ANALYSIS OF AUBERGINE GERMPLASM FOR RESISTANCE SOURCES TO BACTERIAL WILT INCITED BY *Ralstonia solanacearum*

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Bacterial wilt caused by *Ralstonia solanacearum* has become a serious threat to the profitable cultivation of aubergine in Pakistan. Management of the disease is mainly relied on chemicals and their use is often fraught with health risks. The hazardous effects of pesticides can be dispensed with using non-chemical strategies and resistant cultivars can prove a promising alternative. In the present study, twenty four aubergine cultivars were assessed for their resistance to bacterial wilt. Assessment of cultivars on the basis of disease index showed that none of the cultivar was immune, highly resistant or resistant to *R. solanacearum*. Thirteen genotypes viz. Neeli, Saravan, Purple Round, Black Round, Neelum, Kenha 91, Karishna, Violet Prince, Black Beauty, Shamli, Black Nagina, Twinke Star and Kalash F1 were found moderately resistant. Six genotypes viz. Dilnasheen, Black Long, Nirala, Purple Long, Pusa Purple and Black Beauty Long were observed as moderately susceptible while three genotypes namely Purple Queen, Purple Rani and Luffa were found susceptible. Two cultivars viz. Bemissal and Eggplant Round were detected as highly susceptible. The resistant and moderately resistant cultivars are therefore, recommended for cultivation under integrated production systems and in developing new resistant aubergine cultivars.

**Keywords:** Bacterial wilt, resistance, susceptibility, brinjal, disease index

INTRODUCTION

Aubergine, an important solanaceous vegetable, is widely cultivated in Pakistan and the area under its cultivation was 8325 hectares with 82999 tons production during 2014-15. In Punjab, the area under aubergine cultivation was 4452 hectares which produced 54159 tons of aubergine. Many biotic factors have been found to affect the successful production of aubergine including viruses (Ashfaq et al., 2015, 2017; Riaz et al., 2015), Fungi (Fateh et al., 2017), nematodes (Kayani et al., 2017, 2018; Khan et al., 2017; Mukhtar et al., 2017a,b, 2018), insect pests (Javed et al., 2017a,b; Kassi et al., 2018; Nabeel et al., 2018) and particularly bacteria (Shahbaz et al., 2015; Aslam et al., 2017a). Wilt incited by the bacterium *Ralstonia solanacearum* has been found the most disturbing and widespread diseases throughout the world damaging tomato, eggplant, chili and various solanaceous crops (Poussier et al., 1999). The pathogen has over 450 hosts resulting in heavy yield losses (Wicker et al., 2007). The disease has been reported to cause 26 percent loss of fresh fruit production of hybrid tomatoes and yield losses can go up to 90.6 percent under severe disease incidence (Artal et al., 2012). The pathogen has affected crop productivity of more than eighty countries throughout the globe causing annual losses to the tune of over one billion USD every year (Hong et al., 2012). In Pakistan, the prevalence of the disease is widespread in all the agro-ecological zones with varying intensity (Aslam et al., 2017b). The incidence and severity of bacterial wilt increased when root-knot nematodes were found present conjointly with *R. solanacearum* in many vegetables (Hussain et al., 2016; Tariq-Khan et al., 2017). The disease is commonly controlled by using chemicals which are being discouraged due to health hazards coupled with its use. The resistant cultivars can be employed as an important component in integrated disease management programs (Shahzaman et al., 2015; Rahoo et al., 2017, 2018a, b). Development of resistant varieties is the only possible and feasible way of managing this disease. Breeding for resistance requires suitable sources of resistance. For this process, the suitable sources of resistance are necessary and there is scanty information about the resistance to this disease in available aubergine germplasm in Pakistan. Therefore, the objective of the present study was to assess the degree of resistance among the available aubergine germplasm against this quarantine pathogen.

MATERIALS AND METHODS

**Germplasm collection:** Aubergine germplasm comprising 24 cultivars and genotypes (Table 1) was collected from Federal Seed Certification and Registration Department, Islamabad; National Agricultural Research Center, Islamabad; Punjab Seed Cooperation, Ayub Agricultural Research Institute, Faisalabad and local markets.
Assessment of resistance to *R. solanacearum* in aubergine germplasm: The screening of aubergine germplasm was done in polythene bags measuring 12.75x10.15 cm. The bags were filled with sterilized soil containing 3:1:1 sand, silt and compost respectively. Three week old seedlings were transferred individually to polythene bags. There were five replications for each treatment. The bags were arranged randomly in a glasshouse at a temperature of 25°C and were properly moistened in alternative days. One week after transplantation, the plants of each cultivar were inoculated with bacterial culture containing 1x10^7 cfu/ml through soil drenching as described by Aslam et al. (2017a). After inoculation, the plants were watered at alternative days and the wilt symptoms and wilted plants were recorded and graded with disease rating scale of 0-5 (Winstead and Kelman, 1952). The disease index of bacterial wilt of each cultivar was calculated and the germplasm were then categorized following the scale described by Aslam et al. (2017b).

**RESULTS**

Reaction of aubergine germplasm to *Ralstonia solanacearum*: The results regarding the response of aubergine germplasm to *R. solanacearum* has been summarized in Table 2. Assessment of cultivars on the basis of disease index (Table 1) showed that none of the cultivar was immune, highly resistant or resistant to *R. solanacearum*. Thirteen genotypes viz. Neeli, Saravan, Purple Round, Black Round, Neelum, Kenha 91, Karishna, Violet Prince, Black Beauty, Shamli, Black Nagina, Twinkle Star and Kalash F1 were found moderately resistant. Six genotypes viz. Dilnasheen, Black Long, Nirala, Purple Long, Pusa Purple and Black Beauty Long were observed as moderately susceptible while three genotypes namely Purple Queen, Purple Rani and Luffa were found susceptible. Two cultivars viz. Bemissal and Eggplant Round were detected as highly susceptible with disease index of 0.85 and 0.88 respectively.

**DISCUSSION**

Among different management strategies for bacterial wilt in
aubergine, use of resistant cultivars is a cheap, eco-friendly and durable. In many countries, the researchers have tried to identify resistant sources in aubergine against R. solanacearum (Rahman et al., 2011; Gopalakrishnan et al., 2014; Bhavana and Singh, 2016). In the present studies, some of the tested aubergine cultivars showed moderately resistant reactions against R. solanacearum. Resistance against R. solanacearum is due to certain genes. Grimault et al. (1995) found that a single dominant gene is responsible for resistance in tomato to bacterial wilt. Momma et al. (1997) observed that resistance to bacterial wilt is partially recessive whereas Oliveira et al. (1999) reported additive effects of genes for resistance against the disease. Previously Singh (1961) while working with the Hawaii and North Carolina germplasm resistant to bacterial wilt had indicated that resistance in tomato to the disease is due to recessive genes while Acosta et al. (1964) reported the involvement of a relatively small number of genes with major effects in resistance. This shows that a simple genetic control may underlie the resistance to bacterial wilt in some resistant stocks originating from the tropical areas (Tikoo et al., 1990). Plants frequently encounter many stress stimuli including pathogenic infection. As a result, the hosts respond to these cues by triggering a series of pathogen inducible enzymes and other chemicals which have been found implicated in defending the host against the pathogens. The expressions of these defense enzymes and chemicals at initial stages and elevated levels are an important characteristic of host resistance to phytopathogens. The resistance to bacterial wilt is strain specific and temperature dependent as has been observed in potato (French and De Lindo, 1982). Environmental conditions and locations also influence resistance against bacterial wilt. Hanson et al. (1996) reported variable reaction of tomato lines to bacterial wilt evaluated at several locations in Southeast Asia. They found that tomato lines which were resistant to bacterial wilt in Malaysia and Taiwan showed susceptible reactions in Philippine and Indonesia. This recommends that the germplasm should be evaluated at its local conditions against particular isolates of the pathogen of that area.

Conclusion: It is concluded from the present assessment that aubergine cultivars showed variations in their resistance response to R. solanacearum. Thirteen genotypes viz. Neeli, Saravan, Purple Round, Black Round, Neelum, Kenha 91, Karishma, Violet Prince, Black Beauty, Shamli, Black Nagina, Twinkle Star and Kalash F1 were found moderately resistant and therefore, are recommended for cultivation under integrated production systems and in developing new resistant aubergine cultivars.

REFERENCES


