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Alternaria incidence in some alloplasmic lines of Indian mustard (*Brassica juncea* (L.) Coss.)

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Summary. The cytoplasmic substitution lines of *Brassica juncea* (L.) Coss were evaluated for their field resistance to *Alternaria blight* (*Alternaria brassicae*). The euplasmic *B. juncea* cv. 'RLM 198' had a mesothetic reaction while alloplasmic *B. juncea* lines with cytoplasms of *B. campestris, B. chinensis,* and *B. japonica* were highly susceptible. *B. nigra* cytoplasm did not have any effect on the disease reaction of the *B. juncea* genome. However, the alloplasmic lines with the cytoplasm of *B. napus* and *B. carinata* revealed a comparatively higher degree of resistance. The study underlined the utility of cytoplasmic manipulations in modifying the phenotypic expression of nuclear genes.

Key words: Indian mustard – *Brassica juncea* – *Alternaria* – Alloplasm – Nucleo-cytoplasmic interactions

Introduction

The disease epidemics of corn and pearl millet hybrids during the 1970s led to the wide recognition of cytoplasm as an alternative source of crop diversity. Cytoplasmic variability has been best documented in wheat wherein interspecific substitution backcrossing has resulted in varied phenotypic expression (Kihara 1951; Fukasawa 1959; Maan 1973). These alloplasmic wheats have been evaluated for various agronomic traits, disease reactions and other characteristics of economic consequence (Washington and Maan 1974; Busch and Maan 1978). Until the present, very limited information has been published concerning the agronomic and physiological properties of *Brassica* stocks with alien cytoplasm. This paper describes the field resistance of alloplasmic mustard lines to *Alternaria brassicae.*

Materials and methods

The genome of *Brassica juncea* (AABB) cv. 'RLM 198' was substituted into the cytoplasms of six alien species – *B. campestris* (AA), *B. chinensis* (AA), *B. japonica* (AA), *B. nigra* (BB), *B. napus* (AACC) and *B. carinata* (BBCC) – by the backcross method (Banga 1982). The total number of backcrosses with alien species varied from seven to eight. Five rows of each of the alloplasmic and euplasmic lines were grown in November 1981. Each row was alternated with an infector row of 'Ys Pb.24' (*B. campestris*). The field was heavily irrigated to ensure maximum humidity for the optimum spread of the disease. The disease reaction was noted three times during various stages of plant growth. The foliage disease intensity in percentage was calculated by using a slightly modified formula originally suggested by Gemawat and Prasad (1969).

Results and discussion

The euplasmic and alloplasmic lines of Indian mustard differed in their disease reaction to *Alternaria blight* (Table 1). The euplasmic 'RLM 198' had a mesothetic reaction but disease spread was slow. The alloplasmic *B. juncea* with the cytoplasms of *B. campestris, B. chinensis* and *B. japonica* was highly susceptible with a very fast rate of disease spread. The similar disease patterns of these cytoplasms belonging to the 'A' genome species points toward their common origin. This derives support from the proposals of Vaughan and Denford (1968) based on acrylamide gel electrophoresis. The alloplasmic line with *B. nigra* cytoplasm did not differ much from its euplasmic counterpart except for a relatively slower disease spread. The Indian mustard lines with the cytoplasms of *B. napus* and *B. carinata* revealed a higher level of resistance with a relatively lower degree of disease spread. This can be considered as a reflection of the remoteness between the cytoplasm of *B. juncea* to that of *B. napus*

Table 1. Field reaction of some alloplasmic lines of Indian mustard to *Alternaria brassicae*

Cytoplasmic donors	Disease intensity (%) (Foliage)	Disease reaction		Days to maturity	Pollen fertility (%)
		Stem	Pods		
B. juncea Cv. 'RLM 198' (Recurrent male parent)	47.52±1.59	Moderate	Moderate	134	92.30
B. campestris	69.94±3.29	Heavy	Heavy	85	78.77
B. chinensis	63.42±5.82	Heavy	Heavy	96	89.10
B. japonica	51.89±2.46	Heavy	Moderate	103	84.15
B. nigra	45.89±1.18	Moderate	Low	118	64.85
B. napus	31.82±1.42	Moderate	Low	179	0.37
B. carinata	28.13±1.19	Moderate	Traces	158	1.83
B. campestris Cv. 'Ys Pb.24' (infector row)	71.30±1.27	Heavy	Heavy	95	94.14

and *B. carinata*. In addition to diverse disease pattern, the disharmony of *B. juncea* nucleus with *B. napus* and *B. carinata* cytoplasm gave rise to male sterility. However, the similarity of the disease reaction of *B. napus* and *B. carinata* cytoplasms is also expected if we assume that the *Alternaria* reaction is not discriminant enough to distinguish between these two cytoplasms. Moreover, nuclear genomes of the polyploid species have substantial inter-genomic variability due to the multiplicity of homoeoalleles derived from their common diploid progenitors. Thus, polyploid species genomes may be less species-specific in their interaction with alien cytoplasm than with their diploid progenitors. Therefore, the interaction between polyploid nuclear genomes and the cytoplasms of two or more related species may result in similar phenotypes (Maan 1979). A decisive conclusion should be made only when the information regarding reciprocal nuclear substitution between *B. napus* and *B. carinata* is made available.

Our study supports the work of Washington and Maan (1974) in wheat, who ascertained that alien cytoplasm can modify the expression of nuclear genes of the recurrent parent. The magnitude of such modifications is, however, greatly influenced by the plasma sensitivity of such genes and their interaction with environmental conditions. This study also underlines the usefulness of cytoplasmic variability in breeding for disease resistance.

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