

# INHERITANCE OF RESISTANCE TO ASCOCHYTA BLIGHT IN LENTIL

Venkata R. Vakulabharanam<sup>1</sup>, A.E. Slinkard<sup>2</sup>, A. Vandenberg<sup>3</sup>

<sup>1</sup>Department of Crop Science and Plant Ecology, <sup>2</sup> & <sup>3</sup>Crop Development Centre,  
University of Saskatchewan, 51 Campus Drive, SASKATOON, SK, S7N 2R6, CANADA

## SUMMARY

Lentil (*Lens culinaris* Medik.) is a major grain legume (pulse) crop in North America. Canada is the second largest lentil producer and the largest exporter in the world (Slinkard, 1996). Ascochyta blight, caused by *Ascochyta fabae* Speg. f.sp. *lentis* Gossen, is a serious disease in Canada and in many other countries that produce lentil. The main objective of this study was to determine the mode of inheritance of resistance to ascochyta blight in lentil. Seven cultivars/lines, 4 resistant (ILL 5588, Indianhead, PI 374118 and PI 339283) and 3 susceptible (Eston, Laird and ZT4) were crossed in all possible combinations excluding reciprocals.  $F_1$  plants were grown in the greenhouse and spaced  $F_2$  plants were grown in an irrigated ascochyta nursery-.  $F_2$  plants were harvested individually and seeds were plated on agar media to determine percentage seed-borne ascochyta infection. Chi-squared test of goodness-of-fit to various one and two gene ratios were calculated. Data from  $F_2$  plants showed that resistance to ascochyta in Indianhead is governed by a single recessive gene and the resistance in ILL 5588 is governed by one or more dominant genes.  $F_{2,3}$  rows will be grown in an irrigated ascochyta nursery in the field to confirm the ascochyta ratings on individual  $F_2$  plants.

## INTRODUCTION

Lentil ranks among the oldest and the most appreciated grain legumes of the Old World. Lentil is one of the most nutritious and tasty pulses with a protein content of about 25%. Lentil is a major grain legume (pulse) crop in North America. Canada is the second largest lentil producer and the largest exporter in the World (Slinkard, 1996). Saskatchewan traditionally produces 80 to 90% of the Canadian lentil crop. Saskatchewan producers are the only ones in the World who can successfully produce Laird lentil which is the highest quality lentil in many lentil markets (Slinkard, 1996). Ascochyta blight, caused by *Ascochyta fabae* f. sp. *lentis* Gossen, is the most important disease of lentil in Western Canada. This disease can be serious, especially in wet growing seasons, and losses can be as high as 70% due to reduction in yield and quality (Gossen and Morrall, 1983). Ascochyta is specific to lentil and does not affect other pulse crops. The symptoms appear from the seedling to the mature plant stage. Spots, which are initially light grey but become tannoloured with a darker brown margin, develop on the leaflets, stems and pods. The centres of the spots are light coloured and become speckled with tiny, black fruiting bodies (pycnidia). Control measures include use of disease-free seed, crop rotation, and use of resistant cultivars. Chlorothalonil (Bravo) is a protectant fungicide which reduces disease severity and seed infection by inhibiting spore germination.

## OBJECTIVE

The main objective of this study was to determine the mode of inheritance of resistance to ascochyta blight in lentil cultivars/lines ILL 5588, Indianhead, PI 374118 and PI 339283. A second objective is to determine whether the genes for resistance in PI 374118 and PI 339283 are allelic to those in Indianhead or ILL 5588.

## MATERIALS AND METHODS

Seven lentil cultivars/lines, four resistant (ILL 5588, Indianhead, PI 374118, PI 339283) and 3 susceptible (Eston, Laird, ZT4) were crossed in a growth chamber in all possible combinations during fall, 1994-95.  $F_1$  plants of the sixteen successful crosses were grown in the greenhouse during the winter of 1994-95 and  $F_2$  plants were grown in an irrigated ascochyta nursery during the summer of 1995.  $F_2$  plants were harvested individually and 50 seeds of each plant were plated on agar media to determine percentage seedborne ascochyta infection. Fifty plants were randomly selected from each of 16 crosses for this analysis. Chisquared test of goodness-of-fit to various one and two gene ratios were calculated to determine the mode of inheritance of resistance in these various crosses. Crosses were attempted during the winter of 1995-96 to recover the missed crosses and  $F_1$  plants were grown in the greenhouse during the summer of 1996. Growth chamber screening of  $F_2$  plants is now in progress.

## RESULTS AND DISCUSSION

Analysis of parents grown in an irrigated disease nursery showed that Eston cultivar is the most susceptible parent with a disease infection of about 55% followed by Laird (23%) and ZT4 (20%). Among resistant parents, PI 339283 is the most resistant parent with zero percent infection followed by PI 374118 (0.8%) ILL 5588 (5.0%) and Indianhead (5.6%). A

seedborne ascochyta infection level of 12% was used to separate resistant and susceptible plants in the segregating populations.

The Analysis of F<sub>2</sub> plant data for 16 crosses showed that the resistance in Indianhead lentil is governed by a single recessive gene (table:1) as reported by Andrahennadi (1994). Resistance in ILL 5588 is governed by a single dominant gene in crosses with the susceptible parent Eston. However, at least two dominant genes for ascochyta resistance are segregating in crosses between ILL 5588 and the other two susceptible parents. Resistance in PI 339283 apparently is governed by two dominant genes (15:1) in crosses with both of the susceptible parents. Resistance in PI 374118 apparently is governed by one or more genes in crosses with the susceptible parent ZT4. Genes responsible for the resistance in ILL 5588 and PI 374118 apparently are the same (all:0). Individual F<sub>2</sub> plant classification will be confirmed by growing F<sub>2,3</sub> rows in an irrigated ascochyta nursery in the field in 1997.

## CONCLUSIONS

- Lentil line PI 339283 is the most resistant parent.
- Resistance in Indianhead is governed by a single recessive gene.
- Resistance in ILL 5588 is governed by one or more dominant genes.
- Resistance in PI 339283 is governed by two dominant genes.
- Genes responsible for the resistance in ILL 5588 and PI 374118 apparently are the same.

## REFERENCES

- \*Andrahennadi, C. P. 1994. Genetics and linkage of isozyme markers and resistance to seed-borne ascochyta infection in lentil. M.Sc., Thesis, University of Saskatchewan Saskatoon, Canada.
- \*Morrall, R A. A., Beaulé, R, Ahmed, S., Downing, J. L. and Pearse, P. G. 1993. Anthracnose and Ascochyta blight of lentil in Central Saskatchewan in 1992. Can. Plant Dis. Surv. 73:91-92.
- \*Pedersen E. A. and Morrall, R A. A. 1994. Effects of cultivars, leaf wetness duration, temperature and growth stage on infection and development of Ascochyta Blight in Lentil.

Table 1. Best Fit Segregation Ratios For Reaction To Seedborne Ascochyta Infection In 16 F<sub>2</sub> Populations Of Lentil

CROSS	DISEASE REACTION (Resistant : Susceptible)	CROSS	DISEASE REACTION (Resistant : Susceptible)
<b>Crosses with Indianhead</b>		<b>Crosses with PI 339283</b>	
Indianhead X Eston	1:3	PI 339283 X Eston	15:1
Indianhead X ZT4	1:3	PI 339283 x ZT4	15:1
Indianhead X Laird	1:3 *(poor fit)	PI 339283 X Indianhead	13:3
Indianhead X ILL 5588	13:3	PI 339283 XPI 374118	13:3
Indianhead X PI 339283	13:3	PI 339283 X ILL 5588	NA
Indianhead X PI 374118	NA	PI 339283 X Laird	NA
<b>Crosses with ILL 5588</b>		<b>Crosses with PI 374118</b>	
ILL 5588 X Eston	3:1	PI 374118 X ZT4	9:7
ILL 5588 X Laird	15:1	PI 374118 X ILL 5588	13:3
ILL 5588 X ZT4	15:1	PI 374118 XPI 339283	13:3
ILL 5588 X Indianhead	13:3	PI 374118 X Indianhead	NA
ILL 5588 X PI 374118	All:0	PI 374118 X Laird	NA
ILL 5588 X PI 339283	NA	PI 374118 X Eston	NA