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# FURTHER STUDIES ON THE INHERITANCE OF RESISTANCE TO *PHAEOSPHAERIA* LEAF SPOT OF MAIZE

BY

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Diallel crosses among nine open-pollinated varieties of maize *(Zea mays* L.), namely Pantnagar-7425, $J_1$ (W), (Phil. DMR-4 x Mixicol Gr-I) Eto, South African Comp., VC 80 x (Ant 2D x AED) Kitale, Tuxpeno 1, (VC 80 x Tuxpeno), BI x Thaicomp. DMR (W), Phil. DMR-2 without parents and reciprocals, were exposed to highly epiphytotic condition of *[ Phaeosphaeria maydis* (P. hennings) Rane, Payak and Renfro *]*, the incitant of *Phaeosphaeria* leaf spot at Kalimpong hills of Darjeeling (altitude of 1070 m), India. The resistance to this disease was found to be dominant in nature.

Key words ; Inheritance ; Resistance ; *Phaeosphaeria maydis* ; maize.

## INTRODUCTION

*Phaeosphaeria* leaf spot caused by [ *Phaeosphaeria maydis* (P. hennings), Rane, Payak and Renforo ] has been reported by Rane, Papak and Renfro only in 1966. The disease is wide spread in Sikkim, Kalimpong (West Bengal). and Tarai regions of Utter Pradesh. The disease severity is fairly high and it causes considerable reduction in photosynthetic area (Rane, Payak and Renfro, 1966). Das and Chattopadhyay (1984) evaluating maize germplasms over a period of four years at Kalimpong (altitude 1070 m) found an incidence of this disease in 59.23 to 67.34 percent of germplasm with high degree of disease susceptibility in some of the germplasms. Recently Das *et al* (1988) studied the nature of inheritance of this disease and the results obtained are reported here.

## MATERIALS AND METHODS

Seeds of diallel crosses among nine open-pollinated varieties of maize such as Pantnagar 7425, $J_1$ (W), Phil. DMR-4 × (Mixicol Gr. 1) Eto, South African comp., VC 80 × (Ant 2D × AED) Kitale, Tuxpeno 1, (VC 80 × Tuxpeno 1), B-1 × Thai

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comp. DMR (W) and Phil DMR-2 excluding parents and reciprocals were sown in a randomised block design with two replications having 30 plants each at the University Experimental station, Kalimpong situated at an altitude of 1070 m msl. in the District of Darjeeling. Standard cultural practices were followed.

Plants were exposed to natural epiphytotic condition of [ *Phaeosphaeria maydis* (P. hennings) Rane, Payak and Renfro ] and environmental conditions were highly conducive to infection and spread of the disease. The disease appeared after tasseling of plants and continued till leaves remain green. The intensity of disease was recorded in the scale of 0 to 5 as adopted by Ullstrup *et al*, (1945) in case of leaf blight of maize. Individual plants in each entry was scored for *Phaeosphaeria* leaf spot and the scores were analysed for inheritance to this disease.

Since the study was on the crosses of open pollinated varieties of maize, Griffing's (1956) method-4 was followed for analysing combining ability as suggested by Gardner and Eberhart (1966 . Analysis of variance was done on plot basis and method followed was a fixed one.

## RESULTS AND DISCUSSION

The initial test of significance showed that the mean indices of resistance of thirty six crosses were significantly different Mean disease scores for gca and sca effects are presented in Table 1. It is found from this table that crosses namely (VC 80×Tuxpeno 1)×(B 1XThai comp. DMR(W), (Tuxpeno 1) [B-1X Thai comp DMR)W)], (Tuxpeno 1XPhil. DMR-2), Pantnagar 7425XTuxpeno 1, Phil. DMR-4X (Mixi. Col. Gr-1) Eto X (VC 80XTuxpeno 1), South African comp. X(VC 80XAnt. 2DXAED) Kitale showed highly resistant reaction (Scores upto 1.25).

The analysis of variance for combining ability is presented in Table 2. The mean sum of squares for both general and specific combining ability were found to be significant. Estimated dominance and additive variances showed that the former one was larger than the latter one indicating major role of dominance variance in controlling the resistance to *Phaeosphaeria* leaf spot of maize.

A large number of crosses such as (VC 80× Taxpeno 1)X[B-1XThai comp. DMR (W)], Tunpeno 1X[(B-1 XThai comp. DMR(W)], Phil. DMR-4 (Mixi col. Gr. 1) EtoX(VC 80XTaxpeno 1), South African comp.X[VC 80X (Ant 2DX AED)XKitale], Pantnagar 7425X$J_1$(W), (VC 80XTuxpeno 1) (B-1XThai comp DMR(W) exhibited highly significant sca effects for resistance to *Phaeosphaeria* leaf spot in decending order of magnitude Howevr, a good number of crosses namely Pantnagar 7425X[B1XThai comp. DMR (W)], [VC 80X(Ant 2DXAED) Kitale] Phil. DMR 2, $J_1$(W)X(VC 80XTuxpeno 1), $J_1$(W)XTuxpeno 1, expressed susceptibility towards this disease.

Table 1. *Mean disease indices (upper diagonals), gca effects (central diagonal) and sca effects (lower diagonals) for* Phaeosphaeria leaf spot.

| Parents | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $P_5$ | $P_6$ | $P_7$ | $P_8$ | $P_9$ |
|---|---|---|---|---|---|---|---|---|---|
| Pantnagar 7425 ($P_1$) | 0.02 | 1.28 | 1.48 | 1.55 | 1.30 | 1.25 | 1.28 | 2.45 | 2.05 |
| $J_1$(W) ($P_2$) | - 0.51** | 0.21** | 1.55 | 1.38 | 1.88 | 2.28 | 2.30 | 1.95 | 1.30 |
| Phil. DMR 4 x (Mixi x col Gr-1) Eto. ($P_3$) | - 0.01 | - 0.12** | 0.09** | 1.28 | 1.95 | 1.30 | 1.23 | 1.45 | 1.55 |
| South African Comp. ($P_4$) | 0.16** | - 0.19** | 0.01 | - 0.20** | 1.23 | 1.45 | 1.43 | 1.33 | 1.43 |
| VC 80 x (Ant. 2D x AED) Kitale ($P_5$) | - 0.36** | 0.04 | 0.41** | - 0.21** | 0.07** | 1.48 | 1.30 | 1.38 | 2.45 |
| Tuxpeno 1 ($P_6$) | - 0.29** | 0.55** | - 0.12** | 0.13** | - 0.11** | - 0.05** | 2.07 | 1.10 | 1.25 |
| (VC 80 x Tuxpeno 1) ($P_7$) | - 0.22** | 0.61** | - 0.15** | - 0.15** | 0.25** | 0.63** | - 0.09** | 1.00 | 1.28 |
| B1 x Thai comp. DMR(W) ($P_8$) | 0.84** | 0.16** | - 0.04 | - 0.05 | - 0.027** | - 0.44** | - 0.50** | 0.02 | 1.95 |
| Phil DMR-2 ($P_9$) | - 0.35** | - 0.58** | - 0.03 | - 0.04 | 0.70 | - 0.38** | - 0.31** | 0.25** | 0.11 |

S. E. (gi) =0.015
S. E. (gi—gj) =0.023

SE (sij) = 0.038
SE (sij — sik) = 0.058
SE (sij — ski) = 0.053

Table 2. *Analysis of variance of combining ability for* Phaeosphaeria *leaf spot disease indices and estimates of additive and dominance variances.*

| Source | d. f | M.S. |
|---|---|---|
| gca | 8 | 0.26** |
| sca | 27 | 0.14* |
| Error | 35 | 0.002 |

Variance A=0.035 Variance D=0.144

In all cases there is good agreement between phenotypic expression of disease resistance/susceptibility and sca effect of the crosses. The estimated effects of gca (Table 1) indicated that parent South African comp. had the highest significant gca effect for resistance followed by Phil. DMR-4X (Mixi col. Gr-1) Eto, (VC 80X Tuxpeno 1), Tuxpeno 1.

Since additive genetic variance cannot be overlooked altogether and dominance is a major genetic component, adoption of recurrent selection for sca would be rewarding in obtaining resistant lines. Das *et al*, (1988) also observed similar picture of inheritanee for Phaeosphaeria leaf spot in the $F_1$ population of a diallel set of crosses.

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