RESULTS OF THE REGIONAL NUSERY FOR THE EVALUATION OF RESISTANCE, 1988

(RESULTATES DE LA PEPINIERE REGIONALE POUR L'EVALUATION DE RESISTANCE 1988.)

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SUMMARY

Best sources of resistance in the Great Lakes Region were evaluated for stability of resistance and multi-disease resistance at four locations in Burundi, Rwanda and Zaire. Some anthracnose, Angular leaf spot and sources were found resistant at all sites. Correlation analysis also suggest pathogenic variability of Colletotrichum lindemuthianum, Pheoisariopsis griseola, and to a lesser extent for Mycovellosiella phaseoli between sites. ACV8331, G 10747 (late) and G35182 (Phaseolus coccineus subsp polyanthus) had high levels of resistance at all sites tested to anthracnose, angular leaf spot and floury leaf spot.

Introduction

The revised PRER containing new selections of best resistant sources was evaluated for the first time last season, in Burundi, Rwanda and Zaire at a total of four sites: Gisozi (Bu), Murongwe(Bu), Mulungu (Z), and Rubona (Rw). Lines originated largely from International resistance nurseries, but also from the PRELAAC I which was a source of particularly well adapted germplasm, and local sources. Resistance to particular diseases were provided by pathologists of each national program as follows:

Burundi:	Dominique Perreaux	Floury Leaf Spot
	Nephtalie Ntahimpara	Halo blight
		Common blight
Rwanda:	Joseph Kayitare	Anthracnose
		Phoma blight

Zaire: Pyndji Mukishi — Angular leaf spot, Rust

The objectives of the PRER are to provide information for best resistance sources about stability of resistance over region and time, and about their reaction to multiple diseases to avoid selection of materials with highly susceptible to other prevalent diseases.

Methods

As a collaborative effort the combined resistance nursery was evaluated by National and CIAT pathologists at "hot spots" for particular diseases. Due to lack of seed in the first season the same sites were used to evaluate more than one disease. This season materials are evaluated principally for one disease only at each site due to greater availability of seed.

At each site were sown 2 replications of the trial, with each 1m rows bordered by a spreader on one side, and inoculated with the pathogen of interest. Evaluations were taken at R6,7, and R8. Values at R8 were used in this analysis. The scale used was 1-9, where:

1 = symptomless
2*= between 0 and 1% surface area infected
3 = 1% " " "
4 = between 1 and 5% " " "
5 = 5% " " "
6 = between 5 and 10% " " "
7 = 10% " " "
8 = between 10 and 25% " " "
9 = 25% or more " " "
* for anthracnose 2= uncertain

Materials were coded as follows:

Colour: 1=white,2=cream,3=yellow,4=brown,5=rose,6=red,7=purple, 8=black,9=other colours
Seed size: p=petite, m=moyen, g=grande

Disease resistance: A=L'anthracnose,
C=La bacteriose commune
F=Les taches farineuses
H=La haleuse
M=Les maladies racinaires
O=Ophiomyia (la mouche du haricot)
R=la Rouille
S=L'Ascochyta (Phoma)
T=les taches anguleuses
V=BCMV/black-root

Results were analyzed for stability using a correlation analysis, best materials were sorted for each disease and for combined resistance.

Results and Discussion

The reactions of materials to anthracnose, angular leaf spot, Phoma, and floury leaf spot are given in table 1. In general, groups of materials added to the PRER for particular diseases (note particular codes) remained the best sources of these traits. However, a number of diseases were not evaluated in the first season due to lack of seed.

Anthracnose

For anthracnose resistance (coded A), most original sources of resistance remained resistant over sites. However, there were some notable exceptions. In particular, BAC 76, Cornell 49 242, A343, RWR 111, PVA 46, Ikinimba, A 484, and G2338, were susceptible to anthracnose at one or more sites. Cornell 49 242, the source of the "ARE" gene again was susceptible; A484 the source resistance in many early crosses for anthracnose was also susceptible at one site, Ikinimba a local resistant source in Rwanda was susceptible in Burundi, and G 2338 regarded as one of the broad sources of resistance to Anthracnose was susceptible at one site. Varieties without anthracnose symptoms at all sites are given in table 2. There is a good range of materials available of various growth and grain types for breeders to use in future crosses, some like A 411, G2333 and G 2331 have already been extensively used.

Materials with various degrees of multiple resistance to anthracnose and other diseases are presented in tables 5 & 7. The correlation of anthracnose reaction between sites in Rwanda and Burundi was lower (Rsq=0.310,p=0.04) for Rub&Giz;Rsq=0.282 p=0.09 for Rub&Mur), than between sites in the same country (Rsq=0.862,p=0.001 for Giz&Mur), but still significant (p=0.05) for all sites except Rubona and Murongwe. This implies that although similarity is still significant between resistant materials, variation in anthracnose reactions exists within the region, and increases with distance. Consequently, materials need to be screened in diverse environments to confirm the resistance. It would be beneficial to screen the PRER in north Kivu and to use other regional bean programs to screen resistant materials at other "hot spots" in Africa.

Angular leaf spot

Angular Leaf spot, according to diagnostic analyses, is the most important disease in Rwanda and probably the region as a whole.

The PRER materials reacted diversely to the disease in the region. Varieties such as A 285, and A300 were resistant at one or more sites, but relatively susceptible at an other (table 1). Low correlations were found between disease reactions Rwanda and South Kivu (Rsq=0.178,p=0.2 for Rub&Mul) and between Rwanda and Burundi (Rsq=0.273,p=0.08 for Rub&Mur). Conversely, significant (p=0.01) correlations in reactions to angular leaf spot were found between Burundi and south Kivu (Rsq=0.496). This indicates that significant pathogenic variation exists in the region, particularly between Rwanda and the other countries of the region. The results also support previous findings which reported low correlations angular leaf spot reactions of PRER 1 varieties between Rwanda and south Kivu (Trutmann and Dessert 1987), and suggests materials should be tested for angular leaf spot at more than one site.

Nevertheless, most of the angular leaf spot resistant materials (coded T) remained resistant over sites. Best sources of resistance over sites are presented in table 2. They include ACV 8331, XAN 162, A140, A339, A240, and A384. However, many of these lines were susceptible to anthracnose. Those resistant to both angular leaf spot and anthracnose are presented in table 5. A240, a veteran source of resistance used in crosses for the Great Lakes region and G5473 combine resistance to these two diseases. Varieties symptomless to both angular leaf spot and floury leaf spot are given in table 6. These two important diseases often occur together and it is desirable to select sources of resistance simultaneously. Varieties angular leaf spot resistance combined with multiple disease resistance over multiple sites are given in table 7.

Floury Leaf spot

For the first time this year resistant sources to floury leaf spot were reported by Perreaux (ISABU 1988). These sources were added for regional evaluation into the PRER II. The PRER was evaluated for Floury leaf spot resistance (coded F), at two sites, Rubona (Rwanda), and Murongwe (Burundi). A highly significant (p=0.01) correlation (Rsq=0.614) was found between reactions of materials to the disease at both sites, which suggests limited pathogenic variation of Mycovellosiella phaseoli in the region. This is interesting as qualitative resistance has been found in a good number of lines. The susceptibility of G2333 in Cameroon, a resistant variety in the GLR, suggests however, that pathogenic variation exists widely and should be monitored. Even within the region, under even disease pressure, some lines previously reported resistant like, RAB211, EMP143, and DOR306 were susceptible at one site (Table 1).

On the other hand, new potential resistant sources to floury leaf spot were found in Lines like ACV8331, VNB81005, G4603 and G10747 (Table 3). Crosses should be made soon to incorporate resistance to floury leaf spot into susceptible local materials and advanced lines as the disease has been shown to limit production

significantly in regions of Burundi and Rwanda and resistance is now available.

Phoma (Ascochyta)

Earlier studies by Kornegay and Trutmann (CIAT 1988) indicated that reactions of materials to Phoma (coded S) in Rwanda and Colombia are highly correlated (Rsq R7= 0.797,p=0.001; Rsq R8=0.735,p=0.001). Some of the best materials from the IASCON were placed in the PRER and were further tested in Burundi (Dickburt 1988). These materials were tested seperately. The other materials had, on the whole, low Phoma pressure , and are hence probably less reliable. For the Phoma resistant materials a relatively good correlation (Rsq=0.518 p=0.005) was obtained between Colombia and Burundi and a high correlation (Rsq=0.892, p=0.001) was found between varietal reactions to Phoma blight in Burundi and Rwanda. The results will need to be repeated due to a low reaction of a susceptible check A 477; it may be due to uneven disease pressure. The variety was previously highly susceptible in Reanda and Colonbia. Nevertheless, the results also showed that all materials selected for Phoma blight in previous trials remained resistant and were still amongst the least attacked materials available (Table 1). Particularely good sources continue to be G 4603 (bush) and G 10747(type III). Unfortunately the former is very susceptible to anthracnose, as are a number of other sources like A 182 and BAT 795. Some materials like G 10747, VNA 81051 and G 35182 (Phaseolus coccineus subsp polyanthus were resistant to anthracnose. G 35182 was again the best Phoma resistant material. Certainly, we need more information on reactions of other lines in the PRER to Phoma.

Conclusion

The PRER has been useful in providing information on the stability of resistant sources over sites, and to detect sources of multiple resistance as well as multiple susceptibility. Next season, the first analysis of resistance stability over time can be made to add a further dimension to the evaluation of stability. We are still lacking information on a number of important diseases such as halo blight, root rots, and others like rust, common blight, and BCMV. Some of these are being evaluated this season. In the mean time good information is available on the sources of resistance to various important diseases. It is hoped breeders will take full advantage of these sources.

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