B)=92.3%
CV(C)=64.5%
[a]Analysis is based on values transformed to square root.
[b]** : Significantly different at 1% level.
ns : Not significantly different.

disposing temperature regimes and no typical lesion were produced.

Highly significant differences among varieties for number of hypersensitive lesions were found while there were only significant differences among isolates and temperature regimes (Table 6). The interaction between isolate by variety for number of hypersensitive lesions was highly significant while the isolate by temperature, temperature by variety and isolate by temperature by variety interactions were not significant (Table 6). Highly significant differences among predisposing temperature regimes and varieties for number of typical lesions were found (Table 7). The interactions between predisposition temperature by variety as well as isolate by variety were highly significant for number of typical lesions while the isolate by temperature and isolate by temperature by variety interactions were not significant (Table 7). Symptom occurrence on a specific variety, as measured by the number of typical lesions, was more affected by temperature or isolate than by temperatures and isolates combined (Table 7). This same relationship was found for percent penetration. Symptom occurrence on a specific variety, as measured by the number of hypersensitive lesions, was more affected by isolate than by temperature (Table 6).

摘　要

本 實驗中 罹病性品種인 Khao-tah-haeng 17에서는 4個 接種前處理溫度어디서나 接種에 使用된 6個 菌株에 對하여 抵抗性보다는 罹病性病斑이 많이 나타났다. Tetep, Carreon, IR36 및 Sensho에서는 罹病性病斑보다는 抵抗性病斑이 많이 나타났다.

抵抗性 및 罹病性病斑數 共히 接種前 處理溫度間, 供試品種間에 高度의 有意性이 있었다. 特定品種에서 罹病性病斑의 發現은 接種前處理溫度와 稻熱病菌菌株에 依해서 左右되었으며 抵抗性病斑의 發現은 接種前處理溫度보다는 稻熱病菌菌株에 依해서 左右되었다.

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