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Slinkard, A.E.

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New *Ascochyta* Resistant Lentil Varieties

A. Slinkard and A. Vandenberg
Crop Development Centre
University of Saskatchewan
Saskatoon SK S7N 5A8

Ascochyta blight, caused by the fungus *Ascochyta babae* f.sp. *lentis*, is the most important lentil disease in Saskatchewan. Laird lentil is grown on 70 to 80% of the lentil area in Saskatchewan. It has extra large seeds that often command a premium in many export markets. When Laird was registered in 1978, it had some resistance to *ascochyta* blight, but Morrall at the University of Saskatchewan has shown that the *ascochyta* has become more aggressive on Laird lentil in recent years. The other major lentil variety in Saskatchewan is Eston and it always has been rated susceptible to *ascochyta*. In addition, the summers since 1990 have been relatively cool and moist in most of the lentil growing area of Saskatchewan, resulting in several *ascochyta* infection in many lentil fields. This has necessitated spraying of many of these fields with chlorothalonil (Bravo), sometimes twice, in order to minimize losses in yield and quality. Fungicide spraying is expensive and may cause environmental damage. Breeding of *ascochyta* resistant cultivars is the least costly and most environmentally benign method of controlling *ascochyta* blight of lentil.

Early Research

Andrahennadi (1994) studied the inheritance of *ascochyta* resistance in lentil and reported a dominant gene (**Ral₁**) from ILL 5588 lentil and a recessive gene (**ral₂**) from Indianhead lentil. He also reported a loose linkage (20 cM) between the **Ral₁** gene and the locus for the isozyme Aat-p and a loose linkage (28 cM) between the **ral₂** gene and the locus for the isozyme Pgd-p. Subsequently, the lentil breeding program released two *ascochyta* resistant lentil varieties: CDC Redwing with the dominant **Ral₁** gene from ILL 5588 lentil and CDC Matador with the recessive **ral₂** gene from Indianhead lentil. CDC Matador was released as a possible niche market type mimicking the Spanish Brown type lentil. Unfortunately, the seed coats have some tiny dark purplish flecks on the brown seed coat, and, thus, it is not acceptable in the Spanish market. In addition, it has a high frequency of somatic mutation to a black seed coat, and thus this variety never became successful. However, the outlook for CDC Redwing is much more favourable. It is the first small-seeded, red lentil developed in Canada. It was released exclusively to Saskatchewan Wheat Pool and they anticipate contracting over 8,000 ha (20,000 ac) in 1997. By fall 1997 three or four new plants capable of dehulling and splitting lentil will be constructed in Saskatchewan. They will then be able to service the domestic red split lentil market and start competing overseas in 1998.

In his Ph.D. research, Andrahennadi (1997) attempted to find random amplified polymorphic DNA (RAPD) markers closely linked with these two genes for *ascochyta*

resistance so that they could be used in a marker assisted selection program to pyramid both genes for ascochyta resistance into elite breeding lines. Unfortunately, the best he could do was find a RAPD marker linked in repulsion (14 cM) with the recessive gene (**ral₂**) for resistance to ascochyta blight. He concluded that this was close enough for a backcross breeding program, but that it would not be useful in a straight selection program or in a gene pyramiding program.

Current Status

In 1996 the Lentil Co-operative Test consisted of 24 lentil lines and yield was collected from 13 sites, including three sites in Manitoba and two irrigated sites. The yield of 14 lines from 8 dryland sites in Saskatchewan and the ascochyta ratings from 2 sites at Saskatoon are presented in Table 1. At least one high yielding entry in each market class has good ascochyta resistance (Table 1).

Small yellow lentil: Line 512-2 is a second year entry in the Lentil Co-operative Test. It was increased in Chile in the 1996-97 winter and eight breeder seed plots, each one ha in size, will be grown in 1997 for release in 1998. It was supported for registration in 1997 by the Prairie Registration Recommending Committee on Grains. Line 512-2 should replace Eston almost completely by 1999.

Small red lentil: CDC Redwing has good ascochyta resistance, but lines B-15 and 502-44 are higher yielding and line 502-44 has a higher level of ascochyta resistance than CDC Redwing. It will be retested in the 1997 Lentil Co-operative Test.

Medium yellow lentil: Three lines outyielded CDC Richlea, but one of them was susceptible to seedborne ascochyta infection. Line 638-23 will be retested in the 1997 Lentil Cooperative Test and several breeder seed plots will be grown in 1997 in anticipation of its release in 1998.

Large: Three lines outyielded Laird lentil, but one of them was susceptible to ascochyta blight (line 523-11). However, some ascochyta susceptible plant rows were removed from this line and this should make the remaining population more resistant. This reconstituted population and line 578-28 will be retested in the 1997 Lentil Cooperative Test. Breeder seed plots of both line 523-11 and line 578-28 will be grown in 1997 and one of them will likely be released in 1998.

Future

The continuing objective is to develop high yielding lentil varieties with higher levels of ascochyta resistance, to pyramid two or more genes for ascochyta resistance into elite breeding materials for a more durable type of ascochyta resistance and eventually to incorporate some resistance to anthracnose, caused by *Colletotrichum truncatum*, into these

ascochyta resistant breeding materials. Research on anthracnose resistance is being done in cooperation with Dr. Lone Buchwaldt at the University of Manitoba.

Summary

Excellent progress is being made in the development of ascochyta resistant lentil varieties. Line 512-2, an ascochyta Eston-type lentil, has been supported for registration and a major breeder seed increase program will be instituted in 1997. Line 638-23, an ascochyta resistant CDC Richlea-type lentil, is in a preliminary increase with possible 1998 release. Lines 523-11 and 578-28, two ascochyta resistant Laird-type lentils, are in a preliminary increase with possible release of the best one in 1998. When these new varieties are in full scale commercial production by the year 2001, ascochyta blight should no longer be a serious problem on lentil in Saskatchewan, unless a race change occurs rapidly.

Literature Cited

- Andrahennadi, C.P. 1994. Genetics and linkage of isozyme markers and resistance to seedborne ascochyta infection in lentil. M.Sc. thesis. University of Saskatchewan, Saskatoon.
- Andrahennadi, C.P. 1997. RAPD markers for ascochyta resistance, phylogenetic studies, and cultivar identification in lentil. Ph.D. thesis. University of Saskatchewan, Saskatoon.

Table 1. Yield, ascochyta foliage ratings and percentage seedbome ascochyta infection in selected lentil lines in the 1996 Lentil Co-operative test.

Market class/genotype	Yield ^x kg/ha	Foliage rating ^y	Seedbome ascochyta (%) ^z
<u>Small yellow</u>			
Eston	1739	10.0	32
5 12-2	2277	2.1	26
544-59	2081	2.8	14
<u>Small red</u>			
CDC Redwing	1846	1.4	6
B-15	2041	1.8	16
502-44	1924	1.1	2
<u>Medium yellow</u>			
CDC Richlea	1921	6.0	49
639-28	2316	3.2	49
638-23	2215	2.4	16
637-6	2293	2.3	21
<u>Large yellow</u>			
Laird	1582	5.4	52
532- 14	1880	3.6	24
523-1 1	1787	2.8	44
578-28	1735	1.9	18

x Average yield at eight dryland sites in Saskatchewan.

y Foliage rating as percentage diseased foliage derived from a 0-11 Horsfall Barratt scale on a whole plot basis on July 24 by R. Morrall on two ascochyta nurseries at Saskatoon in 1996.

z Seedborne ascochyta is from two ascochyta nurseries at Saskatoon by R. Morrall in 1996.