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Short communication

Identification of resistance to common bacterial blight disease on bean genotypes grown in Turkey

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Abstract

Common bacterial blight (CBB) in edible beans (*Phaseolus vulgaris*), incited *Xanthomonas campestris* pv. *phaseoli*, reduces bean yields and seed quality. The main objective of this study was to determine resistance to common bacterial blight in bean genotypes. Twenty-two bean genotypes grown in Turkey including common and snap bean cultivars/lines were collected from different parts of Turkey and tested for resistance against to *Xanthomonas campestris* pv. *phaseoli* strain MFD-11. All the common and snap bean lines/cultivars tested were moderately susceptible, susceptible or highly susceptible, except AG-7117 which was found resistant to *Xanthomonas campestris* pv. *phaseoli*. This is the first report of a resistance source in a common bean line (AG-7117) against *Xanthomonas campestris* pv. *phaseoli*.

Introduction

Legumes play an important role in human nutrition. Edible bean (*Phaseolus vulgaris*) is one of the most important legumes in the World due to its high commercial value, extensive production, consumer use, and nutrient value (carbohydrates, protein, minerals, and vitamins). It is traditionally a basic food crop in many developing countries, and it serves as a major plant protein source for rural and urban areas.

Diseases are important constraint affecting bean yields. Among the many diseases affecting beans, common bacterial blight (CBB), caused by *Xanthomonas campestris* pv. *phaseoli* (Xcp), is one of the most destructive bean diseases when environmental conditions are favourable for the pathogen (Zaumeyer and Thomas, 1957; Coyne et al., 1973; Yoshii et al., 1978; Webster et al., 1983). Severe disease outbreaks result in reduced yield and poor seed quality (Coyne et al., 1965).

There is no adequate chemical control for CBB. Management practices such as use of bacteria-free seed, rotation, and ploughing of infested straw have been utilized successfully in the United States of America in order to reduce losses from CBB (Suchuster and Coyne, 1981). Limited success has been achieved with pesticide applications such as bordeaux mixture, cupric hydroxide, copper oxychloride, copper sulphate, and antibiotics (Schwartz and Galvez, 1981; Saettler, 1989). Cost, potential chemical residues, and resistance among Xcp strains are the known drawbacks of chemical applications. Thus, use of bean cultivars resistant to Xcp is economically and technically the most practical method for effective management of CBB (Coyne et al., 1973; Yoshii et al., 1978; Pastor-Corrales and Abawi, 1988; Arnaud-Santana, 1992).

Some sources of resistance to Xcp have been reported in tepary bean (*Phaseolus acutifolius*) (Valladares-Sanchez et al., 1979; Schuster et al., 1983; Drijfhout and Blok, 1987; Freytag, 1989; Dursun et al., 1995; Park et al., 1998) and in common (French) bean (*Phaseolus vulgaris*) (Schuster et al., 1983; Dursun, 1994) cultivars.

Halo and common blights are two bacterial diseases causing serious decrease in yield and quality of bean

production in Turkey (Demir and Gündoğdu, 1994). Unfortunately, there have not been many studies to search resistance in bean cultivars grown in Turkey against Xcp. A few bean cultivars in Turkey have been reported to be resistant and/or slightly resistant to the halo blight disease, but none of them was found to be resistant to CBB (Benlioğlu et al., 1994).

The objective of this study was to evaluate bean cultivars/lines commonly grown in Turkey for resistance to Xcp.

Materials and methods

Twenty-two bean cultivars/lines including common bean (Dermason, Karacaşehir, Şehirali, Şeker, Şahin-90, Kirkgünlük, Battal, Barbunya, Oturak, Yalancı Dermason, Alacalı Şeker, Kurşun, Süs, and Benekli) and snap bean (Yalova-5, Yalova-17, AG-7110, and AG-7117, Ayşekadın, Arap, Polat, and Çorbalik) genotypes were collected from different parts of Turkey.

Plants were arranged separately on a greenhouse bench in a randomized complete block design using three replications. The experimental unit consisted of four plants per 20 cm (in diameter) plastic pot containing parts of sand, soil, and animal manure (1 : 1 : 1 by volume). Four-week-old plants were used for inoculation. Experiments were conducted twice for each cultivar/lines.

Xcp strain MDF-11 was used for inoculation of plants by a spraying method (Sahin and Miller, 1996). The bacterial culture was grown on yeast dextrose calcium carbonate agar (YDC) medium (Lelliot and Stead, 1987) in Petri plates for 48 h at 27 °C. Inoculated plants were maintained on the greenhouse bench and monitored for symptom development. Disease severity was assessed 21 days after inoculation by using a leaf disease rating scale: 1 = symptomless; 2 = a few necrotic spots; 3 = more than spots, some coalescing; 4 = severe spot and leaf defoliation; and 5 = plant dead. The data were evaluated by analysis of variance (ANOVA) using Minitab statistical software (Minitab, Inc. State Collage, PA). Means were separated by Fisher's Least Significant Difference (LSD) test.

Results and discussion

Characteristic symptoms of CBB were observed on inoculated plants 14–15 days after inoculation. All but one of the *Phaseolus vulgaris* cultivar/lines were susceptible to Xcp-MDF-11. The *Phaseolus vulgaris* AG-7117 genotype had no visible lesions in either experiment and was thus considered as resistant to CBB. The remaining cultivars/lines were assigned to three susceptibility groupings (moderately susceptible, susceptible, and highly susceptible) based on the Average Disease Severity Rating (ADSR) (Table 1).

Of the 21 genotypes that displayed CBB symptoms, Oturak, Barbunya, Alacalı Şeker, and Şahin-90 bean genotypes grouped as moderately susceptible, and had ADSR of 3.67 that was significantly ($P \leq 0.05$) lower than ADSRs (4.33–4.67) of highly susceptible genotypes including Kurşun, Dermason, Benekli, Karacaşehir, Süs, Şeker, Battal, Polat, Yalova17, Yalova-5, Ayşekadın, and AG-7110. The remaining cultivars, Yalancı Dermason, Şehirali, Kırkgünlük, Çorbalık, Arap with the ADSR of 4.00 were grouped as susceptible (Table 1).

Table 1. Reaction of common and snap bean cultivars/lines to Xcp strain MFD-11

Genotypes	Cultivars/lines	Mean*	Classes**
Common bean			
Oturak	Line	3.67 b	MS
Barbunya	Cultivar	3.67 b	MS
Alacalı Şeker	Line	3.67 b	MS
Kurşun	Line	4.33 c	HS
Dermason	Line	4.33 c	HS
Yalancı Dermason	Line	4.00 bc	S
Şehirali	Cultivar	4.00 bc	S
Benekli	Line	4.67 c	HS
Karacaşehir	Cultivar	4.33 c	HS
Şahin-90	Cultivar	3.67 b	MS
Süs	Line	4.33 c	HS
Şeker	Cultivar	4.33 c	HS
Battal	Line	4.67 c	HS
Kırkgünlük	Line	4.00 bc	S
Snap bean			
Çorbalık	Line	4.00 bc	S
Polat	Line	4.33 c	HS
Arap	Line	4.00 bc	S
Yalova-17	Cultivar	4.33 c	HS
Yalova-5	Cultivar	4.67 c	HS
Ayşekadın	Line	4.67 c	HS
AG-7110	Line	4.33 c	HS
AG-7117	Line	1.00 a	R

$LSD_{0.05} = 0.202$.

*Leaf disease rating scale: 1 = symptomless; 2 = a few necrotic spots; 3 = many spots, some coalescing; 4 = severe spot and leaf defoliotion; and 5 = plant dead.

**Classes: R = resistant; MS = moderately susceptible; S = susceptible; HS = highly susceptible.

In previous studies, only a few tepary (Valladares-Sanchez et al., 1979; Schuster et al., 1983; Drijfhout and Blok, 1987; Freytag, 1989; Dursun et al., 1995; Park et al., 1998) and common bean (Schuster et al., 1983; Dursun, 1994) genotypes were reported as a source of resistance genes to Xcp. None of those bean cultivars are commercially grown in Turkey. In addition, the Turkish bean cultivars tested previously showed no resistance to Xcp. Therefore, the Turkish bean cultivars/lines tested for the first time in this study resulted in the bean line, AG-7117 with a new source of resistance against Xcp. The origin of AG-7117 is not well known but it is grown from the spring to fall in all parts of Turkey as a day-neutral and determinate busy-type cultivar. However, no information is available about its resistance to diseases and pest and/or tolerance to cold, flood and other environmental stress factors.

Since there have been no studies to identify the different races among Xcp strains isolated from beans, it can be speculated that the resistance in *Phaseolus vulgaris* line AG-7117 may be significant because it can be utilized in plant breeding to develop Xcp resistant bean cultivars. However, further studies need to be performed to determine the inheritance of resistance in AG-7117. It would be useful to 'tag' the resistant genotypes for resistance to Xcp strains with molecular markers and to use these markers to pyramid resistant genes into the susceptible *Phaseolus vulgaris*.

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