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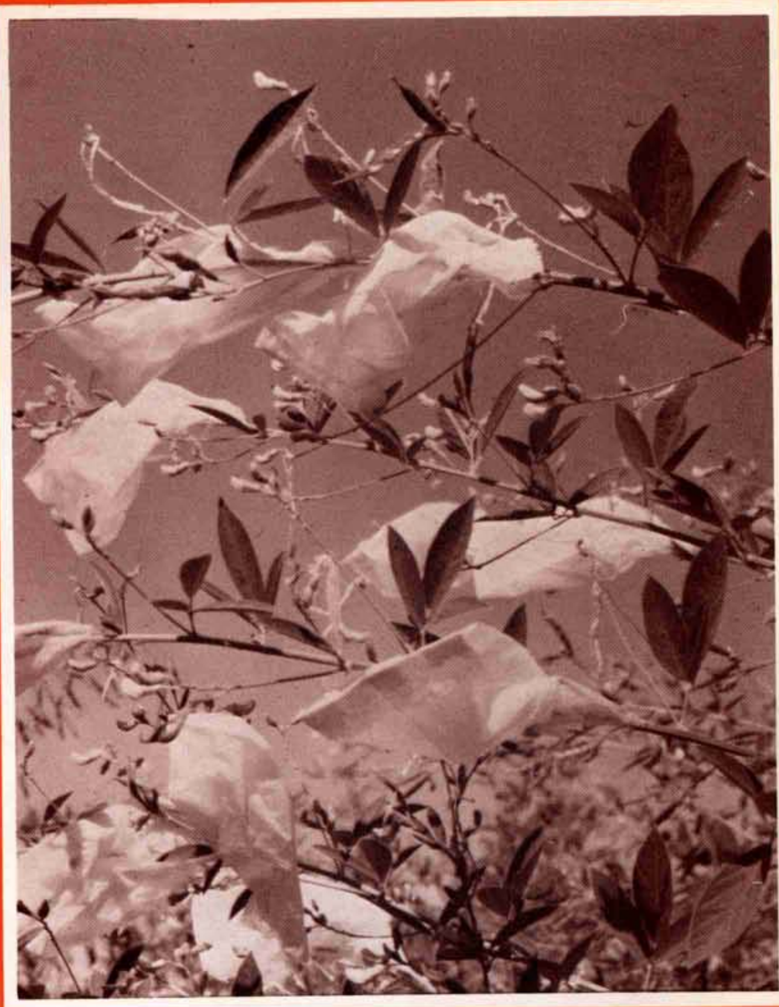

Food Legume Improvement and Development

Proceedings of a workshop held at The University of Aleppo, Syria, 2-7 May 1978

Geoffrey C. Hawtin and George J. Chancellor, Editors

CANADA

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Food Legume Diseases in Ethiopia

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The most important food legume crops in Ethiopia are grown in the highland regions, at altitudes of between 2800 and 3000 m where annual rainfall varies from 950 to 1500 mm. These crops include chick-pea (*Cicer arietinum*), broad bean (*Vicia faba*), lentil (*Lens culinaris*), grasspea (*Lathyrus sativus*), and field pea (*Pisum sativum*). Of these, chick-pea is the most important, occupying 30% of the total pulse acreage. Other relatively newly introduced species, such as soybean (*Glycine max*), cowpea (*Vigna unguiculata*), lima bean (*Phaseolus lunatus*), and haricot bean (*Phaseolus vulgaris*), are also grown on a small scale and predominantly at the lower altitudes.

The pulse improvement program in Ethiopia is still in its infancy. However, the limited studies made to date on legume crops have indicated that diseases caused by several species of soil and foliar fungi, nematodes, viruses, and mycoplasma result in serious crop losses and are a severe constraint to the more widespread and intensive cultivation of food legumes in the country.

Important Diseases

As it is the most widely grown pulse crop, chick-pea has benefited from considerably more work on its disease problems than the other food legumes. Of the diseases that cause serious yield losses in chick-peas, the complex of wilt and root rot is the most significant. These diseases, caused by a group of pathogenic fungi that include *Fusarium oxysporum*, *Sclerotium rolfsii*, *Rhizoctonia bataticola*, and *R. solani*, may result in losses of up to 80% in farmers' fields and contribute significantly to the low yields usually obtained from this crop (630–790 kg/ha). Similar problems of wilt and root rot also beset lentils, broad beans, and field peas.

Both chick-pea and safflower may suffer considerable losses from infection by a species of *Melodogyne* (the root knot nematode) and rust (*Uromyces ciceri arietini*), and more recently blight (*Ascochyta rabiei*) has been found to cause great damage under certain conditions.

On lentils, anthracnose (*Colletotrichum destructivum*), rust *Uromyces fabae*), and blight (*Ascochyta lini*) are the most significant diseases, whereas chocolate spot (*Botrytis fabae*) and rust cause the greatest yield loss in broad beans. Yield reductions of up to 35% have been caused by attacks of powdery mildew (*Erysiphe polygoni*) on field peas, and haricot beans suffer mainly from rust, anthracnose, and bacterial blights. Full details of the diseases recorded throughout Ethiopia are given in Table 1.

Studies on seed-borne microflora involving bioassays have revealed 38 fungi, 1 virus, and 1 bacteria (*Bacillus subtilis*) associated with soybean seed, and 15 fungi together with *B. subtilis* in association with seeds of chick-pea. Tests have shown that many of these fungi are pathogenic and such seeds may thus provide an important source of primary inoculum for disease development in the country.

Control Measures

Seed dressings of Furaden, Polyram combi, and Folcidin, when used in combination with insecticides, have been found to increase chick-pea yields by an average of 14% as a

TABLE 1. List of important pulse diseases recorded from surveys made between 1976 and 1977.

Chick-pea	**Field peas**
Ascochyta rabaei	*Fusarium*
Fusarium oxysporum[a]	*Oidium* spp. (*E. polygoni*)[a]
Rhizoctonia solani[a]	*Ascochyta pisi*
Rhizoctonia bataticola[a]	*Septori pisi*
Sclerotium rolfsii[a]	*Cercospora* leaf spot
Uromyces cicer arietini	*Uromyces pisi*
Leveillula taurica	
Melodogyne spp.	**Haricot beans**
Stunt virus	*Xanthomonas phaseoli*[a]
Phyllody	*Pseudomonas phaseolicola*
	Virus complex
Lentils	*Uromyces phaseoli* var. *typica*
Ascochyta lini	*Colletotrichum lindemuthianum*
Rhizoctonia solani[a]	*Fusarium* wilt
Sclerotium rolfsii[a]	
Fusarium oxysporum	**Soybeans**
Stunt virus	*Pseudomonas glycinea*
Uromyces fabae	Soybean mosaic virus
Colletotrichum destructivum	Downy mildew
Powdery mildew	*Sclerotinia sclerotium*
	Diaporthe phaseolorum var. *sojae*
Broad beans	*Macrophonina phaseolina*
Botrytis fabae[a]	*Colletotrichum dematium* var. *truncatum*
Uromyces fabae[a]	*Sclerotium rolfsii*
Sclerotium rolfsii	
Rhizoctonia bataticola	**Green pea (rough pea)**
Root knot nematodes	Rust
Erysiphe polygoni	Root rot[a]
Colletotrichum lindemuthianum	
Viruses	**Cowpea**
	Bacterial blight[a]
	Virus
	Yellowing flecks

[a] Presently identified as the most important diseases.

result of control of pathogens causing both wilt and rot and the control of soil-living insect pests. Treatments with the fungicide Thiram together with the insecticide Aldrin have also resulted in considerable yield increases (about 69%) over untreated checks.

Fungicide sprays of Tridemorph and Dinocap have given adequate control of powdery mildew, but dusting with powdered sulfur or spraying with Karathane results in much better control.

Dusting with sulfur has also been found to be useful in controlling rust diseases, but the development of resistant varieties appears to be a more practical method of consistent control. In controlling anthracnose, spraying with copper or dithiocarbamate fungicides, using disease-free seed, and planting resistant varieties have proved very effective measures. The use of disease-free seed, resistant varieties, and seed treatment with organomercurial fungicides is recommended for control of bacterial blights.

Screening of chick-pea lines for resistance to wilt, root rot, and *Ascochyta* blight is under way and has so far yielded some indication of a correlation between seed coat colour and wilt/root rot resistance, black and red seeded lines, in general, being fairly resistant to these diseases and white seeded varieties being more susceptible. Because there is a definite consumer preference for light seeded types, the combination of resistance and high yield into light seeded varieties has been a focus of previous research work.

At present, nurseries of chick-pea material from ICRISAT and of lentil material from ICARDA planted and screened in Ethiopia are yielding some promising lines. However, much more rigorous screening must be undertaken in the future to fully evaluate these varieties. Other research work currently under way includes the evaluation of field pea

lines for resistance to *Ascochyta* blight, powdery mildew, and root rot, and of haricot bean varieties for resistance to bacterial blight and viruses.

Studies of cultural practices have shown that date of planting and planting depth have a definite influence on wilt and root rot incidence and development and hence yield loss. Planting around the end of July has given significantly higher yields than when planting is delayed, and the percentage recovery of pathogenic fungi from plants was found to decrease with delay in planting. Investigations have also shown definite improvements in plant stand and seed yield to be associated with planting at a depth of 6 cm as opposed to higher (2 cm) or lower (11 cm and 15 cm) in the profile. This may be as a result of the seed being less exposed on the one hand to adverse weather conditions and on the other to the seed-rotting organisms. Losses from wilt/rot diseases may also be minimized by avoiding the planting of susceptible varieties on low-lying and wet fields.

Research Priorities

The present survey work on pulse diseases will be extended to provide adequate and up-to-date information on the important diseases and the level of losses that result from them across the country.

The collection of local germ plasm and its evaluation alongside introduced material will be continued in an effort to produce a number of high-yielding varieties resistant to the specifically important diseases that prevail in Ethiopia.

Studies on the effect of cultural practices and chemicals on disease incidence and severity will be expanded to complement the breeding and selection work and to evolve a wide range of individual and integrated control measures.

Seed inspection by the plant quarantine section of the Ministry of Agriculture will be strengthened and a seed health-testing centre needs to be established so that pathogens on imported seeds can be detected and eliminated before causing damage within the country.

These developments, it is hoped, will provide a good and solid base to pulse pathology work in Ethiopia. However, severe constraints, such as inadequate laboratory facilities, insufficient field equipment, and trained manpower, and poor access to scientific work and information generated outside the country, are at present combining to prevent the rapid evolution that is necessary within the legume improvement program as a whole. The reduction of these constraining factors will pave the way for the development of adequate, appropriate, and consistent disease control measures, which will in turn reduce limitations to more widespread and intensive production of these legume crops.