Resistance in *Kalanamak* against Panicle Blast Caused by *Magnaporthe grisea*

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Kalanamak is one of the most important small and medium grained indigenous aromatic rices of India. Panicle blast, caused by *Magnaporthe grisea*, is one of the most serious problems of *Kalanamak*. Susceptibility of 37 germplasm of Kalanamak was tested against panicle blast under field conditions during the years 1999 and 2000. These germplasm showed wide variation in their susceptibility towards panicle blast. Ten *germplasm* were resistant to panicle blast. Some *germplasm* exhibiting moderate to high resistance towards panicle blast were also superior in yield and other quality traits.

Key words: Aromatic Rice, *Kalanamak, Magnaporthe grisea*, Panicle Blast, Resistance

Among small and medium grained Indian aromatic rice varieties, '*Kalanamak*' is one of the most important. For more than 2500 years it is being cultivated in districts of Siddharth Nagar, Basti and Gorakhpur of Uttar Pradesh (U.P.). Except for grain length, it is superior to Basmati in all other quality traits like aroma, elongation after cooking, fluffiness, taste etc. (Singh US and Singh RK, unpublished). In local markets, it fetches higher price than even Basmati varieties (Singh *et al.*, 2000). *Kalanamak* faced serious attack of panicle blast, caused by *Magnaporthe grisea*, during 1998 and 1999 resulting in decline in cultivation of this prime scented rice variety from 10 per cent to less than 1 per cent during the year 2000 in district Siddharth Nagar. In the absence of any seed production and/or improvement programme farmers have been using their own seed for hundreds of years. This has resulted in a high degree of impurity in this variety. An extensive survey of *Kalanamak* fields in district Siddharth Nagar, showed that it is now a mixture of lines sharing black husk colour, tall stature and relatively similar maturity durations. Wide variability within seed lot is resulting in decline in quality and yield. However, this variability can be exploited to improve the variety. Thus, the panicle blast susceptibility of 37 germplasm of *Kalanamak* were tested under field condition in order to identify resistant material, which could be either used as donor in breeding programme or can be promoted directly for the cultivation.

Materials and Methods

Plant Material

Thirty-seven germplasm of *Kalanamak*, collected from Siddharth Nagar, Basti and Gorakhpur districts of Uttar Pradesh and West Champaran district of Bihar, were purified by single plant selection at Rice Research Station, Nagina, which is in the aromatic rice growing belt of U.P. Seedlings of these germplasms were raised in field nursery during the years 1999 and 2000. Thirty-five-day old seedlings were used for transplanting. Five one-meter rows were transplanted with each germplasm. Plant to plant and row to row distances were 15 cm and 20 cm, respectively. Basal fertilizer application was @ 10 kg N+ 50 kg P_2O_5 + 40 kg K_2O + 25 kg $ZnSO_4$ per ha. Two more applications of N was done @ 10 kg per ha after 40 days of transplanting and at panicle emergence.

Incidence (proportion of panicles infected) and severity of panicle blast were assessed by following the standard procedure described by IRRI (1998-2000). Ten panicles were selected diagonally per plot (per germplasm) for the assessment. Panicle blast incidence was assessed as:

$$(\Sigma \text{ \% infected panicles from hill 1 to 10}) \div (10)$$

where, % infected panicles for each hill is calculated as: [(number of infected panicles per hill) ÷ (total number of panicles per hill)] *100

Observation on severity was recorded on 5 infected panicles for each sample hill. In case 5 infected panicles are not available, data was recorded only on available

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infected panicles. Severity was recorded using 0 to 9 scale: 0 = no visible lesion; 1 = < 5% of pedicels/ secondary branches of a panicle affected; 3 = 5 to 25 % of pedicels/secondary branches of a panicle affected; 5 = 26 to 50% of pedicels/secondary branches of a panicle affected; 7 = 51 to 75 % of pedicels/secondary branches of a panicle affected; 9 = > 75% of pedicels/ secondary branches of a panicle affected lesion completely around panicle base or uppermost internode or panicle axis near the base.

Disease severity on plot basis is calculated as:

(Σ of disease severity from hill 1 to 10) ÷ (10)

where, mean disease severity for each hill is calculated as:

(Σ of disease severity from panicle 1 to n) ÷ [(9) * (n)]

where, n is number of infected panicles assessed per hill and 9 is maximum disease grade.

Percent panicle blast index (PBI) was calculated as:

(Percent incidence)* (severity)

Based on panicle blast index, germplasm were categorized as Resistant (R; PBI <5), Moderately Resistant (MR; PBI 6 to 10), Moderately Susceptible (MS; PBI 11 to 20) and Susceptible (S; PBI > 20).

Results and Discussion

As shown in Table 1 and Figure 1, a wide variation in susceptibility of different germplasm of *Kalanamak* was observed under field condition. Out of 37 germplasm screened, ten exhibited a high degree of resistance against panicle blast. Although, screening was done under natural condition, incidence of panicle blast in some of the germplasm was as high as 100 %, indicating high degree of reliability of the data.

Details of the yield, agronomic and quality traits of some of the blast resistant and moderately resistant germplasm are given in Table 2. Yields varied from 1.3 t/ha to as high as 2.5 t/ha. These are quite high yields, if one compares with the farmers' average yields of approx. 1.0 t/ha. Large variation was observed for plant height, panicle length and grains per panicle. With a view to test the performance, these lines are being evaluated at several farmers' fields in the districts of Siddharth Nagar and Gorakhpur of Uttar Pradesh during the year 2001 and the observations are recorded on their disease and pest tolerance/resistance, yield and other traits. Based on their performance in these multi-location trails, we hope to promote a couple of them for commercial cultivation.

Table 1. Reaction of *Kalanamak* germplasm towards panicle blast

Disease Reaction	Germplasm
Resistant (R)	3114, 3121, 3128, 3130, 3131, 3213, 3216, 3220, 3259, 3320
Moderately Resistant (MR)	3081, 3089, 3119, 3120, 3126, 3130, 3168, 3214, 3215, 3256, 3266
Moderately Susceptible (MS)	3113, 3117, 3125, 3129, 3202, 3327, 3329
Susceptible (S)	3121, 3122, 3124, 3168, 3212, 3219, 3222, 3257, 3319

Table 2. Characteristics of some selected germplasm of *Kalanamak*

Germplasm	Plant height (cm)	Duration (days)	Tillers/ hill	Panicles/ hill	Panicle length (cm)	Grains per panicle	Grain characteristics			Paddy yield (t/na)*
							Length (L) (mm)	Breadth (B) (mm)	L/B	
3114	116	160	8.8	8.6	24	218	5.1	1.6	3.2	2.5
3119	136	160	8.4	8.4	24	205	4.6	1.6	2.9	2.5
3120	141	160	9.8	9.2	24	247	4.8	1.6	3.0	1.6
3130	107	160	9.4	8.8	30	203	5.9	1.9	2.6	2.4
3131	108	160	11.8	11.6	27	227	4.7	1.8	2.7	2.0
3216	125	165	8.2	8.0	22	202	4.7	1.6	2.9	1.3

*Based on 20 m^2 plot

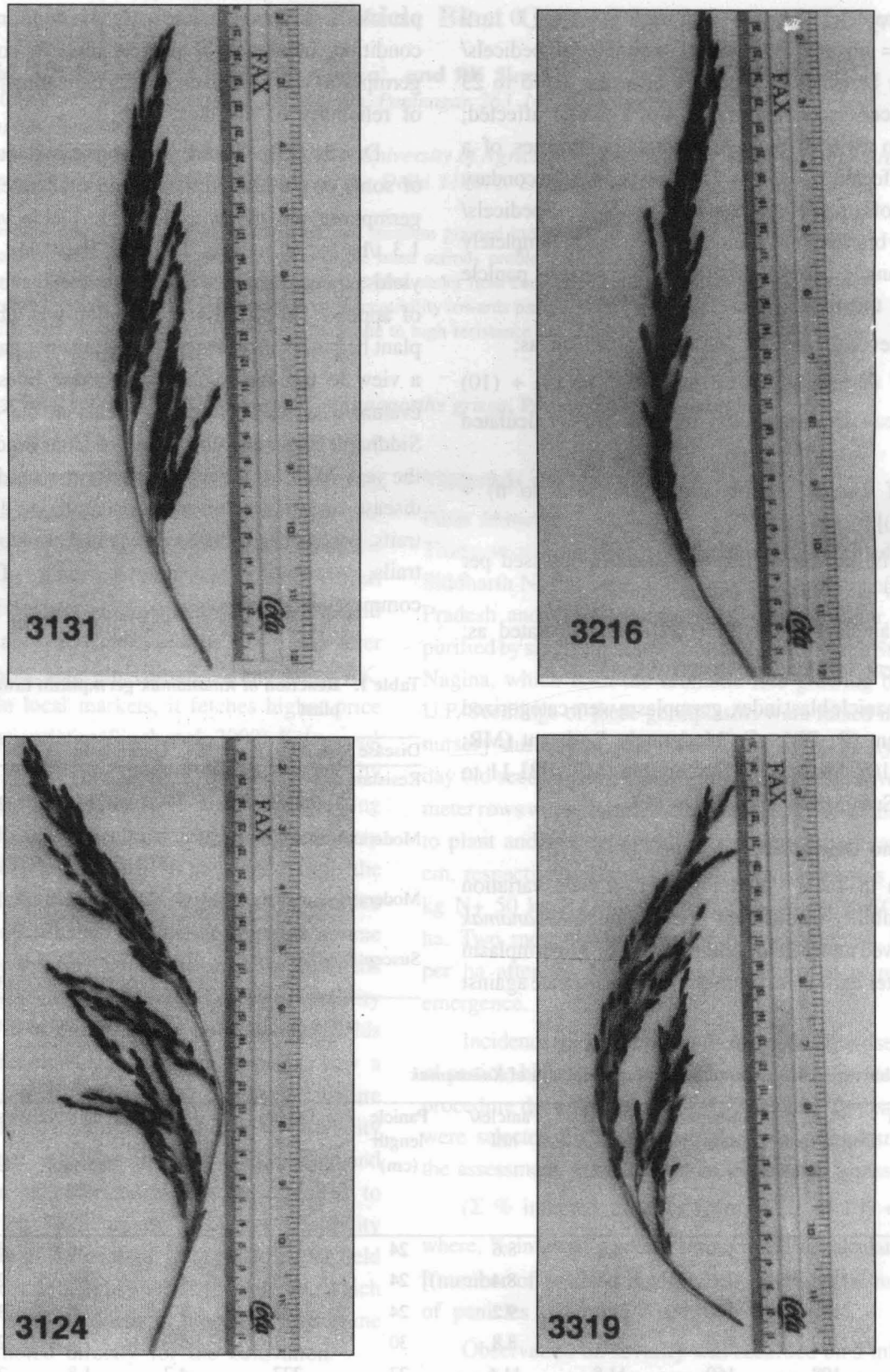

Fig 1. Panicles of two blast resistant (3131 and 3126; incidence 0 %) and two susceptible (3124 and 3319; incidence 100%) germplasm of Kalanamak. *Panicles of germplasm 3124 and 3319 are infected by panicle blast*

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