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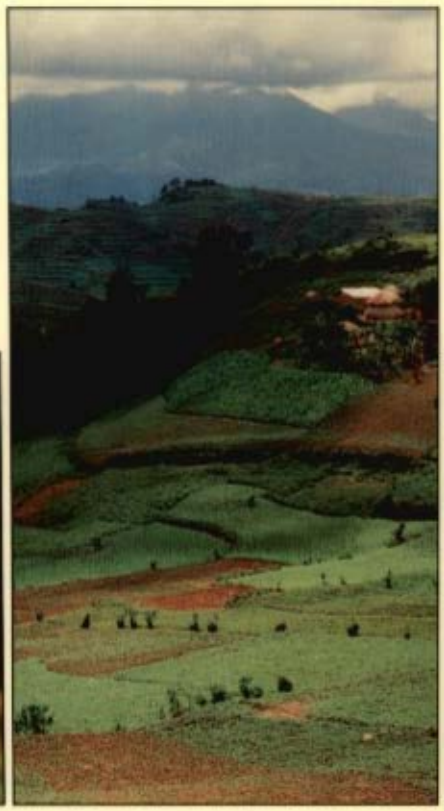
AN ANNOTATED LIST OF DISEASES, PATHOGENS AND ASSOCIATED FUNGI OF THE COMMON BEAN (*Phaseolus vulgaris*) IN EASTERN AND SOUTHERN AFRICA

D.J. ALLEN



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AN ANNOTATED LIST OF DISEASES, PATHOGENS AND ASSOCIATED FUNGI OF THE COMMON BEAN (*Phaseolus vulgaris*) IN EASTERN AND SOUTHERN AFRICA

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SUMMARY

This list brings together many widely scattered unpublished records, from the International Mycological Institute, from the Centro Internacional de Agricultura Tropical, and from field surveys conducted during recent collaborative research between CIAT and Horticulture Research International, Wellesbourne, and the Institute for Biochemistry and Plant Virology, Braunschweig. The literature survey has been extensive but probably not exhaustive: both recent and old checklists of published information have been scanned to provide an historical perspective to the presence of pathogens within a given territory. The list is confined to pathogens and diseases recorded on the common bean (*Phaseolus vulgaris* L.) in 20 countries of eastern, central and southern Africa and its off-shore islands. Information is given on their prevalence and pathogenic variability, with a comprehensive bibliography of more than 150 references. The list should prove valuable to plant pathologists, bean scientists, plant quarantine officers and research directors concerned with crop improvement and the international exchange of genetic resources.

INTRODUCTION

The common bean (*Phaseolus vulgaris* L.) was introduced into Africa from each of two gene centres in Latin America during the past four centuries. Africa is now the second most important bean producing region of the tropics, following Latin America. The total average annual production of dry beans in Africa is estimated at about two million tonnes, some 25 per cent of world production, but as a large part of production is consumed locally, official statistics may underestimate total production. Kenya is the largest producer in Africa, followed in some order by Tanzania, Uganda, Burundi, Rwanda and Zaire, all having more than 270,000 ha under production. Other significant producers in eastern and southern Africa include Angola, Ethiopia, Malawi, Mozambique and Madagascar. Although bean production in Africa has increased in some areas over the past decade, this has been achieved through area increases. Over eastern and southern Africa as a whole, production was stagnant over the 1980s, a period when population grew at an annual rate of over three per cent. The result is that consumption per caput is falling, albeit in an area where beans play a critical role in human nutrition by providing as much as 45 per cent of total protein consumed in some areas (Grisley, 1990; Allen & Smithson, 1991).

Small farmers are the principal producers of beans in most of Africa where the crop is cultivated in a complex array of cropping systems, including the use of cultivar mixtures. Most production is for subsistence and, although its role as a small-scale cash crop is increasing, the use of fertilizers and pesticides is uncommon. Soil infertility, periodic water stress, insect pests and diseases are considered the principal agronomic constraints associated with low yields (Allen *et al.*, 1989; Allen & Edje, 1990). Reviews of the principal bean diseases in Africa and the place of disease among other production constraints of the crop have been compiled recently (Allen, 1987a; Allen *et al.*, 1989; Allen *et al.*, in prep.). Almost 100 pathogens attack the common bean in Africa but only about eight cause substantial economic damage. Diseases like angular leaf spot, anthracnose, rust, common bacterial blight and bean common mosaic are widespread and can decrease seed yield considerably. Other diseases, including ascochyta blight, white mould and halo blight, can also cause significant crop loss, but they tend to be confined to specific environments.

For small scale farmers in sub-Saharan Africa, host plant resistance remains the only feasible means of disease control. At present, many farmers obtain a crop only by planting late so as to avoid the wettest season; improved levels of varietal resistance to disease could give added yield benefits by permitting more timely sowing. Scientists in the national agricultural research systems (NARS) of eastern and southern Africa are devoting varying degrees of effort and resources to the improvement of the common bean, including the evaluation of both local and introduced germplasm. There is growing evidence that immediate, substantial benefit can be gained directly from the large genetic resources and new breeding materials that are available through introduction, especially from the Centro Internacional de Agricultura Tropical (CIAT) in Colombia (Allen & Smithson, 1991), and other centres with well-established breeding programmes. This strategy has enabled many countries in Africa to release new, heavier yielding bean cultivars during the past few years. No international exchange of germplasm can be completely free of risk. East Africa, in particular, has a long history and sound record of operating a closed quarantine service as a safeguard against the accidental introduction of alien pathogens and their races into the region (Sheffield, 1968). Owing to the seed-borne nature of many of the pathogens of the common bean, most of the major diseases occur almost wherever the crop is now cultivated. In some cases, new outbreaks of pests and diseases are attributable not to the

introduction of the causal agent but of novel susceptibility to an indigenous one, presenting a 'new encounter' (Allen, 1983). An example from Africa is the bean stem maggot (*Ophiomyia* sp.) which is an Old World insect pest of a New World introduction, *Phaseolus vulgaris*. New diseases may also arise through changes in crop husbandry or the increasing use of marginal land. For example, root rots, caused by a complex of fungi including *Pythium* species, are apparently increasing through crop intensification (Buruchara, 1992c), while ashy stem blight can be severe in marginal areas subject to drought stress.

It is obviously useful to document what pathogens are present in a given area before substantial introductions are made. Territorial checklists provide a valuable basis for the formulation of regulations governing import by listing those pathogens that are known to be present. As regards the common bean, points of contrast between Africa and Latin America are valuable. Although most of the major pathogens occur in both continents, there are some exceptions: the scab fungus (*Elsinoë phaseoli* Jenk.) is not known on *P. vulgaris* in the Americas, whereas it is fairly widespread in Africa. Conversely, fungi like *Pseudocercosporella albida* (Matta & Bell.) Deighton, *Chaetoseptoria wellmanii* Stev., *Entyloma* sp., *Cercospora vanderystii* Henn. and *Cercospora castellanii* Matta & Bell. are not known to occur in Africa (Allen, 1983; Schwartz, 1989). Viruses not yet recorded from natural infections of beans in Africa include bean mild mosaic, bean rugose mosaic, bean pod mottle, quail pea mosaic, cowpea chlorotic mottle, bean golden mosaic, bean dwarf mosaic and several other geminiviruses that are not seed-borne (Galvez & Morales, 1989; Morales & Gamez, 1989). Among bacteria, there stands alone the strange case of *Curtobacterium flaccumfaciens* (Hedges) Collins & Jones that deserves further comment. *C. flaccumfaciens* has been known for many years to cause a bacterial wilt in common bean in Nebraska and elsewhere in the USA (Mohan & Hagedorn, 1989). Owing to its seed-borne nature and its apparently restricted geographical distribution despite its occurrence in both America and Africa, *C. flaccumfaciens* has been assigned to the high risk category of quarantine objects (Neergaard, 1977) with the result that this pathogen is the 'hot potato' among bean pathogens in the eyes of plant quarantine officials in Africa. With the benefit now of hindsight, it seems timely to review this status. There is little evidence to suggest that bacterial wilt is economically important, even in the USA (J.R. Steadman & M.J. Silbernagel, pers. comm., 1988). *C. flaccumfaciens* is a common soil inhabitant also in Latin America: the bacterium is relatively easy to identify but its role as a pathogen is less easily proven (M.A. Pastor-Corrales, pers. comm., 1987). Furthermore, the presence of the bacterium on other legume genera including *Zornia* seems not necessarily to constitute a threat to the bean crop. These factors together call to question the epidemiological competence of *C. flaccumfaciens* which seems to have been accorded undue prominence in quarantine legislation among pathogens of the common bean.

With the recent development in Africa both of national bean breeding programmes and of regional networks for germplasm exchange, it is no longer only farmers who have interest vested in the transport of bean seed across national boundaries. Yet a lack of knowledge of the risks involved sometimes makes it difficult for countries to collaborate effectively in research on the crop's improvement. At a meeting of African agricultural research directors held in Nairobi in June 1992, it was recognized that "plant quarantine regulations, while intended to prevent the accidental introduction of diseases not present in (a given) country, usually apply knowledge on disease distribution that has not been updated (for many years). . . . It was agreed that CIAT, in collaboration with pathologists in the various national agricultural research systems, should prepare a distribution map of bean diseases for the attention of NARS directors who would use the

information in following up with the quarantine services". This meeting was preceded by a Pan African Working Group Meeting on Fungal Pathogens of Beans, held in Thika, Kenya in May 1992, when CIAT was given the task of compiling a checklist of bean pathogens, as a first step toward drawing the disease distribution maps that are foreseen as necessary. The present list, then, has the following principal purposes: to provide a sound scientific basis for the preparation of disease distribution maps from which to update quarantine legislation governing the movement of bean seed into and within Africa; to provide plant quarantine officers with the information necessary to assess the level and type of risk associated with each individual introduction so as to guide decisions on procedures appropriate to the case; to provide a basis for priority setting by crop improvement teams by giving access to recent information generated from regional surveys of pathogens and their variants; and to provide a basis for site selection in screening for disease resistance. The scope of the list embraces 20 countries of eastern, central and southern Africa and its off-shore islands which together constitute all countries wherein the common bean is an important crop. Since their inception during 1983-1987, CIAT's three regional bean programmes in Africa have catalyzed the development of a research and training network across eastern and southern Africa, and the majority of the territories included in the list are partners in this bean network. The list omits Botswana and Namibia where the common bean is an insignificant crop and no disease records have been found. The literature survey has been extensive but probably not exhaustive. The pathogen and disease records themselves cover many old as well as new records, to provide an historical perspective of their distribution. Substantial use has been made of territorial checklists, where these exist. Supplementary records have been abstracted from other reliable sources and much use has been made of determinations made at the International Mycological Institute, an Institute of CAB INTERNATIONAL, where collections are assigned IMI numbers. Pathogen nomenclature follows IMI usage as given in Holliday (1980). Records are confined to the single host species, *Phaseolus vulgaris*. In many instances, a particular pathogen (or race) may be present in a certain country on a host plant other than *P. vulgaris*, indicating the importance of distinguishing between the geographical distribution of a disease and the distribution of the causal pathogen; they are not synonymous, as stressed elsewhere (Allen, 1983) and illustrated by the distribution of races of the halo blight bacterium (Table 1). During the course of recent surveys, various pathogens have been recorded from legume hosts other than *P. vulgaris* and these records have been published elsewhere (Allen, 1991). Obvious gaps in our knowledge of bean pathogens in Africa remain, and no checklist can ever claim to be complete. As surveys generate new records, it would be most desirable that these are collated on a regional basis and published, perhaps as an annual supplement in an appropriate journal, like the FAO Plant Protection Bulletin.

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A publication of this type inevitably relies substantially upon the help, support and guidance of many people and agencies. At the outset, the Director and staff of the International Mycological Institute gave me access to unpublished records and gave guidance on pathogen nomenclature, supplemented by my constant reference to Paul Holliday's *Fungus Diseases of Tropical Crops*. Mr Peter Filby greatly assisted my access to the important and under-utilized Buttress Collection of the Scientific Periodicals Library in Cambridge, where Dr S. Dale's help is also acknowledged. Drs C.Y.L. Schotman and R. Ikin kindly gave me access to the FAO Global Plant Quarantine Information System.

Country lists have been circulated in draft to plant pathologists and bean programme leaders who have kindly commented on the list's content. I should like particularly to thank the following for their help which, in some cases, included giving access to unpublished information:

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Dr B.C. Sutton has provided most valuable guidance during the final stages of production.

At this point, I should state plainly that the responsibility for the technical content of the list rests solely with myself: my comments do not necessarily reflect official opinion either of CABI or of CIAT by whom it is jointly published. Dr R.A. Kirkby has kindly provided the French and Portuguese translations as well as encouragement to the completion of the task which has been supported throughout by funds donated by the Canadian International Development Agency to the Centro Internacional de Agricultura Tropical in its execution of projects for the development of bean research networks in Africa.

Finally, I should add that my largest debt is to my wife, Leonora, who has helped me directly throughout the long period of compilation and editing of the entire booklet.

DJA
Cambridge, January, 1994

RESUME

Cette liste rassemble beaucoup de rapports d'études et résultats bruts fort dispersés et non publiés, provenant de l'Institut International de Mycologie, du Centre International d'Agriculture Tropicale et des inventaires sur terrain menés pendant des recherches récentes conduites en coopération entre CIAT et "Recherche Internationale en Horticulture", Wellesbourne, et l'Institut de Biochimie et de Virologie des plantes, Braunschweig.

La littérature a été intensivement inventoriée mais cela n'a probablement pas été exhaustif: les deux listes de contrôle sur l'information publiée ont été vérifiées en vue de fournir une perspective historique à la présence des pathogènes dans un territoire donné. La liste se limite aux pathogènes et maladies mentionés sur le haricot commun (*Phaseolus vulgaris* L.) dans vingt (20) pays de l'Afrique orientale, centrale et australe ainsi que dans les îles environnantes. L'information est donnée sur leur prévalence et leur variabilité pathogénique, avec une large bibliographie compréhensible de plus de 150 références. La liste devrait pouvoir présenter une grande valeur pour les phytopathologistes, les spécialistes du haricot, les responsables de la quarantaine des plantes et les directeurs de recherche concernés par l'amélioration des cultures et l'échange international des ressources génétiques.

INTRODUCTION

Le haricot commun (*Phaseolus vulgaris* L.) était introduit en Afrique en provenance de chacun des deux centres de génes en Amérique Latine durant les 4 derniers siècles. L'Afrique est maintenant la deuxième région tropicale la plus importante du point de vue de la production du haricot après l'Amérique Latine. La moyenne de la production annuelle totale du haricot sec en Afrique est estimée à environ deux millions de tonnes, soit 25 pour cent de la production mondiale; mais comme une grande partie de la production est consommée localement, les statistiques officielles pourraient sous-estimer la production totale.

Le Kenya est le plus grand producteur en Afrique, suivi en quelque ordre par la Tanzanie, l'Uganda, le Burundi, le Rwanda et le Zaïre; tous ayant plus de 270,000 ha sous production. D'autres producteurs importants en Afrique de l'Est et Australe sont: l'Angola, l'Ethiopie, le Malawi, le Mozambique et la Madagascar. Bien que la productivité du haricot en Afrique a augmenté dans quelques parties au courrant de la décennie écoulée, l'augmentation moyenne de la productivité est le résultat des augmentations par zones. A travers l'Afrique orientale et australe d'une manière générale, la production était stagnante durant les années 80, période pendant laquelle la population s'est accrue à un taux annuel supérieur à 3 per cent. En conséquence, la consommation par tête va en décroissant, bien que ce soit une zone où le haricot joue un rôle primordial dans la nutrition humaine, en fournissant autant que 45 per cent des protéines totales consommées dans certains coins (Grisley, 1990; Allen & Smithson, 1991).

Les petits fermiers sont les principaux producteurs des haricots dans la plupart des pays africains où la plante est cultivée dans un arrangement complexe de systèmes culturaux, incluant l'usage de mélanges variétaux.

La plus grande partie de la production sert à la subsistance et, bien que son rôle en tant que culture de rente à petite échelle s'accroit, l'usage des fertilisants et pesticides est inhabituel. L'infertilité du sol, le stress hydrique périodique, les pestes et les maladies sont considérés comme les principales contraintes agronomiques justifiant les faibles rendements (Allen *et al.*, 1988; Allen & Edje, 1990). Les études des principales maladies du haricot en Afrique et la place des maladies parmi d'autres contraintes à sa production ont été inventoriées récemment (Allen, 1987*a*; Allen *et al.*, en impression). Près de 100 pathogènes attaquent le haricot commun en Afrique; mais seulement huit (8) d'entre eux causent des dommages économiques substantiels.

Des maladies telles que les taches anguleuses, l'anthracnose, la rouille, la bactériose commune et la mosaïque commune du haricot sont largement répandues et peuvent contribuer à décroître considérablement le rendement en graines. D'autres maladies comme l'ascochytose, la pourriture blanche et la bactériose à halo, peuvent aussi causer d'importantes baisses de productions; mais ces maladies tendent à se confiner dans des environnements bien spécifiques.

Pour les petits fermiers en Afrique sub-saharienne, la résistance de la plante hôte reste le seul moyen possible pour le contrôle des maladies. Pour le moment, beaucoup de fermiers ne peuvent obtenir une récolte qu'en cultivant tard, afin d'éviter la période plus humide. Les niveaux élevés de résistance des variétés aux maladies pourraient permettre d'accroître le rendement, parce qu'on peut alors semer à temps opportun.

Les scientifiques opérant dans des systèmes nationaux de recherches agronomiques (SNRA) de l'Afrique orientale et australe consentent des efforts variés ainsi que des ressources en vue de l'amélioration du haricot commun, y compris l'évaluation du germoplasme local et introduit.

Il est de plus en plus évident qu'un bénéfice substantiel immédiat pourrait être tiré de l'usage de

grandes ressources génétiques disponibles et du nouveau matériel amélioré, spécialement au niveau du CIAT en Colombie (Allen & Smithson, 1991) et d'autres centres ayant des programmes d'amélioration bien établis. Cette stratégie a permis à beaucoup de pays africains de rendre disponibles des nouvelles variétés à plus haut rendement pendant ces dernières années.

Aucun échange international du germoplasme ne peut être dépourvu de risques. L'Afrique de l'Est, en particulier, a une longue histoire et informations appropriées sur son service strict de la quarantaine en guise de sécurité contre l'introduction accidentelle des pathogènes étrangers et leurs races dans la région (Sheffield, 1968).

Dû au fait que beaucoup de pathogènes du haricot commun se transmettent par semences, la plupart des maladies apparaissent presque partout où la plante est maintenant cultivée.

Dans certains cas, les nouvelles éruptions des pestes et des maladies sont causées non pas par l'introduction de l'agent causal, mais plutôt par une susceptibilité singulière du matériel vis-à-vis d'agents locaux du pays hôte (Allen, 1983). Un exemple en provenance de l'Afrique est la mouche du haricot (*Ophiomyia* spp.) qui est une peste du Vieux Monde sur une culture du haricot (*Phaseolus vulgaris*) introduit à partir du Nouveau Monde. Des nouvelles maladies peuvent aussi provenir des modifications des pratiques agricoles ou du recours accru aux sols marginaux. Par exemple, les pourritures racinaires causées par une série de champignons incluant des espèces de *Pythium*, s'accentuent apparemment avec l'intensification de la production du haricot (Buruchara, 1992c) pendant que la pourriture charbonneuse de tiges peut être sévère sur les sols marginaux sujets à la sécheresse.

Il est clairement important de s'informer sur l'existence des pathogènes dans une zone donnée avant de procéder aux introductions substantielles.

Les listes de contrôle par territoires fournissent une base précieuse pour l'élaboration des mesures devant réglementer l'importation, en indiquant les pathogènes qui sont connus être présents.

Concernant le haricot commun, les points de différence entre l'Afrique et l'Amérique Latine sont essentiels. Bien que la plupart des pathogènes apparaissent dans les deux continents, il y a quelques exceptions: le champignon que cause la gale (*Elsinoë phaseoli* Jenk.) n'est pas connu sur *P. vulgaris* aux Amériques, tandis qu'il est largement répandu en Afrique. Par contre, les champignons tels que *Pseudocercosporella albida* (Matta & Bell.) Deighton, *Chaetoseptoria wellmanii* Stev., *Entyloma* sp., *Cercospora vanderystii* Henn. et *Cercospora castellanii* Matta & Bell. n'apparaissent pas en Afrique (Allen, 1983; Schwartz, 1989).

Les virus non encore repérés à partir des infections naturelles des haricots en Afrique comprennent "bean mild mosaic", "bean rugose mosaic", "bean pod mottle", "quail pea mosaic", "cowpea chlorotic mottle", "bean golden mosaic", "bean dwarf mosaic" et plusieurs autres geminivirus qui ne sont pas transmis par les semences (Galvez & Morales, 1989; Morales & Gamez, 1989). Parmi les bactéries, il y a l'étrange cas de *Curtobacterium flaccumfaciens* (Hedges) Collins & Jones qui mérite plus de commentaires. *C. flaccumfaciens* a été connu depuis plusieurs années comme responsable du flétrissement bactérien du haricot commun au Nebraska et ailleurs aux Etats-Unis (Mohan & Hagedorn, 1989). Dû à la nature de sa transmission par graines et de sa distribution géographique apparemment réduites malgré son apparition aussi bien en Amérique qu'en Afrique, *C. flaccumfaciens* a été classé comme un des pathogènes à haut risque mis en quarantaine (Neergaard, 1977) et comme conséquence, ce pathogène est considéré aux yeux des responsables officiels de la quarantaine des plantes en Afrique comme le plus dangereux des pathogènes qui affectent le haricot. Cependant, grâce aux informations rétrospectives, l'on devrait

à présent redéfinir la place de ce pathogène. L'on ne dispose pas de preuves suffisantes pour suggérer que le frétrissement bactérien serait économiquement important, même aux Etats-Unis d'Amérique (J.R. Steadman & M.J. Silbernagel, communication personnelle, 1988). *C. flaccumfaciens* se trouve communément aussi dans le sol de l'Amérique Latine: il est relativement facile d'identifier cette bactérie, cependant son rôle en tant que pathogène est moins facilement prouvé (M.A. Pastor-Corrales, communication pesonnelle, 1987). En plus, la présence de la bactérie dans d'autres genres des légumineuses dont le *Zornia* ne semble pas nécessairement constituer une menace au haricot. Tous ces facteurs mis ensemble remettent en cause la capacité épidémiologique du *C. flaccumfaciens* auquel on semble avoir donné trop d'importance dance la législation en quarantaine parmi les pathogènes du haricot commun.

Avec le développement récent en Afrique aussi bien des programmes nationaux d'amélioration du haricot que des réseaux régionaux d'échange du germoplasme, ce ne sont plus seulement les fermiers qui sont intéressés au transport des semences de haricot au-delà des frontières nationales. Le manque de connaissance des risques qui y interviennent quelque fois continue à rendre difficile la collaboration effective des pays, en matière de recherche pour l'amélioration du haricot. Au cours d'une réunion des directeurs de recherches agronomiques en Afrique tenue à Naïrobi au mois de juin 1992, il a été reconnu que "les mesures de quarantaine des plantes, bien qu'elles visent de prévenir l'introduction accidentelle des maladies inexistantes dans un pays donné, utilisent souvent de connaissances sur la propagation des maladies qui ne sont pas actualisées (depuis plusieurs années). Il a été convenu que CIAT, en collaboration avec les phytopathologistes de plusieurs institutions nationales de recherches agronomiques, devra élaborer une carte sur la distribution géographique des maladies du haricot à l'attention des directeurs des services nationaux de recherches agronomiques. Ceux-ci utiliseraient cette information dans le suivi des services de quarantaines". Cette réunion a été précédée par un atelier du Groupe Panafricain de Travail sur les champignons pathogènes du haricot, tenu à Thika au Kenya, au mois de mai 1992, qui avait demandé au CIAT d'élaborer une liste de contrôle d'agents pathogènes du haricot, comme première étape dans l'établissement des cartes de distribution des maladies, qui seront très utiles.

La liste actuelle, renferme les préoccupations suivantes:

- fournir une base scientifique pour la préparation des cartes de distribution des maladies devant être utilisées pour actualiser la législation relative à la quarantaine, qui régit le mouvement des semences de haricot de l'extérieur et à l'intérieur de l'Afrique;
- fournir au personnel responsable de la quarantaine des plantes, l'information nécessaire pour pouvoir évaluer le niveau et le type de risque liés à chaque introduction nouvelle, afin de proposer des mesures appropriées à prendre pour chaque cas;
- fournir une base pour l'établissement des priorités par les équipes chargées de l'amélioration des plantes, en leur donnant accès aux informations récentes générées par des enquêtes régionales des pathogènes et de leurs races; et
- fournir une base pour la sélection des sites lorsqu'on veut faire le criblage pour la résistance aux maladies.

La liste embrasse 20 pays de l'Afrique orientale, centrale et australe et les îles environnantes, lesquels dans leur ensemble, constituent des pays où le haricot commune est un produit important. Depuis leur établissement (1983–1987), les trois programmes régionaux de haricot du CIAT en Afrique ont développé un réseau de recherche et de formation à travers l'Afrique orientale et

australe et la majorité des territoires inclus sur la liste sont partenaires de ce réseau. La liste n'include pas le Botswana et la Namibie, pays où le haricot commun est un produit négligeable et où aucune maladie n'a été repérée. L'inventaire de la littérature a été intensif, mais certes, pas exhaustif. Les pathogènes et les maladies enregistrés proviennent des informations anciennes aussi bien que récentes, dans le but de donner une perspective historique à leur distribution.

Les listes de contrôle par territoire ont été largement utilisées partout où elles existent. Des résumés d'information supplémentaires ont été élaborés à partir d'autres sources fiables et l'on a beaucoup fait usage des évaluations faites à l'Institut International de Mycologie, un institut faisant partie du CAB INTERNATIONAL, où les collections sont assignées des nombres IMI.

La nomenclature des pathogènes suit le système utilisé par IMI tels qu'indiqué dans Holliday (1980). Les informations se concentrent sur l'unique espèce hôte, *Phaseolus vulgaris*. Dans beaucoup de cas, un pathogène particulier (ou race), peur être présent dans un pays donné sur une plante hôte autre que *P. vulgaris*; ceci montre l'importance qu'il y a de faire la distinction entre la distribution géographique d'une maladie et celle de l'agent causal. Il s'agit de deux choses différentes, comme c'est clarifié ailleurs (Allen, 1983) et illustré par la distribution des races du pathogène de la bactériose à halo (Table 1).

Au cours de récentes enquêtes, plusieurs pathogènes ont été enregistrés sur des légumineuses hôtes autres que *P. vulgaris* et ces résultats ont été publiés ailleurs (Allen, 1991). Toutefois, des limites évidentes demeurent concernant notre connaissance des pathogènes du haricot en Afrique et aucune liste de contrôle ne peut se réclamer être exhaustive.

Comme les études continueront de fournir de nouveaux résultats, il serait très souhaitable que ces informations soient rassemblées sur la base régionale et publiées, peut-être comme un supplément annuel dans un journal approprié tel que le bulletin de la FAO sur la protection des plantes.

RECONNAISSANCE

Une publication de ce genre dépend très sérieusement de l'aide, de l'appui et des conseils de plusieurs personnes et agences. Tout au début, le Directeur et les membres du personnel de l'Institut International de Mycologie m'ont donné accès aux informations non encore publiées et ont fourni des conseils quant à la nomenclature des pathogènes. Ceci a été complété par ma référence constante à l'ouvrage de Paul Holliday sur les *maladies cryptogamiques des plantes tropicales*. M. Pierre Filby m'a grandement assisté pour accéder à l'importante mais sous-utilisée Collection Buttress, à la librairie de Périodiques Scientifiques de l'Université de Cambridge, où je reconnais avoir également reçu l'assistance du Dr S. Dale. Drs C.Y.L. Schotman et R. Ikin, m'ont gentiment donné accès au système d'information global de la FAO sur la quarantaine des plantes.

Les listes par pays avaient été circulées sous forme de brouillon aux phytopathologistes ainsi qu'aux Chefs des programmes haricot, lesquels ont bien gentiment fourni leurs commentaires sur le contenu desdites listes. J'aimerais tout particulièrement remercier les personnes suivantes pour leur assistance qui, dans certains cas, consistait à me faire prendre connaissance des information non publiées:

Dr J. Arias, Dr R. Buruchara, Dr N. Govinden, Ato Habtu Assefa, Dr H.C. Haciwa, Dr J. Kannaiyan, Mr J. Kayitare, Dr A. Liebenberg, Dr R.J.M. Melis, Dr O.Z. Mukoko, Mr N. Ntahimpera, Mr M.E. Omunyin, Dr A.F. Opio, Dr D. Perreaux, Dr A. Phillips, Mr Mukishi Pyndji, Mr A.H. Ramos, Prof Y.P. Rao, Mr S. Saumtally, Dr V. Schmit, Mrs T. Sengooba, Dr J.B. Smithson, Dr N. Spence, Prof J.M. Teri, Dr D.M. Teverson, Dr P. Trutmann et Dr H.J. Vetten.

Dr B.C. Sutton a fourni des conseils précieux durant l'étape finale de la production du document.

A ce stade, je dois dire pleinement que le contenu technique de la liste n'engage que moi-même: mes commentaires ne reflètent pas nécessairement l'opinion officielle ni de CABI ni du CIAT avec lesquels nous publions conjointement. Dr R.A. Kirkby nous a gentiment encouragé à parachever notre tâche qui a été financé par des fonds offerts par l'Agence Canadienne pour le Développement International (ACDI) au CIAT pour l'exécution des projets d'établissement d'un réseau de recherche sur le haricot en Afrique.

Finallement, je dois ajouter que ma plus grande dette demeure envers ma femme, Leonora, qui m'a aidé durant la longue période de dépouillement et d'édition du livret tout entier.

DJA
Cambridge, January 1994

RESUMO

Esta lista tráz um conjunto de vários registros espalhados nao publicados pelo o Instituto Internacional de Micólogia, o Centro Internacional da Agricultura Tropical e a investigacao de campo conduzida recentemenete em colaboracao com o CIAT e a Investigacao Internacional de Horticultura, Wellesbourne, o Instituto Bioquímico e Virólogia das plantas, Braunschweig.

A revisao da bibliógrafia foi extensiva mas provavelmente nao exautiva, abarcou os registos antigos e recentes da informacao publicada que foi selecionada para dar uma prespectiva histórica da presenca dos patogenos num determinado território.

A lista está confinada aos patogenos e as doencas registradas no Feijao vulgar (*Phaseolus vulgaris* L.) em 20 países da Africa Ocidental, Central e Austral; e as suas ilhas vizinhas.

A informacao é dada conforme a prevalencia e variabilidade do patogeno bem como, a informacao bibliógrafica compreendida em mais de 150 referencias.

As listas podem ser úteis para os fitopatológistas, os oficias da quarantena das plantas e os directores de investigacao envolvidos no melhoramento da cultura e a troca os recursos genéticos internacionais.

INTRODUCAO

O feijao vulgar (*Phaseolus vulgaris* L.) foi introduzido em Africa pelos dois centros genéticos da América Latina há quatro séculos passados. Depois da América Latina, Africa actualmente ocupa o segundo lugar entre os países trópicais. A producao média total é de cerca de dois milhoes de toneladas, que é 25% de toda a producao mundial. Porém, como uma grande parte da producao é consumida localmente, as estatísticas oficiais podem subestimar a producao total. Em Africa, o Quénia é o maior produtor seguido pela a Tanzania, Uganda, Burundi, Ruanda e o Zaire; todos estes países em conjunto ocupam 270.000 Ha em producao. Os outros produtores importantes no Este e Sul de Africa incluem Angola, Etiópia, Malawi, Mocambique e Madacgascar. A area de producao do feijao em Africa aumentou em certas regioes, na década passada. Este aumentou, deveu-se a extensao da area de producao. No Este e Sul de Africa, a producao foi estagnante nos anos 80, periódo em que, a populacao cresceu numa taxa anual de mais de 3%. O resultado desse aumento foi a diminuicao das areas de producao nos lugares onde o feijao vulgar tem um papel importante na nutricao humana através do fornecimento de 45% de proteína total consumida (Grisley, 1990; Allen & Smithson, 1991).

Os pequenos agricultores sao os principais produtores do feijao vulgar em Africa onde a cultura é cultivada num sistema de cultivo complexo, incluindo o uso das misturas de cultivares. Quase toda a producao é para a subsistencia e a sua comercializacao tem vindo a aumentar. O uso de fertilizantes e pesticidas nao é muito comum. A fertilidade do solo; a falta periódica das chuvas; as pragas e doencas sao consideradas as principais limitantantes agronómicas associados a baixa producao (Allen *et al.*, 1989; Allen & Edje, 1990). A revisao bibliográfica sobre as principais doencas e, distribuicao das mesmas entre as outras limitantes de producao da cultura foi recentemente compilado (Allen, 1987*a*; Allen *et al.*, 1989; Allen *et al.*, em impressao). Creca de 100 patogenos atacam o feijao vulgar em Africa mas, apenas 8% causa de perda económica da producao. As doencas como a mancha angular da folha, antracnose, ferrugem, mancha bacteriana comum, o mosaico comum estao largamente espalhados em várias regioes e podem baixar consideralvelmente a producao do grao. Outras doencas inclem "ascochyta blight", "white mould" e "halo blight" que podem também causar uma perda significativa na producao, mas elas tendem a confinar-se a específicas condicoes ambientais.

Para os pequenos agricultores da Africa Sub-Sahariana, a planta hospeideira resistente mantam apenas médias razuáveis de controlo da doenca. Neste momento, muitos agricultores semeam tarde a cultura apenas para evitar a estacao muito chuvosa; melhorando o nível de resistencia varietal as doencas e adicionando o benefício de permitir que haja um maior periódo de sementeira. Os cientístas da Investigacao Agrícola Nacional (NARs) com grande dedicacao tem concentrado os seus esforcos em promover a feijao vulgar na Africa Oriental e Austral incluindo a avaliacao de ambos os germoplasmas: intoduzido e local. Existe a evidencia viva de um substancial benefício que pode ser ganho directamente pela a introducao de uma grande diversidade genética, de racas melhoradas disponíveis especialmente no Centro Internacional de Agricultura Tropical (CIAT) em Colombia (Allen & Smithson, 1991) e de materias de outros centros com programas de melhoramento bem estabelicidos. Esta foi a estratégia que permitiu que muitos países africanos libertassem novas variedades muito produtivas depois de poucos anos. Nenhuma troca de germoplasma pode evitar completamente o risco. O Este de Africa, em particular, tem uma longa tradicao e um recorde em trabalhar coordenacao com o Sevico de Quarentena com vista a evitar a introducao acidental de patogeno estrangeiro e as suas racas dentro da regiao (Sheffield, 1968). A

maioria das doencas transmitidas pela semente do feijao vulgar ocorrem na maioria das regioes onde a cultura é cultivada. Em alguns casos, o surgimento das doencas e pragas podem ser atribuidas nao a introducao casual de um agente mas ao nível de susceptíbilidade de uma linha indígena quando é confrontada com uma nova introducao (Allen, 1993). Um exemplo em Africa é a mosca do feijao (*Ophiomyia* spp.) que é uma praga antiga das novas introducoes de *Phaseolus vulgaris*. Novas doencas também chegar devido a mudanca das práticas culturais ou o uso excessivo de terras marginais. Por exemplo, a podridao da raíz, causada por um complexo de fungos que incluindo as espécies do *Pythium*, está a aumentar devido ao cultivo intensivo da cultura (Buruchura, 1992c). Enquanto que a mancha cinzenta pode ser séria em solos nao férteis submetidos as "stress" hídrico.

E obviamente útil conhecer quais os patogenos estao presentes numa determinada area antes de se fazer uma substancial introducao na regiao. A lista de guia internacional fornece uma base útil para formular os regulamentos que guiam as importacoes. Isso pode ser conseguido fazendo uma listagem dos patogenos que sao conhecidos e a sua presenca nessa regiao. Nesse contexto, no feijao vulgar os pontos de comparacao entre Africa e América Latina estao disponíveis. Embora esses patogenos encontarm-se nos dois continentes existe algumas excepcoes: o fungo "scab" (*Elsinoë phaseoli* Jenk.) nao é conhecido no *P. vulgaris* da América, entretanto está largamente espalhado em Africa. Ao contrário, dos fungos como: *Pseudocercosporella albida* (Matta & Bell.) Deighton, *Chaetoseptoria wellmanii* Stev., *Entyloma* sp., *Cercospora vanderystii* Henn. e *Cercospora castellanii* Matta & Bell. ainda nao foram identificadas em Africa. As viroses que ainda nao estao identificadas na lista das infencoes naturais do feijao em Africa incluem o mosaíco comum, mosaíco rugoso, virose da casca do feijao, "quail pea mosaic", o mosaíco clorótico do feijao caupi, o mosaíco doirado do feijao, "bean dwarf" e outros géneros de vírus que nao sao transmitidos pela semente (Galvez & Morales, 1989; Morales & Gamez, 1989). Entre as bactérias, existem algumas que sao diferentes como o caso estranho do *Curtobacterium flaccumfaciens* (Hedges) Collins & Jones que precisa de mais comentários. O *C. faccumfaciens* é conhecida, a vários anos, como sendo o causador da mancha bacteriana do feijao vulgar em Nebraska e outras regioes dos EUA (Mohan & Hagedorn, 1989). Devido a transmissao da bactéria pela semente, a sua distribuicao geográfica é aparentemente limitada em ambos os continentes: em América e Africa; *C. flaccumfaciens* ficou documentada na categoria de alto rísco pela Quarentena (Neergaard, 1977). Segundo a opniao dos oficiais de quarentena em Africa este patogeno é uma "Batata quente" dentro do grupo dos patogenos de feijao. Devido ao facto de agora se conhecer a natureza e a importancia da bactéria é importante explicar o seu estado. Existem evidencias limitadas para provar que a mancha bacteriana é economicamente importante, mesmo nos EUA (J.R. Steadman & M.J. Silbernagel, com. pessaol, 1988). *C. flaccumfaciens* é também um comum habitante na América Latina: é relativamente fácil identificar a bacteria mas a tarefa dela como patogeno é mais dificil de se provar (M.A. Pastor-Corrales, com. pessoal, 1987). A sua prensenca mesmo nos outros legumes incluindo o género *Zornia* mostra que a bacteria parece nao ser necessáriamente perigosa para a cultura do feijao. Estes factores juntos levam a quetoes de competencia epidemiologica do *C. flaccumfaciens* que parece ter sido registrado com uma excessiva prominencia entre os patogenos do feijao vulgar.

Com o desenvolvimento recente em Africa dos programas nacionais de melhoramento e as redes regionais de trabalho para a troca do germoplasma, já nao sao só os agricultores é que tem interesse em transportar semente de feijao através das fronteiras nacionais, mas também os investigadores. A falta do conhecimento sobre os ríscos envolvidos por vezes torna difícil para os

países colaborarem eficientemente na investigacao do melhoramento da cultura. No encontro dos directores africanos de Investigacao Agronómica que teve lugar em Nairobi em Junho de 1992, foi reconhecido que "os regulamentos da quarentena das plantas enquanto visa a prevencao da introducao acidental das doencas que nao estao presentes num dado país, usualmente aplicando o conhecimento da distribuicao das doencas que a muitos anos ainda nao foi aplicado ... Foi concordado que o CIAT, em colaboracao com patológistas da vários programas nacionais de investigacao agronómica, deveriam preparar um mapa das doencas do feijao para os directores nacionais poderem estudar a informacao que será utilizada pelos servicos de quarentena". Este encontro foi precedido pela reuniao do Grupo Pan-africano que Trabalha com os patogenos de fungos do feijao que teve lugar em Thika, Quénia em Maio de 1992, quando o CIAT recebeu a incumbencia de compilar a lista de referencia sobre os patogenos do feijao como um primeiro passo para desenhar um mapa de distribuicao das doencas conhecidas.

A presente lista tem os seguintes objectivos:

- fornecer uma base científica para a preparacao do mapa de distribuicao das doencas através da qual a quarentena tem a legislacao que governa o movimento das sementes do feijao dentro e fora de Africa;
- fornecer aos oficiais da quarentena das plantas informacao necessária do nível e o tipo de risco associado a cada introducao individual assim como orientar as decisoes apropriadas a cada um dos casos;
- fornecer um conjunto de prioridades para os melhoradores das culturas através do acesso da recente informacao recolhida da investigacao regional dos patogenos e as suas varientes; e
- fornecer uma base de seleccao e "screening" de resistencia as doencas.

A revisao da lista inclue 20 países da Africa Oriental, Central e Austral e a ilhas vizinhas onde a cultura do feijao vulgar é regionais de feijao em Africa, já catalizou o desenvolvimento da investigacao e treinamento na Africa Ocidental e Oriental, incluindo na lista os membros da rede de trabalho. Esta lista omite o Botswana e a Namíbia onde o feijao vulgar é uma cultura insignificante e portanto, as doencas ainda nao foram reportadas. A revisao bibliográfica foi extensiva mas provavelmente nao exaustiva. Os registroa dos patogenos e das doencas conseguem cobrir muitos registros antigos bem como os recentes, para dar uma prespectiva histórica da distribuicao das mesmas. Foi feito um uso substancial das listas territoriais de consulta, nos sítios onde elas existem. Um registro suplementar de uma fonte dísponível no Instituto Internacional Micológico (IMI) e o "CAB International" onde as coleccoes estao númeradas IMI número. A nomenclatura do patogeno segue IMI como mostra o Holliday (1980). Os registros estao confinados a uma uníca espécie hospedeira *Phaseolus vulgaris*. Em vários casos, um patogeno (ou raca) particular pode estar presente num determinado país e a planta hospedeira no outro indicando assum, a importancia da distincao entre a distribuicao geografica da doenca e a importancia da distribuicao casual dum casual patogeno; eles nao sao sinónimos, como esta enfatizado nas outras partes do mundo (Allen, 1983) e ilustrado na distribuicao das racas da mancha bateriane (Tabela 1). Durante a recente revisao, vários patogenos tinham sido compilados nas plantas leguminosas hospedeiras e outros no *P. vulgaris* e por sua vez, estes patogenos já tinham sido compilados noutras partes do mundo e publicados (Allen, 1991). Obviamente que fica uma fenda no conhecimento dos patogenos de feijao vulgar em Africa, e as consulta precisam de ser completadas. Com a investigacao novos registros serao melhorados. Estes registros funcionam na base regional e publicados num suplemento anual num jornal apropriado, como por exemplo o Buletim da Protecao de Plantas de FAO.

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Esta publicacao, sem dúvida que deveu-se a ajuda sebstancial de várias pessoas e agencias. No início, o director e colegas do Instituto Internacional de Micólogia deram-me o cesso aos registros nao publicados e deram-me o guiao da nomenclatura do patogenos, suplementado pela constante referencia que eu faço a Paul Holliday: Doencas fungosas das culturas trópicais. O Sr Peter Filby deu-me uma grandiosa assistencia em termos de acesso a importante Coleccao de Buttress, que ainda nao foi muito bem utilizada, da biblioteca científica de Cambridge, onde a juda do Dr S. Dale é também reconhecida. Os Drs C.Y.L. Schotman e R. Ikin generosamente deram-me o acesso ao sistema global de informacao da quarentena das plantas da FAO.

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Dr B.C. Sutton que providenciou o mais valioso guia durante o estágio final de producao.

Neste momento poderia dizer que a responsabilidade do conteúdo técnico é inteiramente minha: os meus comentário nao sao necessarios para a reflexao oficial das opinioes do CABI ou CIAT que em conjunto estao publicados. O Dr R.A. Kirkby generosamente encorajou a terminar esta tarefa que foi totalmente financiada pela Agencia de Desenvolvimento Internacional do Canada (CIDA) para o Centro Internacional de Agricultura Tropical que tem Projectos Desenvolvimento da Rede de Trabalho de Investigacao em Africa.

Finalmente, gostaria de adicionar os meus profundos agradecementos a minha esposa Leonora, que ajudou-me directamente no longo periódo de compilacao e correcao do livro.

DJA
Cambridge, January 1994

ANNOTATED TERRITORIAL LISTS

ANGOLA

Alternaria leaf spot: *Alternaria tenuissima* (Kunze) Wiltshire.
Local. Huambo.
Serafim & Serafim (1968).

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Widespread.
Serafim & Serafim (1968), as *Isariopsis griseola* Sacc.

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
Widespread and important.
Serafim & Serafim (1968).

Ascochyta blight (leaf spot): *Ascochyta phaseolorum* Sacc.
Widespread.
Serafim & Serafim (1968).

Cercospora leaf spot: *Pseudocercospora cruenta* (Sacc.) Deighton.
Local. Huambo and Uige.
Serafim & Serafim (1968), as *Cercospora cruenta* Sacc.

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Chianga, Huambo, Nov. 1988.
Allen (1988).

Fusarium root rot: *Fusarium solani* (Mart.) Sacc. f.sp. *phaseoli* (Burkh.) W.C. Snyder & E.C. Hansen.
Local, minor importance. Bie and Huambo.
Serafim & Serafim (1968).

Mosaic: ? virus.
Camarada (1989).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Widespread and important.
Serafim & Serafim (1968).

Southern blight (stem rot): *Corticium rolfsii* Curzi.
Widespread, minor importance.
Serafim & Serafim (1968), as *Sclerotium rolfsii* Sacc.

Yeast spot (Stigmatomycosis): *Nematospora* sp.
Local, minor importance, associated with the insect *Nezara viridula*. Huambo.
Serafim & Serafim (1968).

BURUNDI

Alternaria leaf spot: *Alternaria alternata* (Fr.) Keissler.
P. Trutmann, unpubl.

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Buyckx (1962), ISABU (1983), as *Isariopsis griseola* Sacc.

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
INEAC (1958b), Buyckx (1962). More important at higher altitudes, as at Gisozi (Perreaux, 1986).

Ascochyta blight: *Phoma exigua* Desm. var. *diversispora* (Bubák) Boerema, and *Ascochyta phaseolorum* Sacc.
Buyckx (1962), Autrique (1981), Perreaux (1986).
Positive identification as var. *diversispora*, coll. at Murongwe, D.J. Allen 1985 (Gerlagh, 1987).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
Autrique & Perreaux (1989).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Autrique (1981), Munimbazi & Perreaux (1986).

Common mosaic: Bean common mosaic virus.
Goethals (1986).
Pathogenicity groups I, III, IVb, Va and VIa. Necrotic strains of the NL3 and NL8 type predominant (Spence, 1992).

Damping off: *Thanatephorus cucumeris* (Frank) Donk.
Buyckx (1962), as *Rhizoctonia solani* Kuhn.

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton. Some damage to beans, especially at altitudes between 1200-1400 m, as in Moso.
Dieudonne (1980), Perreaux (1986), as *Ramularia phaseoli* (Drummond) Deighton.

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Race 3 (IHR 1377A, J.D. Taylor 1985; IHR 1567A and 1568A, D. M. Teverson 1986) and race 4 (IHR 1385A and 1386A, D. Perreaux 1985; IHR 2240A, D.M. Teverson 1988; IHR 2274A, A. Autrique). Teverson (1991), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

Mosaic: Cucumber mosaic virus.
M. Goethals, unpubl.

Mosaic: Bean strains of blackeye cowpea mosaic virus.
Imbo Plains (H.J. Vetten, pers. comm. 1993).
Pythium root rot: *Pythium* spp.
ISABU (1990).

Root rot: associated with a complex of fungi, particularly *Fusarium solani* (Mart.) Sacc. and *Rhizoctonia* sp.
CIAT (1988).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Moso.
INEAC (1958c), Buyckx (1962).

Web blight: *Thanatephorus cucumeris* (Frank) Donk.
Autrique (1981), Perreaux *et al.* (1986).

White mould: *Sclerotinia sclerotiorum* (Lib.) de Bary.
Buyckx (1962).

Southern blight (root rot): *Corticium rolfsii* Curzi.
ISABU (1983), as *Sclerotium rolfsii* Sacc.

ETHIOPIA

Alternaria leaf spot: *Alternaria solani* Sorauer.
IMI 207093.
Alternaria tenuissima (Kunze) Wiltshire.
IMI 207094.

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
IMI 88330, 116687.
Kaffa, Eritrea, Shewa (Stewart & Dagnatchew, 1967), as *Cercospora columnaris* Ellis & Everh.
Didessa (Allen *et al.*, 1976), Awassa (Habtu, 1987).

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
IMI 116596.
Shewa (Stewart & Dagnatchew, 1967).
Bako (Allen *et al.*, 1976).
Didessa (Habtu, 1987).

Ascochyta blight: *Ascochyta phaseolorum* Sacc.
IMI 116509.
Shewa (Stewart & Dagnatchew, 1967).
Bako, Didessa (Habtu, 1987).

Ashy stem blight: *Macrophomina phaseolina* (Tassi) Goid.
Melkassa and Kobbo (Habtu, 1987).

Associated fungi: *Cladosporium oxysporum* Berk. & M.A. Curtis, IMI 207094.
Cladosporium sp., IMI 225599*b*.

Cercospora leaf spot: *Pseudocercospora cruenta* (Sacc.) Deighton.
Kaffa (Stewart & Dagnatchew, 1967), as *Cercospora cruenta* Sacc.

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
IMI B 659, 6930, IMI 136927.

Begemder, Harar, Shewa (Stewart & Dagnatchew, 1967).
Nazreth, Angar Gutin (Allen *et al.*, 1976).

Common mosaic: Bean common mosaic virus.
Bos (1974), Agranovsky (1985).
Recent work has shown that necrotic 'A' serotype strains of BCMV are apparently rare or even absent from Ethiopia, in contrast to elsewhere in eastern and southern Africa.
Pathogenicity groups I and IVb present (Spence & Walkey, 1991; Vetten & Allen, 1991) and possibly also some novel strains (Spence, 1992).

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.
IMI 116536, 207095.
Shewa, Kaffa (Stewart & Dagnatchew, 1967), as *Ramularia phaseoli* (Drummond) Deighton.
Didessa (Allen *et al.*, 1976), Awassa (Habtu, 1987).

From bean plant: unidentified nepovirus.
Alemaya (H.J. Vetten, pers. comm. 1993).

Fusarium root rot: *Fusarium solani* (Mart.) Sacc.
Habtu (1987).

Fusarium wilt: *Fusarium oxysporum* Schlecht.
Habtu (1987).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
IMI B 660.
Shewa, Harar, Sidamo (Stewart & Dagnatchew, 1967). Race 4 (IHR 1448C, Habtu Assefa 1985) and race 6 (IHR 1448A, Habtu Assefa 1985; IHR 1715A, D.J. Allen 1986), Teverson (1991) as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

Leaf spot: *Phoma exigua* Desm.
IMI 225546.
Kidane (1982).

Leaf spot: *Phoma phaseolina* Pass.
IMI 225536.
Kidane (1982).

Mosaic: Peanut mottle virus.
Lake Shalla.
Spence (1992).

Mosaic: Unidentified potyvirus with serological and biological affinities to soybean mosaic virus.
Widespread in the Rift Valley (H.J. Vetten, pers. comm. 1993).

Mycosphaerella leaf spot: *Mycosphaerella pinodes* (Berk. & Bloxam) Vestergr.
IMI 225500*b*.
Kidane (1982).

On leaves: *Cercosporidium* sp.
Kidane (1982).

Periconia leaf spot: *Periconia byssoides* Pers.
IMI 225599*c*.
Kidane (1982).

Phyllosticta leaf spot: *Phyllosticta phaseolina* Sacc. and *Phyllosticta* sp.
IMI 88301.
Kaffa, Shewa (Stewart & Dagnatchew, 1967).

Pod spot: *Phoma sorghina* (Sacc.) Boerema, Dorenb. & van Kest.
IMI 215673.
Kidane (1982).

Rhizoctonia root rot: *Rhizoctonia solani* Kuhn.
Widespread but of minor importance.
Habtu (1987).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
IMI 88610.
Uredinial and telial states. Widespread.
Stewart & Dagnatchew (1967), as *U. phaseoli* var. *typica* Arthur. Epidemiology studied by Habtu (1994).

Southern blight (root rot): *Corticium rolfsii* Curzi.
Kaffa (Stewart & Dagnatchew, 1967), as *Sclerotium rolfsii* Sacc.

Stem anthracnose: *Colletotrichum truncatum* (Schwein.) Andrus & Moore.
Kaffa (Stewart & Dagnatchew, 1967).

Web blight: *Thanatephorus cucumeris* (Frank) Donk.
Pawe (Smithson, 1986).

White mould (stem rot): *Sclerotinia sclerotiorum* (Lib.) de Bary.
Habtu Assefa, pers. comm. 1985.

Yellow mosaic: Bean yellow mosaic virus.
Jimma (H.J. Vetten, pers. comm. 1993).

KENYA

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
IMI 91195*b*, 44232, 44233, 276220*a*, 91195*b*.
McDonald (1936), as *Isariopsis griseola* Sacc.

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
IMI 57460.
McDonald (1936).

Ascochyta blight (Ascochyta leaf spot, phoma blight, black node disease): conventionally referred to *Ascochyta phaseolorum* Sacc., which is often recorded (IMI 44109, 184643*a*). Is now regarded as a synonym of the weak parasite *Phoma exigua* var. *exigua* Desm. (Boerema, 1972), which is often found on beans in Kenya (IMI 184643, 161806*d*, 274551; Gatumbi, 1986). However, *P. exigua* var. *diversispora* (Bub.) Boerema is endemic to eastern Africa, including Kenya, and appears to be the taxon of greatest economic importance (Boerema *et al.*, 1981; Stoetzer & Waite, 1984). Records of *Ascochyta boltshauseri* Sacc. in Kenya (Stoetzer & Waite, 1984) are now referable to *Stagonosporopsis hortensis* (Sacc. & Malbr.) Petr.

Ashy stem blight (charcoal rot): *Macrophomina phaseolina* (Tassi) Goid.
IMI 62566, 114782.
Nattrass (1961), as *M. phaseoli* (Maubl.) Ashby.

Associated fungi: *Alternaria cucumerina* (Ellis & Everh.) J.E. Elliot, IMI 206021.
Alternaria sp., IMI 213685.
Gatumbi (1986).
Chaetomium spirale Zopf, IMI 170327.
Gatumbi (1986).
Cladosporium sp., IMI 161806*g*.
Epicoccum purpurascens Ehrenb. ex Schlecht.
Under *E. nigrum* Link, IMI 161806*a*.
Fusarium semitectum Berk. & Rav., IMI 158641.
Gatumbi (1986).
Penicillium cyclopium Westling, IMI 68119.
Nattrass (1961).

Bacterial wilt: *Curtobacterium* (=*Corynebacterium*) *flaccumfaciens* (Hedges) Collins & Jones.
A few isolated records from the period 1968-1973. Presumed eradicated (Hubbeling, 1973; A.H. Ramos, pers. comm. 1988).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
Kaiser & Ramos (1980).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Very common (Hubbeling, 1973; Mukunya *et al.*, 1981).

Common mosaic, black root: Bean common mosaic virus.
'Mosaic' attributed to virus by McDonald (1936). BCMV positively identified by Kulkarni (1973). See also van Rheenen & Muigai (1984). Strain variation first studied by Omunyin (1979) and presence of both serotypes A and B confirmed by Vetten & Allen (1991). Pathogenicity groups Va and VIa, the former apparently confined to western Kenya, near Kisii (Spence, 1992).

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.
IMI 91195*a*, 151003.
Ondieki (1973), as *Ramularia phaseoli* (Drummond) Deighton.

Fusarium root rot: *Fusarium solani* (Mart.) Sacc. f.sp. *phaseoli* (Burkh.) W.C. Snyder & E.C. Hansen.
Important (Hubbeling, 1973; Njugunah *et al.*, 1980; Mutitu *et al.*, 1983).

Fusarium wilt, yellows: *Fusarium oxysporum* Schlecht. f.sp. *phaseoli* J.B. Kendr. & W.C. Snyder.
Mutitu *et al.* (1988).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
McDonald (1936), as *Bacterium medicaginis* var. *phaseolicola* (Burkh.) Link & Hall; Mukunya *et al.* (1981).
Studies on pathogenic variation have shown the presence of at least three races: race 4 (IHR 1356A, G.K. Kinyua1985), race 6 (IHR 1435A, J.D. Taylor 1985; IHR 2253A, 2254A, 2254C, D.M. Teverson 1988) and race 7 (IHR 1354A, D.J. Allen 1985).
Kinyua *et al.* (1981), Teverson (1991), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

Leptosphaerulina leaf spot: *Leptosphaerulina trifolii* (Rostr.) Petr.
IMI 161806*b*, 124259.

Phyllosticta leaf spot: *Phyllosticta phaseolina* Sacc.
IMI 161806*c*.

Powdery mildew: *Erysiphe polygoni* DC. ex St.-Am.
Moderately important (Hubbeling, 1973; Njugunah *et al.*, 1980).

Pythium root rot: *Pythium* sp.
Hubbeling (1973), Njugunah *et al.* (1980).
Recently found severe in western districts, associated with heavy rainfall (Buruchara, 1992*a*).

Rhizoctonia root rot: *Rhizoctonia solani* Kuhn.
Widespread (Hubbeling, 1973; Njugunah *et al.*, 1980).

Rust: *Uromyces appendiculatus* (Pers.) Unger, and apparently also *U. viciae-fabae* (Pers.) Schroet.
U. appendiculatus recorded by McDonald (1936) and pathogenic variation studied by Howland & Macartney (1966). *U. viciae-fabae* recorded by Nattrass (1961) but this record should be regarded with suspicion.

Scab: *Elsinoë phaseoli* Jenk.
IMI 21136.
Mutitu (1979), Gatumbi (1986).

Southern blight: *Sclerotium rolfsii* Sacc.
Moderately important (Hubbeling, 1973; Njugunah *et al.*, 1980).

Tobacco mosaic: Tobacco mosaic virus.
One record (Hollings *et al.*, 1981).

White mould: *Sclerotinia sclerotiorum* (Lib.) de Bary.
IMI 141593, 141594, 142922.
Ondieki (1973).

Yeast spot: *Nematospora coryli* Peglion.
Nattrass (1961).

Yellow mosaic: Bean yellow mosaic virus.
An early record of yellow mosaic (Wallace, 1941) was presumed to have been BYMV (Zaumeyer & Thomas,

1957). Recorded from Embu and Njoro (Hubbeling, 1973); its presence in Njoro has been confirmed recently (Vetten & Allen, 1991).

LESOTHO

Ashy stem blight (Charcoal rot): *Macrophomina phaseolina* (Tassi) Goid.
IMI 322519, 322522, 322523, 322524, 322525.
Maseru, Mafeteng.
Smithson (1988).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
IHR 2673A-D, 2675C, 2676C, 2677C, 2682C, J.D. Taylor 1990.
Teverson (1991), D.M. Teverson, pers. comm. 1993.

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Widespread (Smithson, 1988).

Common mosaic: Bean common mosaic virus.
Pathogenicity group VIa (Spence & Walkey, 1991).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Maseru, Mafeteng and Machache.
Race 1 (IHR 1967A, J.B. Smithson 1988; IHR 2662A, 2675A, 2676A, 2681A, 2682A, J.D. Taylor 1990), race 2 (IHR 2671A, J.D. Taylor 1990), race 6 (IHR 1965A, J.B. Smithson 1988; IHR 2367A, 2368A, D.J. Allen 1989; IHR 2654A, 2673A, J.D. Taylor 1990) and race 8 (IHR 2654C, 2656A, 2656B, 2656C *et seq.*, J.D. Taylor 1990), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*
Teverson (1991).

Root rot and wilt: *Neocosmospora vasinfecta* E.F. Sm. var. *vasinfecta*
IMI 322520.
Maseru (Smithson, 1988).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Leribe, Maseru and Teyateyaneng (Allen & Smithson, 1989).

MADAGASCAR

Alternaria leaf spot: *Alternaria solani* Sorauer and, to a lesser extent, also *A. longipes* (Ellis & Everh.) Mason.
A. solani is found all over the island and almost all bean cultivars on which both leaves and pods are attacked (Dadant *et al.*, 1961).

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Found around Tananarive, Bealanana and Lac Alaotra (Bouriquet, (1946). Common but regarded of minor importance (Dadant *et al.*, 1961).

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
Found first in February 1937 (Bouriquet, 1946).
Common and fairly important (Dadant *et al.*, 1961).

Ascochyta blight: presumably *Phoma exigua* Desm. var. *diversispora* (Bubák) Boerema
Buruchara (1992b).

Bacterial wilt: *Burkholderia solanacearum* (E.F. Sm.) Yabuuchi *et al.*
Widely distributed and damaging, 20-50 per cent incidence.
Dadant *et al.* (1961), as *Pseudomonas solanacearum* (E.F. Sm.) E.F. Sm.

Cercospora leaf spot: *Pseudocercospora cruenta* (Sacc.) Deighton.
Damage apparently insignificant (Bouriquet, 1946), as *Cercospora cruenta* Sacc.
Frequent but unimportant (Dadant *et al.*, 1961).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Found near Lac Itasy in 1932 (Bouriquet, 1946), as *Bacterium phaseoli* Smith.

Common mosaic: presumed to be bean common mosaic virus.
Rasolofo-Razafindramamba & Raliarison (1976).

Fusarium wilt: *Fusarium* sp.
Uncommon and of little importance (Dadant *et al.*, 1961).

Mosaic: Peanut mottle virus.
H.J. Vetten, pers. comm. 1993.

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Found first in 1929 but thought then to have been present for a long time (Bouriquet, 1946).
Widespread; important on very susceptible cultivars (Dadant *et al.*, 1961).

Sclerotium root rot (southern blight): *Corticium rolfsii* Curzi.
Found in 1934 on the East coast at Fenerive (Bouriquet, 1946), as *Sclerotium rolfsii* Sacc. Causes important damage under conditions of poor drainage or heavy shade (Dadant *et al.*, 1961).

Web blight: *Thanatephorus cucumeris* (Frank) Donk.
Frequent; severe under humid conditions (Dadant *et al.*, 1961), as *Corticium solani* (Prill. & Delacr.) Bourd. & Galz.

MALAWI

Alternaria leaf spot: *Alternaria* sp.
Sometimes causes severe defoliation.
Peregrine & Siddiqi (1972).

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
IMI 156668*b*, 164268, 89206, 130925, 137407.
Peregrine & Siddiqi (1972).

Anthracnose:*Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
IMI 114415, 124356*a*, 124357*a*, 125115.
The most serious disease in Malawi (Peregrine, 1971; Peregrine & Siddiqi, 1972).
Pathogenic variation studied by Ayonoadu (1974) who found that the gamma race group predominated among 16 isolates obtained from three sites in Malawi. Three new races were identified.

Ascochyta leaf spot: *Ascochyta* sp. and *A. phaseolorum* Sacc.
IMI 92151.
Peregrine & Siddiqi (1972).

Associated fungi: *Epicoccum nigrum* Link, IMI 124357*b*.
Peregrine & Siddiqi (1972).

Cercospora leaf spot: *Cercospora* sp. and *Cercospora canescens* Ellis & G. Mart.
IMI 164267, 119349*d*.
Peregrine & Siddiqi (1972).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
IMI B 3340, B 3643.
Widespread (Peregrine & Siddiqi, 1972), as *X. phaseoli* (E.F. Sm.) Dowson, and includes isolates referable to fuscous blight.

Common mosaic: Bean common mosaic virus.
Peregrine & Siddiqi (1972). Necrosis-inducing strain identified from distorted apical leaves from Bunda, Feb. 1989 (H.J. Vetten, unpubl. 1989). Pathogenicity groups IVb and VIa (Spence, 1992).

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.
IMI 156668, IMI 155355.
Serious, Central Region (Peregrine & Siddiqi, 1972), as *Ramularia phaseoli* (Drummond) Deighton.

Fusarium root rot: *Fusarium solani* (Mart.) Sacc.
Mughogho, 1970 in Allen (1975*a*).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
IMI B 3376.
Peregrine & Siddiqi (1972), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.* Pathogenic variation of halo blight in Malawi studied by Msuku (1985). Subsequent studies have identified race 2 (IHR 2710A, J.D. Taylor 1990), race 5 (IHR 2708A, J.D. Taylor 1990) and race 9 (IHR 2709A, J.D. Taylor 1990). Teverson (1991).

Mild mottle: cowpea mild mottle virus.
Bunda, nr Lilongwe.
Vetten & Allen (1991).

Mycosphaerella leaf spot: *Mycosphaerella pinodes* (Berk. & Bloxam) Vestergr.
IMI 86575*b*.
Peregrine & Siddiqi (1972).

On roots: *Rhizopus stolonifer* (Ehrenb.) Lind.

IMI 159467*b*.
Peregrine & Siddiqi (1972).

Periconia leaf spot: *Periconia byssoides* Pers.
IMI 86575*a*.
Peregrine & Siddiqi (1972).

Phyllosticta leaf spot: *Phyllosticta* sp.
Peregrine & Siddiqi (1972).

Root rot: *Gibberella fujikuroi* (Sawada) Ito (anamorph: *Fusarium moniliforme* J. Sheld.).
IMI 159467*a*.
Peregrine & Siddiqi (1972).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
IMI 155355*c*.
A serious disease with heavy yield losses in dry season irrigated crops; particularly white-seeded cultivars.
Peregrine & Siddiqi (1972).

Scab: *Elsinoë phaseoli* Jenk.
IMI 81050, 164269.
Peregrine & Siddiqi (1972).

Southern blight: *Corticium rolfsii* Curzi.
Not serious.
Peregrine & Siddiqi (1972).

Stem anthracnose: *Colletotrichum truncatum* (Schwein.) Andrus & Moore.
IMI 155356*b*.
Peregrine & Siddiqi (1972).

Web blight, collar rot and stem blight: *Thanatephorus cucumeris* (Frank) Donk.
IMI 124773.
Peregrine & Siddiqi (1972), as *Corticium solani* (Prill. & Delacr.) Bourd. & Galz.

Yellow mosaic: Bean yellow mosaic virus.
Peregrine & Siddiqi (1972).
Dubious, not confirmed during recent surveys (Vetten & Allen, 1991).

MAURITIUS

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
E.F.S. Shepherd, 1937 (Wiehe, 1948), as *Isariopsis griseola* Sacc.

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
E.F.S. Shepherd, 1937 (Wiehe, 1948).

Bacterial wilt: *Burkholderia solanacearum* (E.F. Sm.) Yabuuchi *et al.*
IMI B 1728, 1729.
Beau Bassin, 1963 (Orieux & Felix, 1968), as *Pseudomonas solanacearum* (E.F. Sm.) E.F. Sm.
Also *Curtobacterium flaccumfaciens* (Hedges) Collins & Jones, as *Corynebacterium flaccumfaciens* (Hedges) Dowson, the latter reported for the first time from Beau Bassin and Black River in 1963. In 1964, found at Mapou. In the summer of 1965, *C. flaccumfaciens* was reported as severe in a bean crop of Local Red, at an incidence of 10-36% (Anon., 1965-67).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
Autrey & Saumtally (1990).

Cercospora leaf spot: *Cercospora canescens* Ellis & G. Mart.
IMI 76665.
Reduit, 1959 (Orieux & Felix, 1968).

Charcoal rot (ashy stem blight): *Macrophomina phaseolina* (Tassi) Goid.
IMI 90236, 90237.
Richelieu, 1961 (Orieux & Felix, 1968).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
First recorded 1981. Its fuscous variant found more recently.
Autrey & Saumtally (1990).

Fusarium root rot: *Fusarium solani* (Mart.) Sacc.
Rojoa (1989).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
1950 (Orieux & Felix, 1968), as *P. phaseolicola* (Burkh.) Dowson.
Race 2 (IHR 1502A, 1986), Teverson (1991).

Leaf spot: *Pleospora* sp.
IMI 76664*b*.
Orieux & Felix (1968).

Mosaic: ? Bean common mosaic virus.
Wiehe (1948), Anon. (1986).

Phyllosticta leaf spot: *Phyllosticta phaseolina* Sacc.
IMI 76664*a*.
Reduit, 1959 (Orieux & Felix, 1968).

Powdery mildew: *Erysiphe polygoni* DC. ex St-Am.
F.A. Stockdale, 1915 (Wiehe, 1948).

Rhizoctonia root rot (as wilt): *Thanatephorus cucumeris* (Frank) Donk.
Orieux & Felix (1968), as *Corticium solani* (Prill. & Delacr.) Bourd. & Galz.

Rust: *Uromyces appendiculatus* (Pers.) Unger.
E.F.S. Shepherd, 1937 (Wiehe, 1948).

Southern blight (as root rot): *Corticium rolfsii* Curzi.
1958 (Orieux & Felix, 1968).

White mould (as pod rot): *Sclerotinia sclerotiorum* (Lib.) de Bary.
Reduit, G. Orian, 1945 (Wiehe, 1948).

Yellow mosaic: ? Bean yellow mosaic virus.
Beau Plan (Anon., 1986).

MOZAMBIQUE

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Plumb-Dhindsa & Mondjane (1984).

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
Plumb-Dhindsa & Mondjane (1984).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Plumb-Dhindsa & Mondjane (1984).

Damping off: causal fungi apparently undetermined.
Common in Lichinga.
J. Arias, pers. comm. 1993.

Fusarium root rot: *Fusarium* sp.
Plumb-Dhindsa & Mondjane (1984).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Plumb-Dhindsa & Mondjane (1984), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*
Races not yet identified.

Leaf spot: *Phoma exigua* Desm.
Plumb-Dhindsa & Mondjane (1984).

Mosaic: Complex of viruses.
Plumb-Dhindsa & Mondjane (1984).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Plumb-Dhindsa & Mondjane (1984).

Seed decay: Complex of fungi.
Plumb-Dhindsa & Mondjane (1984).

Stunt: associated with cowpea mild mottle virus
Umbeluzi, March 1989 (Vetten & Allen, 1991).

Web blight: *Thanatephorus cucumeris* (Frank) Donk (sclerotial state *Rhizoctonia solani* Kuhn).
Plumb-Dhindsa & Mondjane (1984).

RWANDA

Alternaria leaf spot: *Alternaria alternata* (Fr.) Keissl.
P. Trutmann, unpubl.

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Nyabyenda *et al.* (1981), as *Isariopsis griseola* Sacc.

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
Goeteyn (1975), Nyabyenda *et al.* (1981), Kamanzi (1982).
Pathogenic variation studied by Nkezabera (1987).

Ascochyta blight: *Phoma exigua* Desm. var. *diversispora* (Bubák) Boerema, and *Ascochyta phaseolorum* Sacc.
Durnez (1983), Price & Cishahayo (1986), Munyemana (1987).
Positive identification as var. *diversispora*, coll. P. Trutmann 1986 (Gerlagh, 1987).

Ashy stem blight: *Macrophomina phaseolina* (Tassi) Goid.
P. Trutmann & W. Graf, unpubl. 1987, Rusuku (1991), Buruchara & Rusuku (1992).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
IHR 1378A-D, J.D. Taylor 1985; IHR 1912A-C, 1913A-D, 1915A-D, 1917A-D, 1918A-D, 1922A-D, 1928A-D, J.D. Taylor 1987.
Teverson (1991), D.M. Teverson, pers. comm. 1993.

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Durnez (1983).

Common mosaic, black root: Bean common mosaic virus.
Pathogenicity groups III, IVb and VIa (Spence, 1992).

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.
Durnez (1983).

Fusarium root rot: *Fusarium solani* (Mart.) Sacc.
P. Trutmann, unpubl. 1987, Rusuku (1991), Buruchara & Rusuku (1992).

Fusarium wilt: *Fusarium oxysporum* Schlecht. f.sp. *phaseoli* J.B. Kendr. & W.C. Snyder.
Butare and Gikongoro (Rusuku, 1991; Buruchara, 1992*c*; Buruchara & Rusuku, 1992).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
ISAR (1985), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*
Race 1 (IHR 1500A, P. Trutmann 1985), race 2 (IHR 1612A, D.M. Teverson 1986) and race 4 (IHR 1302A, J.H.C. Davis 1984; IHR 1348A, 1349A, P. Trutmann 1984; IHR 1357A, P. Trutmann 1985; IHR 1392A, 1403A, 1404A, J.D. Taylor 1985; IHR 1410A, D.J. Allen 1985; IHR 1413A, M.A. Pastor-Corrales 1985; IHR 1485A, D.J. Allen 1985; IHR 1499A, P. Trutmann 1985; IHR 1613A, 1614A, D.M. Teverson 1986; IHR 1909A, J.D. Taylor 1987; IHR 2233A, 2252A, D.M. Teverson 1988).
Teverson (1991).

Mosaic: Southern bean mosaic virus.
Rubona (H.J. Vetten, unpubl. 1988).

On leaves: *Phoma sorghina* (Sacc.) Boerema, Dorenb. & van Kest.
Coll. D.J. Allen, Rubona 1985 (det. M. Gerlagh).

Powdery mildew: *Erysiphe polygoni* DC. ex St-Am.
Haut Terres Volcaniques, P. Trutmann, unpubl. 1987.

Pythium root rot: *Pythium* spp.
Durnez (1983), Rusuku (1991), Buruchara (1992*c*), Buruchara & Rusuku (1992).

Rhizoctonia root rot: *Thanatephorus cucumeris* (Frank) Donk.
Nyabyenda *et al.* (1981), as *Rhizoctonia solani* Kuhn.
Rusuku (1991), Buruchara & Rusuku (1992).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Lac Mohasi, Mildbraed, 1911 (Hendrickx, 1948).

Southern blight: *Corticium rolfsii* Curzi.
Nyabyenda *et al.* (1981), as *Sclerotium rolfsii* Sacc.
Buruchara & Rusuku (1992).

White mould: *Sclerotinia sclerotiorum* (Lib.) de Bary.
Durnez (1983), R.A. Buruchara, unpubl. 1992.

SEYCHELLES

Cercospora leaf spot: *Cercospora ? canescens* Ellis & G. Mart.
On 'runner bean', so host *Phaseolus* species in question.
Mathias (1971).

Collar rot (wilt ?): *Fusarium oxysporum* Schlecht. f.sp. *phaseoli* J.B. Kendr. & W.C. Snyder.
Frequent heavy losses (Mathias, 1971).

SOMALIA

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Golato (1967*a*, 1967*b*), as *Cercospora columnaris* Ellis & Everh.

Bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
As *Pseudomonas phaseoli*, recorded by Curzi (1934) but from *Lablab purpureus* (as *Dolichos*) not from *Phaseolus vulgaris*.

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Golato (1967*a*).

Wilt: ? *Fusarium* sp.
C. Wortmann, pers. comm. 1989.

SOUTH AFRICA

Alternaria leaf spot (black blight): *Alternaria tenuissima* (Kunze) Wiltshire, and ? *Alternaria* sp., latter species as *Macrosporium phaseoli* Fautrey.
Durban and Natal (Doidge *et al.*, 1953).

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Natal, Transvaal (Doidge *et al.*, 1953), as *Cercospora columnaris* Ellis & Everh.

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
Widespread, common; often epiphytotic (Doidge *et al.*, 1953).
Races not yet identified.

Ascochyta blight: *Phoma exigua* Desm. var. *exigua* and as *Ascochyta phaseolorum* Sacc.
Transvaal low veld and Natal.
Trench *et al.* (1986), A.J. Liebenberg, pers. comm. 1993.

Ashy stem blight: *Macrophomina phaseolina* (Tassi) Goid.
Vorster, 1964 cited by Gorter (1977).

Bacterial brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
Transvaal; damaging in 1992 (Serfontein, 1994).

Cercospora leaf spot (leaf blotch): *Pseudocercospora cruenta* (Sacc.) Deighton.
Cape, Transvaal and especially Natal where it is most damaging (Doidge *et al.*, 1953), as *Cercospora cruenta* Sacc.

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Doidge *et al.* (1953), Gorter (1977), as *X. phaseoli* (E.F. Sm.) Dowson and *X. phaseoli* var. *fuscans* (Burkh.) Starr & Burkh.

Common mosaic: Bean common mosaic virus.
Common and widespread (Doidge *et al.*, 1953).
Isolates from Transvaal and Natal identified as belonging to pathogenicity group V (Edington & Whitlock, 1988).

Fusarium root rot: *Fusarium solani* (Mart.) Sacc.
Doidge *et al.* (1953), Gorter (1977).

Fusarium wilt: *Fusarium oxysporum* Schlecht.? f.sp. *phaseoli* J.B. Kendr. & W.C. Snyder.
Doidge *et al.* (1953), Gorter (1977).

Grey mould: *Botrytis cinerea* Pers.
Seasonal and unimportant (A.J.L. Phillips, unpubl.).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Doidge *et al.* (1953), as *Pseudomonas medicaginis* f.sp. *phaseolicola* (Burk.) Link & van Hall.
Races not yet identified.

Leaf scorch: attributed to the effects of high temperature and strong winds on plants suffering from manganese deficiency.
Southwestern Cape (Doidge *et al.*, 1953).

Mosaic: Cucumber mosaic virus.
M. Koch, unpubl.

Mosaic: Peanut mottle virus.
M. Koch, unpubl.

Mottle leaf: Non-parasitic.
Very common on Cape Flats resulting from manganese deficiency (Doidge *et al.*, 1953).

Phyllosticta leaf spot: *Phyllosticta phaseolina* Sacc.
Pretoria (Doidge *et al.*, 1953).

Pod blight: *Phoma subcircinata* Ellis & Everh.
Zululand, unimportant (Doidge *et al.*, 1953).

Pythium root rot (wilt): *Pythium debaryanum* Hesse and *Pythium ultimum* Trow.
Wager, 1941 cited by Gorter (1977).

Rhizoctonia root rot: *Thanatephorus cucumeris* (Frank) Donk.
Doidge & Bottomley, 1931 cited by Gorter (1977).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Doidge *et al.* (1953).

Scab: *Sphaceloma* anamorph of *Elsinoë phaseoli* Jenk.
Natal and Transvaal, often epiphytotic.
Phillips (1994).

Virus-like disease: associated with a geminivirus.
Eastern Transvaal low veld.
G. Pietersen, pers. comm. 1994.

White mould (stem rot): *Sclerotinia sclerotiorum* (Lib.) de Bary.
Gorter (1977).

Wilt: associated with *Fusarium oxysporum* Schlecht. and *F. solani* (Mart.) Sacc. and their varieties as well as with *Pythium debaryanum* Hesse, *P. spinosum* Sawada and *P. ultimum* Trow.
Unimportant except when growing conditions are unfavourable.
Doidge *et al.* (1953).

Yeast spot: *Nematospora coryli* Peglion and *Nematospora gossypii* Ashby & Nowell.
Doidge *et al.* (1953), as *Ashbya gossypii* (Ashby & Nowell) Guill.

Yellow dot, yellow mosaic: Alfalfa mosaic virus.
Minor (Neveling, 1956).

Yellow mosaic: Bean yellow mosaic virus.
M. Koch, unpubl.

SUDAN

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
IMI 323.
Occasional in Equatoria but rarely severe.
Kagelu, 1944 (Tarr, 1955), as *Isariopsis griseola* Sacc.

Ascochyta blight: *Ascochyta phaseolorum* Sacc.
Tarr (1955).

Ashy stem blight (charcoal rot): *Macrophomina phaseolina* (Tassi) Goid.
Tarr (1955), as *Macrophomina phaseoli* (Maubl.) Ashby.

Bacterial blight: Tarr (1955) suspected the presence of bacterial diseases on "various species of *Phaseolus*" (which may have included spp. now consigned to the genus *Vigna*) "but little is known of them and investigation is needed". *Xanthomonas phaseoli* was reported from the Sudan by Sabet (1959) and Sabet *et al.* (1969) but from legume hosts other than *P. vulgaris*.

Cercospora leaf spot: *Cercospora canescens* Ellis & G. Mart.
Tarr (1955).

Curly top: Cowpea mild mottle virus.
Attributed to a virus by Tarr (1955) who described the symptoms. Considered serious, since severely infected plants are strongly distorted and sterile. Widespread in the North of the country but particularly severe North of Khartoum where losses may be heavy, especially in hot weather. Regarded as the most important disease of beans in the Sudan, especially when populations of the whitefly vector are dense (Salih & Salih, 1985). Recently found strongly associated with cowpea mild mottle carlavirus but field symptoms at Ed-Damer could not be reproduced under greenhouse conditions (Vetten & Allen, 1991; H.J. Vetten, pers. comm. 1993).

Mosaic: ? Virus.
Plants stunted, leaves being dwarfed, asymmetrical in shape with distinct light-dark green mosaic. Leaf laminae narrowed, plants sterile. Nuba Mountains (Tarr, 1955). BCMV not found in recent surveys (Vetten & Allen, 1991).

On leaves: *Periconia byssoides* Pers.
IMI 48174.
Katire, 1951, Tarr (1955).

On seed: *Aspergillus flavus* Link.
Habish (1972).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Widespread in the southern and central Sudan south of the Gezira, often causing severe damage (Tarr, 1955).

Sooty mould: *Cladosporium* sp.
Red Sea Coast (Tokar).
Tarr (1963).

Wilt: attributed to sodium toxicity but associated also with *Fusarium* sp.
Salih & Salih (1985).

SWAZILAND

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Minor importance.
Lin (1984), Y.P. Rao, pers. comm. 1987.

Ashy stem blight, charcoal rot: *Macrophomina phaseolina* (Tassi) Goid.
Big Bend.
Allen & Ampofo (1992).

Bacterial wilt of seedlings: *Burkholderia solanacearum* (E.F. Sm.) Yabuuchi *et al.*
Y.P. Rao, pers. comm. 1987, as *Pseudomonas solanacearum* (E.F. Sm.) E.F. Sm.

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
Lin (1984), Allen (1987*b*).

Common mosaic: Bean common mosaic virus.
Lin (1984), Y.P. Rao, pers. comm. 1987.
Pathogenicity groups IVb and VIa (Spence & Walkey, 1991).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Y.P. Rao, pers. comm. 1987.
Race 6 (IHR 2688A, J.D. Taylor 1990).
Teverson (1991), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Lin (1984), Allen (1987*b*).

Seedling mortality: *Rhizoctonia* sp.
Y.P. Rao, pers. comm. 1987.

TANZANIA

Alternaria leaf spot: *Alternaria tenuissima* (Kunze) Wiltshire, IMI 119349*a,d*, *A. alternata* (Fr.) Keissler, IMI 159445, 159944, *A. macrospora* Zimm., IMI 110997, 112075, and *Alternaria* sp., IMI 110717.
Ebbels & Allen (1979).

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Wallace & Wallace (1949), as *Isariopsis griseola* Sacc.
Ebbels & Allen (1979). A more aggressive variant reported from Arusha by Hocking (1967).

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
IMI 21059, 106512, 112167, 112168, 118796, 118797, 118798, 118799, 118803.
Wallace & Wallace (1949).

Ascochyta blight (leaf blotch, leaf spot): *Phoma exigua* Desm. var. *diversispora* (Bubák) Boerema.
Wallace & Wallace (1953), as *Ascochyta phaseolorum* Sacc. Positively identified as var. *diversispora*, coll. D.J. Allen 1985 (Gerlagh, 1987).

Ashy stem blight (charcoal rot, as 'root disease'): *Macrophomina phaseolina* (Tassi) Goid.
IMI 22161, 281338.
Wallace & Wallace (1949), Riley (1960), as *M. phaseoli* (Maubl.) Ashby.

Associated fungi: *Acremonium* sp., IMI 245763.
Arthrinium phaeospermum (Corda) M.B. Ellis, IMI 159443.
Ebbels & Allen (1979).
Botrytis cinerea Pers., IMI 73755, 118653.
Cladosporium sp., IMI 76591.
Cladosporium sphaerospermum Penz., IMI 91250*b*, 91251*b*.
Ebbels & Allen (1979).
Colletotrichum dematium (Pers.) Grove, IMI 91245.
Fusarium sulphureum Schlecht., IMI 96598.
Hyalodendron sp., IMI 279911.
Periconia byssoides Pers., IMI 76591*c*.
Verticillium sp., IMI 91257.
Ebbels & Allen (1979).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
IHR 2566A-B, 2567A-B, D.J. Allen 1989 (D.M. Teverson, pers. comm. 1993).

Cercospora leaf spot: *Cercospora canescens* Ellis & G. Mart.
IMI 112081, 119349*d*.
and *Cercospora* sp., IMI 8178a, 118680, 106747, 134068, 133602.
Ebbels & Allen (1979).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
IMI B 2702 and probably IMI B 2636, 2637, 2638, 2639, 2702.
First recorded on seed in 1964 (Ebbels & Allen, 1979) as *X. phaseoli* (E.F. Sm.) Dows. and *X. phaseoli* var. *fuscans* (Burkh.) Starr & Burkh.

Common mosaic: Bean common mosaic virus.
First reported by Wallace & Wallace (1949) and confirmed by Kulkarni (1973). Strains identified by Mink (1985), Silbernagel *et al.* (1986) and H.J. Vetten (unpubl.).
Pathogenicity groups I, III, IVb and VIa (Spence, 1992).

Damping off: *Thanatephorus cucumeris* (Frank) Donk.
Wallace & Wallace (1953), Riley (1960), as *Corticium solani* (Prill. & Delacr.) Bourd. & Galz.

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.
Wallace & Wallace (1949), as *Erostrotheca multiformis* G.H. Martin & Charles.
Riley (1960), as *Hyalodendron album* (Dowson) Diddens.
Ebbels & Allen (1979).

From stem pith and cotyledons: *Erwinia* sp., probably *E. carotovora* (Jones) Bergey *et al.*
IMI B 2835, 2836.
Ebbels & Allen (1979).

Fusarium root rot (as collar rot): *Fusarium* sp.
Riley (1960).

Grey mould: *Botrytis cinerea* Pers.
Riley (1960).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Wallace & Wallace (1949), Riley (1960), as *Pseudomonas phaseolicola* (Burkh.) Dows.
Pathogenic variation studied by Gondwe (1987), Teverson (1991) and Mabagala & Saettler (1992), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*
Race 2 (IHR 2568A, D.J. Allen 1989), race 3 (IHR 1301A, J.H.C. Davis 1984; IHR 1427A, J.D. Taylor 1985), race 4 (IHR 1727A, 1729A, D.M. Teverson 1986; IHR 2569A, D.J. Allen 1989), race 5 (IHR 99/NCPPB 1341, 1962) and race 6 (IHR 1299A, 1300A, J.H.C. Davis 1984; IHR 1303A, P. Trutmann 1984; IHR 1420A, J.D. Taylor 1985; IHR 1514B, D.J. Allen 1986; IHR 1725A, D.M. Teverson 1986; IHR 1987A, J.B. Smithson 1988).

Leaf spot: *Mycosphaerella pinodes* (Berk. & Bloxam) Vestergr.
Wallace & Wallace (1949), Riley (1960).

Mild mottle: Cowpea mild mottle virus.
Morogoro (Mink, 1985) and Lushoto, Tanga (Vetten & Allen, 1991).

Oily pod: Considered to be a physiological disorder by Riley (1960), but it seems possible that 'oily pod' was in fact a symptom from infection either with bean common mosaic virus or *Xanthomonas campestris* pv. *phaseoli*. Zaumeyer & Thomas (1948) referred to 'greasy pod' being caused by a necrosis-inducing strain of BCMV, and a greasiness of pods in common bacterial blight is well-known.

Pythium root rot (Wilt): *Pythium ultimum* Trow.
Wallace & Wallace (1953).

Powdery mildew: *Leveillula taurica* (Lév.) G. Arnaud.
IMI 73753, 8178*b*.
Riley (1960).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
IMI 65423, 112080, 126948, 126954, 126955, 126956, 126957.
Wallace & Wallace (1949), Riley (1960).
Races identified by Howland & Macartney (1966), Allen (1975b), Mmbaga & Stavely (1987). At least 25 races now recognized in Tanzania (M.T. Mmbaga, pers. comm. 1992).

Scab: *Elsinoë* sp., presumably *E. phaseoli* Jenkins.
IMI 237697.
Uyole, Mbeya 1979; also Arusha and Kilimanjaro Regions (D.J. Allen, unpubl.).

Scorch: non-parasitic.
Wallace & Wallace (1949), Riley (1960).

Southern blight: *Corticium rolfsii* Curzi.
IMI 119385, 121765, 259574.
Ebbels & Allen (1979).

Web blight: *Thanatephorus cucumeris* (Frank) Donk.
IMI 92529, 76533, 279916.

White mould: *Sclerotinia sclerotiorum* (Lib.) de Bary.
Observed on beans for the first time in 1942 in Arusha. In the same year, the fungus caused considerable damage to beans at Oldeani and near Moshi (Wallace, 1944). The disease continues to be damaging in Arusha and Kilimanjaro Regions (Msuya *et al.*, 1992).

Wilt: *Fusarium* spp.
Wallace & Wallace (1953), Riley (1960).

Yeast spot (Stigmatomycosis): *Nematospora coryli* Peglion.
Wallace & Wallace (1949).

Yellow mosaic: Bean yellow mosaic virus.
Recorded by Wallace & Wallace (1949) but, since subsequent surveys have not confirmed the presence of BYMV in Tanzania, the record has to be regarded with suspicion.

UGANDA

Angular leaf spot: *Phaeoisariopsis griseola*(Sacc.) Ferraris.
IMI 96166*b*, 102842*b*, 102825*b*, 7158*b*, 85772, 144489, 91775*b*, 93654, 93602*a*, 91347*b*, 93593*a*, 98742, 98777, 98778*a*, 98749*c*.
Hansford (1937), as *Isariopsis griseola* Sacc.

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
IMI 102877, 102878, 102879, 102880, 102881, 102882, 102883, 102884, 102885, 102887, 103577, 93602b, 98794, 102886.
Hansford (1937), as *Glomerella lindemuthianum* Shear.
Pathogenic variation studied by Leakey & Simbwa-Bunnya (1972).

Ascochyta blight (leaf spot): *Phoma exigua* Desm. var. *diversispora* (Bubák) Boerema.
IMI 91773, 91741, 91750*a*, 93582, 93622*a*, 93591, 93602*b*, 98796.
Hansford (1937), as *Ascochyta* sp. and *A. phaseolorum* Sacc.
Positive identification as var. *diversispora*, coll. nr Kabale, D.J. Allen 1985 (Gerlagh, 1987).

Ashy stem blight (charcoal rot): *Macrophomina phaseolina* (Tassi) Goid.
Hansford (1937), as *M. phaseoli* (Maubl.) Ashby.

Associated fungi: *Alternaria alternata* (Fr.) Keissler, IMI 164951, 268982.
Alternaria sp., IMI 123945.
Cladosporium sp., IMI 164959.
Colletotrichum truncatum (Schwein.) Andrus & Moore, IMI 164955.
Epicoccum nigrum Link, as *E. purpurascens* Ehrenb. ex Schlecht., IMI 93622*b*, 164961, 165518.
Gibberella sp., IMI 91381.
Glomerella cingulata (Stonem.) Spauld. & Schrenk, IMI 95999.
Mycosphaerella pinodes (Berk. & Bloxam) Vestergr., Hansford (1943).
Nematospora coryli Pegl., IMI 77422.
Phoma sorghina (Sacc.) Boerema, Dorenb. & van Kest., IMI 165526, 165517.
Phoma sp., IMI 102865, 102866, 102867, 102869, 102870, 102871, 102872, 102873, 102875, 102876, 164956.
Pleospora sp., Hansford (1937).
Speira punctulata Cooke & Ellis var. *latebrosa* Bizz., Hansford (1943).
Xylaria hypoxylon (Fr.) Grev., IMI 165539.

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
IHR 1931A-D, 1932A-D,1943A-D,1945A-D, J.D. Taylor 1987; IHR 2795A-B, 2800A-B, 2801A-B, 2811B-C, D.M. Teverson 1991.
D.M. Teverson, pers. comm. 1993.

Cercospora leaf spot: *Pseudocercospora cruenta* (Sacc.) Deighton and *Cercospora canescens* Ellis & G. Mart.
Hansford (1937), former species as *Cercospora cruenta* Sacc.

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F.Sm.) Dye.
Leakey (1973). Pathogenic variation studied by Opio (1993).

Common mosaic, black root: Bean common mosaic virus.
Kulkarni (1973). Necrosis-inducing strains predominant (Owera, 1990) and pathogenicity groups I, IVb and VIa identified (Spence & Walkey, 1991; Spence, 1992).

Dactuliophora leaf spot: *Dactuliophora tarrii* Leakey.
IMI 98272.

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.
IMI 7158*a*, 91750*b*, 101370, 102825*a*, 102842*a*, 91775*a*, 98749*b*, 96166*a*.
Hansford (1937), as *Cladosporium album* Dowson.

Golden mosaic: ? Whitefly-transmitted geminivirus.
Kabanyolo (H.J. Vetten, pers. comm. 1993).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Probably of minor importance in the hotter and lower areas (Leakey, 1970). Common and damaging in the Kigezi highlands of Kabale.
Race 3 (IHR 1334A, T.N. Sengooba 1984) and race 4 (IHR 1460A and 1490A, D.J. Allen, 1985). Teverson (1991), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

Mild mottle: Cowpea mild mottle virus.
Kabanyolo, Kampala.
Vetten & Allen (1991).

Mosaic: Bean strains of blackeye cowpea mosaic virus.
Kabanyolo (H.J. Vetten, pers. comm. 1993).

Powdery mildew: *Oidium* sp., suspected to be *Erysiphe polygoni* DC. ex St-Am.
Hansford (1937).

Root rot: *Rhizoctonia solani* Kuhn.
Hansford (1937).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
IMI 91349, 91357, 74271, 85783, 91772, 93604, 98796, 98749, 98740, 162848, 96166.
Hansford (1937).
Pathogenic variation studied by Howland & Macartney (1966).

Scab: *Elsinoë phaseoli* Jenkins.
IMI 251363.

Southern blight: *Corticium rolfsii* Curzi.
Causes damage in early growth and later to pods carried near ground under wet conditions (Leakey, 1970), as *Pellicularia rolfsii* (Sacc.) Westend.

Web blight: *Thanatephorus cucumeris* (Frank) Donk.
Kinkizi, Kabale, May 1985 (Allen & Trutmann, 1985).

ZAIRE

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
Mulungu, South Kivu (Hendrickx, 1939; Hendrickx, 1948), as *Isariopsis griseola* Sacc.
Loutu, Ndihira, North Kivu (P. Trutmann and M. Pyndji, unpubl., Pyndji, 1988).
Bas Zaire, 1985 (P. Trutmann, unpubl.).

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
Mulungu (Hendrickx, 1939); Veamba, Kivu, 1942 (Steyaert, 1948).
Goma, Loutu, Ndihira, North Kivu (P. Trutmann and M. Pyndji., unpubl.).

Ascochyta blight: *Ascochyta phaseolorum* Sacc.
Mulungu, Kivu, D.L. Hendrickx, 1939 (Hendrickx, 1948).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
IHR 2242A-B, D.M. Teverson, 1988 (Teverson, 1991).

Cercospora leaf spot: *Cercospora canescens* Ellis & G. Mart.
Mvuazi, Bas Zaire (INEAC, 1959).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
North Kivu, 1985 (P. Trutmann, unpubl.)
Bas Zaire, 1987 (P. Trutmann, unpubl.)

Common mosaic: Bean common mosaic virus.
An early report (INEAC, 1939) mentions attack by a virus disease transmitted by a jassid and a capsid at Nioka in North Kivu, and there is reference to mosaic at Mulungu, Kivu (INEAC, 1949). BCMV positively identified much more recently, and pathogenicity groups III and VIa found (Spence & Walkey, 1991; Spence, 1992).

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.
Mulungu, South Kivu; and Rushuru, Ndihira, North Kivu, 1985 (P. Trutmann, unpubl.).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Race 2 (IHR 1507A, P. Trutmann 1986), race 3 (IHR 1412A, M.A. Pastor-Corrales 1985) and race 4 (IHR 1414A, M.A. Pastor-Corrales, 1985). Teverson (1991), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

'On bean': *Phytophthora phaseoli* Thaxt.
Mulungu, Kivu (Hendrickx, 1939; Hendrickx, 1948).

'On bean': *Stagonosporopsis hortensis* (Sacc. & Malbr.) Petr.
Mulungu, Kivu (Hendrickx, 1939), as *Ascochyta boltshauseri* Sacc.

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Kasai (Steyaert, 1927 in Hendrickx, 1948); severe in Gandajika (INEAC, 1944). Mulungu, Kivu (Hendrickx, 1939).

Southern blight: *Corticium rolfsii* Curzi.
South Kivu and Bas Zaire, 1987 (P. Trutmann, unpubl.)

Web blight: *Thanatephorus cucumeris* (Frank) Donk.
Yangambi, 1956 (INEAC, 1958a), as *Rhizoctonia solani* Kuhn.
Prevalent and damaging during periods of rain (Lama, 1989).

ZAMBIA

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
IMI 103514, 87901, 55938, 85670, 89743, 89729, 90008, 90009, 95374, 130491*b*.
Central & Eastern Provinces (Riley, 1956), as *Isariopsis griseola* Sacc.

Alternaria leaf spot: *Alternaria tenuissima* (Kunze) Wiltshire, *A. solani* Sorauer, *A. tomato* (Cooke) G.F. Weber and *Alternaria* sp.
IMI 163680, 169475, 121311*b*, 68953.
Angus (1962-66).

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
IMI 68953*a*, 166107*b*.
Central & Eastern Provinces (Riley, 1956).

Ascochyta blight (leaf spot):*Phoma exigua* Desm. var. *diversispora* (Bubák) Boerema, and *Ascochyta phaseolorum* Sacc.
IMI 69319, 85698, 89773, 89777, 89789, 899986, 90009, 90010, 93582, 93591, 93602*b*, 93622*a*, 162994.
Angus (1962-66). Positive identification as var. *diversispora*, coll. at Nakonde, D.J. Allen 1985 (Gerlagh, 1987).

Ashy stem blight (charcoal rot): *Macrophomina phaseolina* (Tassi) Goid.
Central Province (Riley, 1956), as *M. phaseoli* (Maubl.) Ashby.

Associated fungi: *Aspergillus flavus* Link, IMI 92573.
Cladosporium herbarum (Pers.) Link, IMI 287637.
Colletotrichum truncatum (Schwein.) Andrus & Moore, IMI 68165, 89724, 90022.
Corticium sp., IMI 74082.
Epicoccum nigrum Link, as *E. purpurascens* Ehrenb., IMI 85685*e*.
Fusarium sp., IMI 85685*b*.
Gloeosporium sp., IMI 90019.
Phoma sp., IMI 287649.
Pleospora sp., IMI 69305*a*.
Pseudoplea trifolii (Rostr.) Petr., IMI 85695.
Angus (1962-66).
Pythium myriotylum Drechsl., IMI 184696.

Brown spot:? *Pseudomonas syringae* pv. *syringae* van Hall.
Angus (1962-66).

Cercospora leaf spot: *Cercospora canescens* Ellis & G. Mart. and *Cercospora* sp.
IMI 90020, 93860, 130493.
Angus (1962-66).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.
IMI B 12509, B 12501, 75700, 89777.
Angus (1962-66), J. Kannaiyan (pers. comm. 1989).

Floury leaf spot: *Mycovellosiella phaseoli* (Drummond) Deighton.

Angus (1962-66), as *Ramularia deusta* (Fuckel) Karakulin.

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Western & Central Provinces (Riley, 1956).
Eastern Province, race 6 (IHR 1304A and 1361A, J. Kannaiyan 1985). Teverson (1991), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

Leptosphaerulina leaf spot: *Leptosphaerulina trifolii* (Rostr.) Petr.
IMI 85695, 85685*a*.

Mosaic, black root: Bean common mosaic virus.
Central Province (Riley, 1956).
Northern Province (Angus, 1962-66).
Eastern Province.
Both serotypes A and B present (Vetten & Allen, 1991) and strains from pathogenicity groups IVb and VIa identified. Sohati *et al.* (1992), Spence (1992).

Mosaic: Cucumber mosaic virus.
Msekera, Chipata, Eastern Province (Vetten & Allen, 1991).

Mosaic: Peanut mottle virus.
Lusaka and Msekera, Chipata, Eastern Province (Vetten & Allen, 1991).

Mycosphaerella leaf spot: *Mycosphaerella pinodes* (Berk. & Bloxam) Vestergr.
IMI 93861*b*, 287635.
Angus (1962-66).

Phyllosticta leaf spot: *Phyllosticta phaseolina* Sacc. and *Phyllosticta* sp.
IMI 93858, 166107*a*.
Angus (1962-66).

Powdery mildew: *Oidium* sp. and *Phyllactinia ? corylea* (Pers.) Karst.
IMI 119634, 70818.
Angus (1962-66).

Red leaf spot: *Phoma ? sorghina* (Sacc.) Boerema, Dorenb. & van Kest.
IMI 277713.
Nr Nakonde (Greenberg *et al.*, 1973).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
IMI 89744, 89772, 90001*c*, 85713, 68164, 103514, 110743, 115404, 165201*a*.
Central & Western Provinces (Riley, 1956).
Northern & Eastern Provinces (Angus, 1962-66).

Scab: *Elsinoë phaseoli* Jenkins.
IMI 77503, 130493*a*, 130471.
Central Province (Angus, 1962-66). Northern Province, where sources of resistance were identified (Kannaiyan *et al.*, 1990).

Southern blight (stem rot or collar rot): *Corticium rolfsii* Curzi.

IMI 90021.
Angus (1962-66), as *Sclerotium rolfsii* Sacc.

Stem anthracnose: *Colletotrichum truncatum* (Schwein.) Andrus & Moore.
Angus (1962-66).

Web blight: *Thanatephorus cucumeris* (Frank) Donk.
Nr Nakonde (Greenberg *et al.*, 1983).

Wilt: *Fusarium equiseti* (Corda) Sacc.
Southern Province (Riley, 1956).

Yeast spot: *Nematospora coryli* Peglion.
Central Province (Riley, 1956).

Yellow mosaic: Bean yellow mosaic virus.
Riley (1956).
Dubious. Presence of BYMV not confirmed in recent virus surveys (Vetten & Allen, 1991).

ZIMBABWE

Alternaria leaf spot: *Alternaria solani* Sorauer, *Alternaria* sp. and *Alternaria tomato* (Cooke) G.F. Weber.
IMI 68953*b*.
Whiteside (1966), Rothwell (1983).

Angular leaf spot: *Phaeoisariopsis griseola* (Sacc.) Ferraris.
IMI 59542, 99839*b*.
Whiteside (1966), Rothwell (1983).

Anthracnose: *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara.
IMI 99839*a*, 21062.
Whiteside (1966), Rothwell (1983).

Ashy stem blight: *Macrophomina phaseolina* (Tassi) Goid.
IMI 92595.
Whiteside (1966), Rothwell (1983), as *M. phaseoli* (Maubl.) Ashby.

Bald Head: Mechanical injury to seed.
Whiteside (1966).

Brown spot: *Pseudomonas syringae* pv. *syringae* van Hall.
IHR 2692C, 2703C, J.D. Taylor 1990 (Teverson, 1991).

Cercospora leaf spot: *Cercospora canescens* Ellis & G. Mart.
Whiteside (1966), Rothwell (1983).

Common bacterial blight: *Xanthomonas campestris* pv. *phaseoli* (E.F. Sm.) Dye.

Whiteside (1966), Rothwell (1983), as *X. phaseoli* (E. F. Sm.) Dows. and *X. phaseoli* var. *fuscans* (Burkh.) Starr & Burkh.

Common mosaic: Bean common mosaic virus.
Whiteside (1966), Rothwell (1983).
Necrosis-inducing strains predominant. Pathogenicity groups I, IVa, IVb and VIa identified.
Spence & Walkey (1991), Mukoko (1992), Spence (1992).

Crown rot: *Sclerotium rolfsii* Sacc.
Archibald (1974).

Damping-off: *Pythium* sp. and *Rhizoctonia solani* Kuhn.
Whiteside (1966), Rothwell (1983).

Fusarium wilt: *Fusarium* sp.
Whiteside (1966), Rothwell (1983).

Halo blight: *Pseudomonas savastanoi* pv. *phaseolicola* (Burkh.) Gardan *et al.*
Whiteside (1966), Rothwell (1983), as *Pseudomonas phaseolicola* (Burkh.) Dows.
Race 2 (IHR 2370A, J.B. Smithson 1989; IHR 2698B and 2700A, J.D. Taylor 1990) and race 6 (IHR 2692A, 2693A, 2694A, 2698C and 2703A, J.D. Taylor 1990). Teverson (1991), as *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young *et al.*

Intumescence: Physiological.
Whiteside (1966).

Mosaic: Cucumber mosaic virus, often in mixed infections with peanut mottle virus.
Gwebi, Harare and Shamva (Vetten & Allen, 1991).

Pink rot: *Trichothecium roseum* (Pers.) Link.
Whiteside (1966), Rothwell (1983).

Rhizoctonia root rot: *Thanatephorus cucumeris* (Frank) Donk, as *Rhizoctonia solani* Kuhn.
Whiteside (1966), Rothwell (1983).

Rust: *Uromyces appendiculatus* (Pers.) Unger.
Whiteside (1966), Rothwell (1983).

Scab: *Elsinoë phaseoli* Jenkins.
IMI 56161, 56102.
Whiteside (1966), Rothwell (1983).

Southern blight (root rot): *Sclerotium rolfsii* Sacc.
Whiteside (1966), Rothwell (1983).

White mould: *Sclerotinia sclerotiorum* (Lib.) de Bary.
Rothwell (1983).

Yeast spot: *Nematospora coryli* Peglion.
Follows injury by sucking bug.
Whiteside (1966), Rothwell (1983).

FUNGAL PATHOGEN INDEX

Erysiphe polygoni DC. ex St-Am.
KE, MA, RW, UG
Fusarium equiseti (Corda) Sacc.
ZA
F. moniliforme J. Sheld.
(Teleomorph *Gibberella fujikuroi* (Sawada) Ito)
MW
F. oxysporum Schlecht.
ET, ZA
F. oxysporium Schlecht. f.sp. *phaseoli* J.B. Kendr. & W.C. Snyder
KE, RW, SY, ?SA
F. semitectum Berk. & Rav.
KE
F. solani (Mart.) Sacc.
(Teleomorph *Nectria haematococca* Berk. & Broome)
BU, ET, MW, MA, RW, SA
F. solani (Mart.) Sacc. f.sp. *phaseoli* (Burkh.) W.C. Snyder & E.C. Hansen
AN, KE
F. sulphureum Schlecht.
TZ
Fusarium sp.
MD, MO, ?SO, SD, TZ, ZA, ZW
Gibberella fujikuroi (Sawada) Ito
(Teleomorph *Fusarium moniliforme* J. Sheld.)
MW
Gibberella sp.
UG
Gloeosporium sp.
ZA
Glomerella cingulata (Stonem.) Spauld. & Schrenk.
UG
G. lindemuthianum Shear
(Putative teleomorph of *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi & Cavara)
UG
Hyalodendron album (Dowson) Diddens
(See *Mycovellosiella phaseoli* (Drummond) Deighton)
TZ
Hyalodendron sp.
TZ
Isariopsis griseola Sacc.
(See *Phaeoisariopsis griseola* (Sacc.) Ferraris)
AN, BU, KE, MA, RW, SD, UG, ZR, ZA
Leptosphaerulina trifolii (Rostr.) Petr.
KE, ZA
Leveillula taurica (Lév.) G. Arnaud
TZ
Macrophomina phaseoli (Maubl.) Ashby
(See *M. phaseolina* (Tassi) Goid.)
KE, SD, TZ, UG, ZA, ZW
M. phaseolina (Tassi) Goid.
ET, KE, LO, MA, RW, SA, SD, WD, TZ, UG, ZA, ZW
Macrosporium phaseoli Fautrey
(See *Alternaria macrospora* Zimm. ?)
SA
M. pinodes (Berk. & Bloxam) Vestergr.
ET, MW, TZ, UG, ZA
Mycovellosiella phaseoli (Drummond) Deighton
BU, ET, KE, MW, RW, TZ, UG, ZR, ZA
Nematospora coryli Peglion
KE, SA, TZ, UG, ZA, ZW
N. gossypii Ashby & Nowell
SA
Nematospora sp.
AN
Neocosmospora vasinfecta var. *vasinfecta* E.F. Sm.
(Anamorph *Cephalosporium* sp. = *Acremonium* sp.)
LO
Oidium sp.
UG, ZA
Pellicularia rolfsii (Sacc.) Westend.
(See *Corticium rolfsii* Curzi)
UG
Penicillium cyclopium Westling
KE
Periconia byssoides Pers.
ET, MW, SD, TZ
Phaeoisariopsis griseola (Sacc.) Ferraris
AN, BU, ET, KE, MD, MW, MA, MO, RW, SO, SA, SD, WD, TZ, UG, ZR, ZA, ZW
Phoma exigua Desm.
ET, KE, MO, SA
P. exigua Desm. var. *diversispora* (Bubák) Boerema
BU, KE, ?MD, RW, TZ, UG, ZA
P. phaseolina Pass.
ET
P. sorghina (Sacc.) Boerema, Dorenb. & van Kest.
ET, RW, UG, ?ZA
P. subcircinata Ellis & Everh.
SA
Phoma sp.
UG, ZA

Phyllactinia ? corylea (Pers.) Karst.
ZA
Phyllosticta phaseolina Sacc.
ET, KE, MA, SA, ZA
Phyllosticta sp.
ET, MW, ZA
Phytophthora phaseoli Thaxt.
ZR
Pleospora sp.
MA, UG, ZA
Pseudocercospora cruenta (Sacc.) Deighton
(Teleomorph *Mycosphaerella cruenta* Latham)
AN, ET, MD, SA, UG
Pseudoplea trifolii (Rostr.) Petr.
(See *Leptosphaerulina trifolii* (Rostr.) Petr.)
ZA
Pythium debaryanum Hesse
SA
P. myriotylum Drechsl.
ZA
P. spinosum Sawada
SA
P. ultimum Trow
SA, TZ
Pythium sp.
BU, KE, RW, ZW
Ramularia deusta (Fuckel) Karakulin
(See *Mycovellosiella phaseoli* (Drummond) Deighton)
ZA
R. phaseoli (Drummond) Deighton
(See *Mycovellosiella phaseoli* (Drummond) Deighton)
BU, ET, KE, MW
Rhizoctonia solani Kuhn
(Teleomorph *Thanatephorus cucumeris* (Frank) Donk)
BU, ET, KE, MO, RW, SA, UG, ZR, ZA, ZW
Rhizoctonia sp.
BU, WD
Rhizopus stolonifer (Ehrenb.) Lind
MW
Sclerotinia sclerotiorum (Lib.) de Bary
BU, ET, KE, MA, RW, SA, TZ, ZW
Sclerotium rolfsii Sacc.
(Teleomorph *Corticium rolfsii* Curzi)
AN, BU, ET, KE, MD, RW, ZA, ZW
Speira punctulata Cooke & Ellis var. *latebrosa* Bizz.
UG
Sphaceloma sp.
SA
Stagonosporopsis hortensis (Sacc. & Malbr.) Petr.
KE, ZR
Thanatephorus cucumeris (Frank) Donk
(Sclerotial state *Rhizoctonia solani* Kuhn)
BU, ET, KE, MD, MW, MA, MD, MO, RW, SA, TZ, UG, ZR, ZA, ZW
Trichothecium roseum (Pers.) Link
ZW
Uromyces appendiculatus (Pers.) Unger
AN, BU, ET, KE, LO, MD, MW, MA, MO, RW, SO, SA, SD, WD, TZ, UG, ZR, ZA, ZW
U. phaseoli (Pers.) Wint. var. *typica* Arthur
(See *U. appendiculatus* (Pers.) Unger)
ET
U. viciae-fabae (Pers.) Schroet.
?KE
Verticillium sp.
TZ
Xylaria hypoxylon (Fr.) Grev.
UG

BACTERIAL PATHOGEN INDEX

VIRUS INDEX

DISTRIBUTION OF PATHOGENIC VARIANTS

Table 1. Geographical distribution[1] of races of *Pseudomonas savastanoi* pv. *phaseolicola* in Africa (after Teverson, 1991)

Country	Races on *Phaseolus vulgaris*									Additional races on other hosts	
Burundi			3	4							
Ethiopia				4		6				2	7
Kenya				4		6	7				
Lesotho	1	2				6		8			
Madagascar										1	
Malawi		2			5				9		
Mauritius		2									
Rwanda	1	2		4							
Swaziland						6					
Tanzania		2	3	4	5	6				7	8
Uganda			3	4							
Zaire						6					
Zambia		2	3	4							
Zimbabwe		2				6					

[1] Countries in which races have been identified.

Table 2. Geographical distribution[1] of the pathogenicity groups[2] comprising bean common mosaic virus in Africa[3]

Country	Pathogenicity groups					
Burundi	I	III		IVb	Va	VIa
Ethiopia	I			IVb		
Kenya					Va	VIa
Lesotho						VIa
Malawi				IVb		VIa
Rwanda		III		IVb		VIa
South Africa					V	
Tanzania	I	III		IVb		VIa
Uganda	I			IVb		VIa
Zaire		III				VIa
Zambia				IVb		VIa
Zimbabwe	I		IVa	IVb		VIa

[1] Only countries from where BCMV strains have been positively identified.

[2] Strains representative of pathogenicity groups I(NL1), II(NL7), III(NL8), IVa(Florida), IVb(NL6), Va(NY15), Vb(NL2), VIa(NL3), VIb(NL5) and VII(NL4). Serotype A consists of temperature independent necrosis inducing strains belonging to pathogenicity groups III, VIa and VIb, whereas B serotypes belong to pathogenicity groups I, II, IVa, Va and VII which do not induce necrosis, and groups IVb and Vb which may induce necrosis at high temperatures.

[3] Sources: Edington & Whitlock (1988), Spence & Walkey (1991), Mukoko (1992), Spence (1992).

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