Monthly Changes of Pathogenic Races of Pyricularia Oryzae in a Blast Nursery

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ABSTRACT

A total of 363 monoconidial cultures of *Pyricularia oryzae* were isolated from diseased leaf samples collected monthly for 21 consecutive months from the blast nursery at The International Rice Research Institute (IRRI). These isolates, when inoculated individually on the 8 international and the 12 Philippine differential rice cultivars, were differentiated into 37 and 60 pathogenic races, respectively. The number, composition, and frequency of races varied greatly between months as determined by the isolates. A few prevalent races appeared in most of the months, some intermittently, and others only once during the 21-month period. The qualitative and quantitative changes of the races which occur in a blast nursery suggest the need for repeated tests to screen cultivars resistant to blast and explain why some cultivars resistant in the early stages of growth become susceptible at the flowering stage in fields. Phytopathology 60:1266-1269.

Pyricularia oryzae Cav. consists of many pathogenic races. Studies have been made on the prevalence and distribution as well as on the annual changes of such races (1, 2, 5). Many cultivars show different reactions when tested at different times in blast nurseries in the same locality (6, 8). Varieties resistant at the seedling stage but susceptible at flowering were suspected of reacting to different races at these two

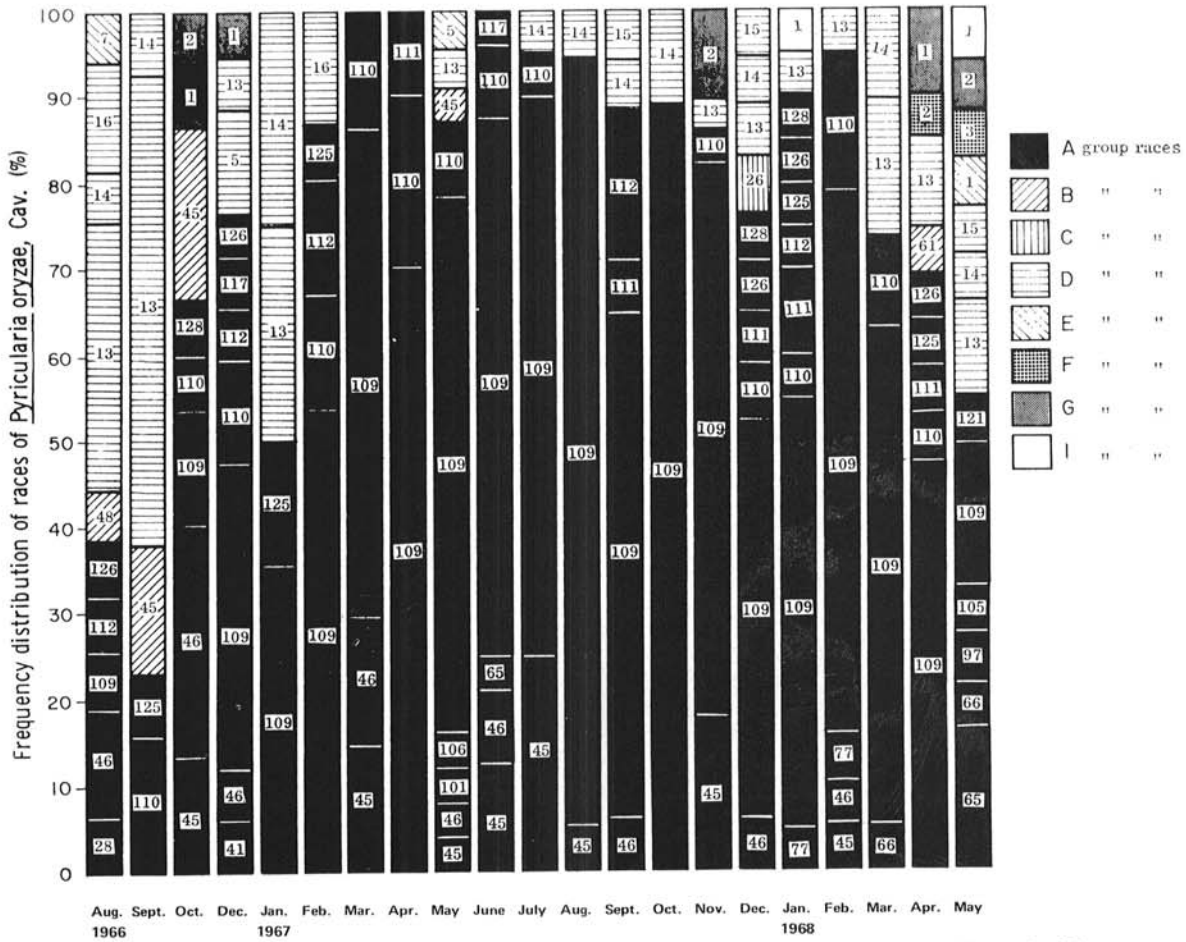

Fig. 1. Population of the International race groups of *Pyricularia oryzae* Cav., sampled monthly at the blast nursery, Los Baños, Laguna, The Philippines, from August 1966 to May 1968.

stages (9). No precise data have been reported, however, on the number of races present in a field and the rate at which the races shift during a relatively short period of time. The present study was aimed at determining the number and frequency of races and their monthly shifts in a blast nursery.

MATERIALS AND METHODS.—Each month for 21 consecutive months starting in August, 1966, 30 samples of rice leaves with typical blast lesions were collected at random from the IRRI blast nursery. Each leaf sample was washed with water, and a portion containing one lesion was cut and placed on the inner surface of a petri dish cover by means of a wet filter paper. A single conidium was isolated from those present on the agar plate next day and placed on potato-dextrose agar (PDA). The cultures were kept in a room at 4 C until grown on rice straw nodes for spore production.

The isolates were inoculated separately on 8 international and 12 Philippine differential cultivars; their reactions on each cultivar were recorded according to the conventional procedure (2, 3). About 10 isolates were inoculated each week.

The race numbers were designated according to the standardized international race numbers (10) and the Philippine races so far identified (3, 4, 7).

RESULTS.—The results of 363 successful isolations and inoculations are summarized in Fig. 1, 2. The frequency (in per cent) of each race recovered in each month was calculated on the basis of the total number of isolates tested during the month.

Based upon the international differentials, 37 races were detected during the 21-month period. The number of races present each month varied between 3 and 13. The most prevalent races, A-109 and A-110, were found in 20 and 15 months, respectively, of the 21-month period. The frequency of A-109 was much higher (188 out of 363 isolates) than that of A-110 (24/363). Races IA-112, IA-125, and IA-126 occurred intermittently, while the others occurred only once.

Based upon the Philippine differentials, 60 races were found in the 21-month period, with 3 to 14 races being present in each month. Race P-8 was most prevalent, having occurred in 19 out of the 21 months, with a frequency of 134 out of the 363 isolates. Races P-21, P-23, P-24, etc., were detected only once.

It is obvious from the data obtained that the num-

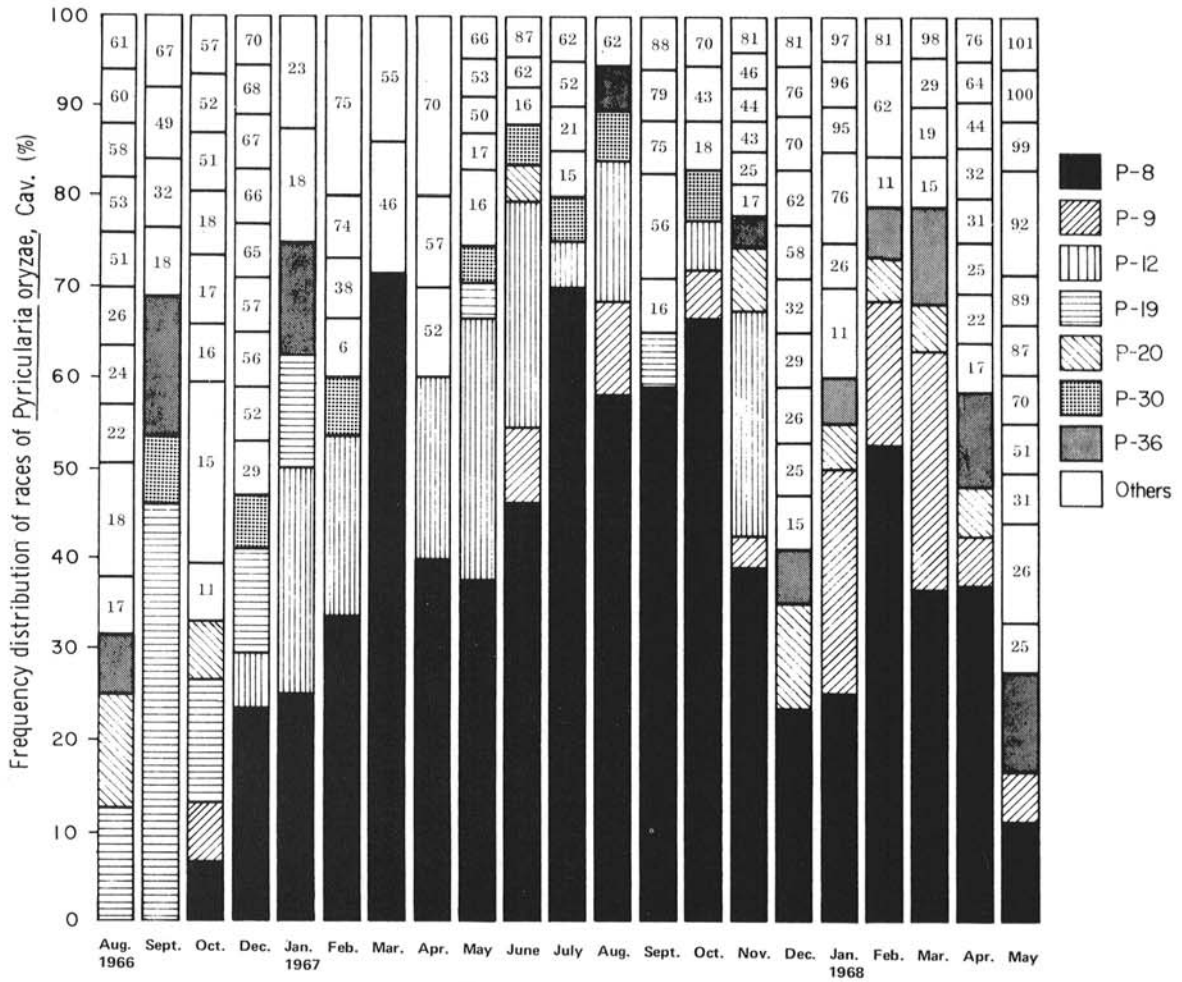

Fig. 2. Population of the Philippine race groups of *Pyricularia oryzae* Cav., sampled monthly at the blast nursery, Los Baños, Laguna, The Philippines, from August 1966 to May 1968.

TABLE 1. Susceptibility of the international differentials of rice to isolates of *Pyricularia oryzae* obtained from samples collected monthly from August 1966 to May 1968, Los Baños, Laguna, The Philippines

	International differentials							
Month	Raminad Strain 3	Zenith	NP-125	Usen	Dular	Kanto 51	Shatiao-tsao(s)	Caloro
	Susceptibility index							
August 1966	3.0	2.0	1.4	3.8	1.4	1.4	3.0	2.2
September	2.6	1.8	1.0	4.2	1.0	1.0	5.0	3.4
October	3.5	2.5	1.0	3.5	1.0	1.0	4.5	3.0
December	3.8	1.8	1.0	3.8	1.8	1.4	4.6	3.0
January 1967	3.0	1.0	1.0	4.0	1.0	1.0	5.0	4.0
February	4.2	1.0	1.0	4.2	1.0	1.0	4.0	2.6
March	5.0	3.0	1.0	5.0	1.0	1.0	5.0	3.0
April	5.0	1.0	1.0	5.0	1.0	1.0	3.7	3.7
May	3.7	4.0	1.0	4.6	1.9	1.4	5.0	3.7
June	5.0	2.3	1.7	4.3	2.3	1.7	5.0	3.7
July	4.0	2.0	1.0	5.0	1.0	1.0	5.0	3.0
August	3.7	2.3	1.0	5.0	1.0	1.0	5.0	3.7
September	3.7	1.7	1.0	5.0	1.0	1.0	3.0	3.0
October	3.0	1.0	1.0	5.0	1.0	1.0	5.0	3.0
November	4.0	2.0	1.0	5.0	1.0	1.0	5.0	4.0
December	3.4	1.4	1.4	3.8	1.0	1.4	3.8	2.6
January 1968	4.2	1.0	1.4	3.4	1.0	1.0	3.4	3.0
February	4.3	2.3	1.7	5.0	1.0	1.0	5.0	3.7
March	3.4	1.0	1.8	5.0	1.8	1.8	5.0	2.6
April	3.2	1.4	1.0	2.8	1.0	1.4	4.6	3.5
May	2.9	1.0	1.6	3.5	2.2	3.2	4.1	4.1
Avg	3.7	1.8	1.2	4.3	1.3	1.3	4.5	3.3

ber or kind and frequency of the races differed between months during the period of study.

The susceptibility indices of several varieties, as shown in Tables 1 and 2, varied considerably. (The susceptibility indices were calculated by the formula,

$$\frac{1N_R + 5N_S}{N_R + N_S},$$

where N_R and N_S represent the number of resistant and susceptible reactions; 1 = the min score and 5 = the max score for the disease reactions.) Based upon the Philippine differentials, for example, the susceptibility index of the cultivar Wagwag varied from 1.3 in August 1966 to 4.3 in August 1967, and that of the cultivar Peta varied from 2.2 to 5.0. The indices of some resistant and susceptible varieties were more consistent in different months.

TABLE 2. Susceptibility of the Philippine differentials of rice to isolates of *Pyricularia oryzae* obtained from samples collected monthly from August 1966 to May 1968, Los Baños, Laguna, The Philippines

	Philippine differentials											
Month	Katak-tara	C.I. 5309	Chokoto	Co 25	Wagwag	Paikan-tao	Peta	Raminad Strain 3	Taichung TCWC	Lacrosse	Shatiao-tsao(s)	KTH 17
	Susceptibility index											
August 1966	1.0	1.0	1.0	1.3	1.3	1.3	3.2	2.5	2.5	3.5	3.2	5.0
September	1.0	1.0	1.6	1.6	3.3	1.6	3.9	3.3	3.3	4.4	5.0	5.0
October	1.0	1.0	1.0	1.3	2.3	1.3	4.0	3.7	3.3	3.3	4.3	5.0
December	1.0	1.0	1.9	2.2	3.5	1.9	4.7	4.1	3.5	3.8	4.7	5.0
January 1967	1.0	1.0	1.0	1.0	3.0	1.7	4.3	2.3	4.3	5.0	5.0	5.0
February	1.0	1.0	1.0	1.8	2.6	2.6	5.0	4.2	3.4	4.2	4.2	5.0
March	1.0	1.0	1.0	2.3	2.3	1.0	3.7	5.0	3.7	3.7	5.0	5.0
April	1.0	1.0	1.0	1.8	4.2	1.8	5.0	5.0	3.4	3.4	4.2	5.0
May	1.0	1.0	1.0	1.9	2.8	2.3	5.0	3.7	4.1	4.6	5.0	5.0
June	1.5	1.5	1.5	1.5	3.5	1.5	4.0	5.0	3.0	4.0	5.0	5.0
July	1.0	1.0	1.0	1.6	3.3	1.6	4.4	4.4	3.3	4.4	5.0	5.0
August	1.0	1.0	1.0	1.0	4.3	1.7	4.3	4.3	3.7	5.0	5.0	5.0
September	1.0	1.0	1.0	1.6	2.7	1.0	5.0	3.9	3.3	2.7	3.3	5.0
October	1.0	1.0	1.0	1.0	3.9	1.6	3.9	3.9	2.7	3.9	5.0	5.0
November	1.0	1.0	1.0	1.0	3.6	1.4	2.8	3.6	3.6	3.2	5.0	5.0
December	1.0	1.0	1.0	1.0	3.5	1.0	3.2	3.8	2.2	2.5	4.3	5.0
January 1968	1.0	1.0	1.0	1.0	4.2	1.4	2.2	4.2	3.4	3.0	3.8	5.0
February	1.0	1.0	1.0	1.0	4.4	1.6	3.3	3.9	4.4	3.3	5.0	5.0
March	1.0	1.0	1.0	1.0	3.5	1.0	3.5	3.0	3.0	3.5	5.0	5.0
April	1.0	1.0	1.0	1.0	3.3	1.0	2.7	3.3	3.0	3.7	5.0	5.0
May	1.9	2.1	2.4	2.1	3.0	1.3	3.0	3.3	3.3	3.6	4.3	5.0
Avg	1.1	1.1	1.2	1.4	3.3	1.5	3.9	3.8	3.4	3.7	4.6	5.0

DISCUSSION.—The data show that many pathogenic races may occur in a blast nursery at any time of year. The kinds and frequency of races present in each month vary greatly. According to the international differentials, the races detected during the 21-month period belong to 37 race groups. But only 3 to 13 race groups were found in each month. As previously mentioned, 60 races were differentiated by the Philippine set of varieties during the 21-month period, of which only 3 to 14 races occurred in each month. This supports the proposition that the shift in reaction to blast of some varieties, from resistant to leaf blast at the seedling stage to susceptible to neck rot at the flowering stage, may be caused by a change in the composition of races (9). Cultivars either resistant or susceptible to prevailing races should have the same reaction at the two different stages. This condition is generally observed in most varieties.

The qualitative (kind) and quantitative (frequency) changes of the pathogenic races in the blast nursery also explain why, in the same blast nursery, cultivars showing resistant reaction in one test may become susceptible in others. This implies that repeated tests are necessary to expose cultivars to most of the races.

Had more isolates been used, it is possible that more races would have been detected. Nevertheless, the data obtained present a general picture of the pathogenic races occurring at different times in the same nursery during a year.

The relatively large number of races present in the nursery may have been caused by the presence of the several hundred rice cultivars of diverse origin planted each month, many of which may have served as hosts to some races derived from the original races (7).

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