spins to nutate at the modulation frequency. A spin-spin coupling transmits this modulation to any proton in the molecule coupled to C^{13}. Effectively it represents a small magnetic field modulation at such proton sites, and shifts proton lines accordingly. This method has been used to identify C^{13} shifts in some organic liquids.

The Tata Institute of Fundamental Research (India) presented a paper which illustrated the effectiveness of using deuteron as a probe into the nature of molecular structure and chemical bonding. Replacing proton by a deuteron does not change a compound chemically. However, proton resonance is sensitive purely to magnetic perturbations while deuteron resonance, apart from magnetic perturbation, is very susceptible to even slight changes in charge distribution. Other papers in this Conference mainly dealt with the technique of analysis of the high resolution N.M.R. spectra and its usefulness in the identification and complex structure of organic molecules.

In conclusion, the two Conferences brought out some selected topics by specialists in the field of nuclear magnetic resonance. They were extremely profitable to young scientists by offering them an incentive and opportunity to discuss a variety of recent problems with experts in this field.

PHYSIOLOGIC SPECIALIZATION OF *PIRICULARIA ORYZAE* CAV. THE CAUSAL ORGANISM OF BLAST DISEASE OF RICE

S. Y. PADMANABHAN

Central Rice Research Institute, Cuttack-6, India

BLAST disease of rice, caused by *Piricularia oryzæ* Cav. is the most serious disease of rice, wherever rice is cultivated. Prevention of loss caused by the disease through the cultivation of resistant varieties is the most hopeful and economic method. When rice varieties which had been selected as resistant to the disease at Cuttack[1,2] were sent to the State Research Centres under a co-ordinated programme for a trial of their performance under local conditions, many of them (except S. 67, BJ-1 and AC-2489 which were consistently resistant) behaved as resistant at some centres and susceptible at others.

This differential reaction exhibited by some varieties might be due to the interaction of environmental factors with the expression of disease resistance or due to the phenomenon of physiologic specialization in *Piricularia oryzæ*[3-6] with the varieties being susceptible to some races of the pathogen, while behaving as resistant to others. This could only be found out by undertaking artificial infection tests under standard set of conditions with the isolates of the pathogen obtained from different regions of India.

Such a study has been undertaken at the Central Rice Research Institute, since 1961 (under a grant received from the United States Department of Agriculture from PL-480 funds). The principal object of the study was to determine whether *Piricularia oryzæ* exists as specialised races of the pathogen in India and if so, to determine the number and distribution of such races in the country.

Samples of diseased leaf necks and nodes of infected rice were collected from the principal rice-growing regions of India, mostly through the courtesy of departmental officials in each State and also by personal collection during tours.

The varieties used for the tests included the differentials which had been selected for this purpose in U.S.A. and Japan and also some more varieties which had shown marked differential reaction in co-ordinated varietal susceptibility trials in India and in an International blast varietal programme, organised during 1957-59 by the writer.[7] The varieties used in the tests are listed in Table I.

Standard procedures were adopted for raising seedlings, infecting them, for scoring of infection and classifying the varieties. By the end of 1962 four distinct races could be distinguished, one each in the Eastern, Southern, Western and Northern rice zones. Several more races have been identified in India since then. The results are presented in detail elsewhere.

The reaction of four typical Indian races differentiated on U.S. differentials are presented in Table II. The first isolate corresponds to race 8 of the U.S.A. and the last to race 25.

TABLE I

U.S. differentials		Japanese differentials	Differentials selected by the writer
Zenith	..	Ishikare Shiroke	BJ.-1
C.I. 8970 (F)	..	Homare Nishiki	AC-1613
C.I. 8970 (S)	..	Norin. 20	S. 67
P.I. 201902	..	Norin. 22	SM. 6
P.I. 180061	..	Kanto. 51	AC-1423
Calaro (1561-1)	..	Aichi-Asahi	AC-1443
Lacrosse (C,I. 8985)		Ginga	CR. 906
C.I. 5309	..	Chokoto	CR. 907
Wag Wag	..	Tadukan	Co. 13
Raminad Str. 3	..	Usen	Mas
		Yakeiko	Bengawan
		Rei-Shi-ko	Intan
		Tetep	

The tests have to be rigidly standardised, if comparable results are to be obtained, not only with reference to the isolation, purification and artificial infection but also with regard to the seed used, and the method and conditions under which seedlings are raised for artificial infection as the reaction of rice to blast varies a great deal with Nitrogen nutrition and its interaction with the temperature of growth and age of the host.[8-11]

The writer wishes to thank Dr. R. H. Richharia, Director, Central Rice Research Institute, for his keen interest in the studies and the United States Department of Agriculture for the financial assistance in undertaking the study.

TABLE II

	Zenith	Lacrose	Caloro	C.I. 8970 (S)	C.I. 8970 (P)	C.I. 5309	P.I. 180061	P.I 201902	Wag-Wag	Raminad Str. 3	Corresponding U.S. race
Cuttack ..	R	S	S	S	S	S	S	R	R	M	8
M_4 (Madras) ..	R	M	M	M	M	S	S	S	M	R	..
Kanpur (U.P.) ..	R	S	S	S	S	S	S	R	R	S	
Gujerat ..	R	S	S	S	S	S	S	S	S	S	25

R=Resistant; M=Moderately Resistant; S=Susceptible.

It may be seen that sharply differentiating reaction of the isolates has been obtained with the last three varieties in Table I, *viz.*, P.I. 201902, Wag Wag and Raminad Str. 3, three varieties of the *indica* group. On the basis of comparative studies in different countries it may be possible to have a common set of international differentials with some additional types for local use in each country or region, as for instance, for *japonica* and *indica* rice zones, etc.

Identification of physiologically specialized races of *P. oryzæ* in India is a significant advance as the work of evolving resistant varieties can now be taken up on the basis of the races, occurring in each region. Studies on inheritance of resistance which have not made much progress so far, can also be undertaken with confidence against specific race or races.

1. Padmanabhan, S. Y. and Ganguly, D., *Proc. Ind. Acad. Sci.*, 1959, **50 B**, 289.
2. —, — and Chandwani, G. H., *Ibid.*, 1959, **59 B**, 287,
3. Goto, R. and Yamanaka, T., *Proc. International Rice Commission, F.A.O.—U.N., Working Party on Rice Production and Protection*, 1961.
4. Latterell, F. M., Tullis, E. C., Otten, R. J. and Gubernick, A., *Phytopath.*, 1954, **44**, 495.
5. —, — and Collier, J. W., *Pl. Dis. Rept.*, 1960, **44**, 679.
6. —, Marchetti, M. A. and Grove, B R., *Symposium on Rice Blast Disease*, 1963, July 7-12, Paper Q.
7. Richharia, R. H., Padmanabhan, S. Y., Veeraraghavan, J., Das, P. D. and Collaborators, Summary of results obtained under the Co-operative Blast Resistance Trials, *I.R.C. Newsletter.*, 1961, **10** (1), 8.
8. Padmanabhan, S. Y., *Curr. Sci.*, 1953, **22**, 271.
9. — and Ganguly, D., *Proc. Ind. Acad. Sci.*, 1954, **39**, 44.
10. —, *Proc. Rice Res. Work. Conf.*, 1961, p. 308.
11. Suryanarayan, S., *Curr. Sci.*, 1958 *a*, **27**, 447.