RESEARCH ON COMMON BACTERIAL BLIGHT AND HALO BLIGHT OF COMMON BEAN IN EAST AND CENTRAL AFRICA

F. Opio[1], P. M. Kimani[2] S. M. Musaana[3] and R. Buruchara[3]

[1]NAARI, P.O Box Kampala; [3]CIAT, Kawanda Agricultural Research Institute, P.O Box 7065, Kampala, Uganda and [2]CIAT Regional Program on Beans In Eastern Africa, P.O. Box 29053, Nairobi, Kenya

Introduction

Common bacterial blight (CBB) caused by *Xathomonas campestris pv. phaseoli* [XCP] (Smith) Dye and haloblight (HB) caused by *Pseudomonas syringae pv. phaseolicola)* are the two most important bacterial bean diseases in East and Central Africa. A variant of common blight pathogen, *Xanthomonas campestris pv. phaseoli var. fuscans* causes fuscous blight. The two strains frequently occur together. CBB is ranked the fourth most important bean disease in Africa, and HB the sixth. CBB causes losses of 220,000 t/year in Africa; of these 146,000 t are lost in Eastern Africa and nearly 70,000 t per year in Southern Africa (Wortmann et al, 1998). Annual losses due to haloblight are estimated at 181,000 t in Africa. Disease incidence and severity varies with country and also from season to season. Because of the economic importance of the CBB, a regional collaborative project was started in 1987. The project was led by Uganda where CBB is most severe, with national programs of Ethiopia, Kenya, Burundi, Rwanda, DR Congo and Tanzania as collaborators. Objectives of the sub-project were to identify suitable methods for germplasm evaluation; develop a regional CBB nursery; study variation, symptomatology and host range of Xcp and develop resistant cultivars. Our objective is to highlight some of the results from this sub-project, review briefly status of haloblight and discuss the relevance of these results to the regional breeding programs.

Results and Discussion

Results showed that CBB scores increased from R6 to R9 stages and spreaders increased disease pressure. Disease pressure was higher when the test materials were sown 1 to 2 weeks earlier than the spreaders than when they sown three weeks later. It was concluded that maximum CBB pressure can be obtained by (i) sowing the spreaders 1 to 2 weeks earlier, and (ii) sowing a spreader after every 6-8 test lines in single rows or box formation. XAN 159, XAN 112, G4399, PI 207262, GN Jules, GN Tara and GN`Sel.27 were found resistant to CBB at Kawanda. However progenies of crosses with XAN 112, XAN159 and G4399 succumbed to black root making transfer of CBB resistance to local cultivars difficult. A regional CBB nursery with 118 entries was created in 1989 from local collections, introductions, 30 lines from Ethiopia and six from Burundi-all with resistant reactions to CBB. Unfortunately, most of these materials succumbed to black root and were not used in further breeding work. At present the Regional CBB nursery has 70 entries from Ethiopia, Uganda, Kenya, Tanzania, Rwanda, Burundi and Malawi (Opio and Musaana, 1993). Of the 93 isolates collected from Uganda (68), Ethiopia (13), Tanzania (7), Rwanda (2) and Kenya (3), 75% were fuscous and 25% phaseoli. Pathogenic variation of Xcp was quantitative on *Phaseolus vulgaris* and qualitative on *P.acutifolius*. Differences existed in levels of resistance between leaves, stems, pods and seeds on the same plant. Gene action controlling resistance in most crosses was quantitative but was influenced by the stage at which data was recorded. Results showed that MCM 5001 and XAN 112 have resistance to seed transmission and can be used for breeding lines resistant to both CBB infection and seed transmission. Additional resistance is found in VAX lines (Shree and Miklas, these proceedings).

Although haloblight is considered to be of high to moderate importance in Kenya, Tanzania, DR Congo, Rwanda and Burundi, limited work on halo blight has been done in Eastern Africa. However, work done by Teverson and Taylor (1994) with isolates from Africa identified nine races based on eight differential cultivars (Canadian Wonder, ZAA 54(A52), Tendergreen, Red Mexican U13, 1072, ZAA55(A53), ZAA12(A43) and Guatemala 196-B). All nine races occurred in Africa. Three frequent races (1, 4 and 6) accounted for over 60% of *P.s. pv.phaseolicola* isolates characterized. They reported that races 3 and 4 were confined to east and central Africa. Races 5 and 8 were dominant in Africa. Race specific and non-specific resistances were found in the 1048 accessions tested. However, race non-specific resistance occurred in only 1% of the accessions (GLP-X92, Urobonobono, Wis HBR 72, AFJ 29, Valliant, NAC 6S, NDM 14, GN*1 Sel 27, 2702/2, Pajuro, PI 150414, Gloriabamba, Jules and Poroto).

A sub-project to develop halo blight resistant cultivars was started at ISABU in Burundi in 1990 (Schmit, 1994). Crosses were made with the locally popular Dore' de Kirundo as a recurrent parent. Halo blight donors were Calima, Urubonobono, A410, A321, PVA 779, H75, Aroana and SM 1197. Additional 30 F_2/F_3 populations from CIAT were included in this program. Several advanced lines with a high level of resistance to halo blight have been selected from these populations. Populations derived from parents with I-gene (A321, A410 and Aroana) were severely affected by black root. Lines with I-gene were also highly resistant to race 3 of halo blight. Progress of this work has been severely hindered by civil strife in Burundi since 1994.

The current market led regional breeding programs in East and central Africa are focusing on multiple constraint breeding. Key to the success of these programs in knowledge of pathogenic diversity and reliable sources of resistance described in this paper. CBB is a priority constraint for red mottled, pinto, sugar, navy, yellow and brown/tan market classes. Halo blight is major constraint in red and white kidneys, climbers, large white, yellow and brown/ tan. New *P.s.pv.phaseolicola* differentials and sources of resistance identified by Teverson and Taylor (1994) should be incorporated in a regional halo blight nursery. The VAX lines, which have shown consistent resistance in many countries in Africa, need to be included in the CBB nursery and used in breeding programmes. Use of both race specific and race-non specific resistance appropriate to this region should provide an effective strategy for developing cultivars with improved and durable resistance to halo blight. The genetic map of the common bean seems to show that resistance genes for CBB and halo blight are closely linked (Miklas, 2002 personal communication). This implies that selection for resistance to Xcp may results to improved resistance to *P.s.*pv. *phaseolicola*. The recently formed African Bean CBB/HB working group is expected to coordinate activities addressing the two constraints.

References

Teverson, D.M. and J.D. Taylor. 1994. Race characterization and identification of resistance to halo blight in Africa. CIAT African Workshop Series 34: 44-54.

Schmit, V. 1994. Halo blight resistant varieties. CIAT African Workshop Series 34: 55-64.

Opio, F. and S. M. Musaana. 1993.Collaborative research project on common bacterial blight of beans. CIAT African Workshop Series 28: 108-112.

Wortmann, C.S., R.A.Kirkby, C.A. Eledu and D.J.Allen.1998. Atlas of common bean production in Africa. CIAT, Cali, Colombia