Registration of ‘Verano’ White Bean

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ABSTRACT

‘Verano’, Reg. No. CV-282, PI 653706, a multiple disease resistant white bean (Phaseolus vulgaris L.) cultivar adapted to the humid tropics, was developed and released in 2007 cooperatively by the University of Puerto Rico Agricultural Experiment Station and the USDA-ARS. Verano has tolerance to high temperature and resistance to Bean golden yellow mosaic virus, a whitefly [Bemisia tabaci (Gennadius)]-transmitted begomovirus, Bean common mosaic virus, and common bacterial blight [caused by Xanthomonas axonopodis pv. phaseoli (Smith) Dye]. The release and adoption of a high temperature–tolerant cultivar such as Verano will improve yield and seed quality of green-shelled beans produced in Puerto Rico. Verano possesses traits that may be useful to breeding programs where high temperature, viral diseases, and common bacterial blight limit bean production.

‘V’erano’ (Reg. No. CV-282, PI 653706), a multiple disease resistant white bean (Phaseolus vulgaris L.) adapted to the humid tropics, was developed and released cooperatively by the University of Puerto Rico (UPR) Agricultural Experiment Station and the USDA-ARS. Verano has tolerance to high temperature and resistance to Bean golden yellow mosaic virus (BGYMV), a begomovirus transmitted by whitefly [Bemisia tabaci (Gennadius)], Bean common mosaic virus (BCMV), and common bacterial blight [caused by Xanthomonas axonopodis pv. phaseoli (Smith) Dye].

Verano (UPR breeding line PR0443-48 [PR0528-(36-43)] was derived from the cross DOR 364/WBB-20-1/’Don Silvio’/VAX 6. DOR 364 (released in Honduras as ‘Dorado’ [Rosas et al., 2004]), is a small red breeding line from the International Center for Tropical Agriculture (CIAT) that was selected for resistance to BGYMV and heat tolerance (Singh et al., 2000; Miklas et al., 2000). WBB-20-1 is a white-seeded bean breeding line developed and released by the UPR in collaboration with the USDA-ARS that has resistance to common bacterial blight derived from P. cocineus (Zapata et al., 2004). Don Silvio (CIAT bean breeding line DOR 482) has the bgm (Velez et al., 1998), and Bgp-1 (Acevedo-Román et al., 2004) genes and the SW12 quantitative trait locus (QTL) (Singh et al., 2000) for resistance to BGYMV. VAX 6 is a small red bean breeding line from CIAT that has erect architecture, heat tolerance, and common bacterial blight resistance derived from P. acutifolius (Singh and Muñoz, 1999). The release of Verano will increase yield and reduce seed quality losses and benefit green-shelled bean producers in Puerto Rico.

Methods

The F1 nursery was planted at the UPR Substation at Isabelia, PR, in October 2000. Individual plants having desirable agronomic traits and white seed were selected from the F1 nursery, which was planted at the Isabelia Substation in October 2001. Pedigree selection was used in the F3, F4, and F5 generations to identify plants with disease resistance and desirable agronomic and seed traits. The most promising F5 lines were bulked in a nursery planted at the Isabelia Substation in June 2004.

During winter 2004–2005, the F1 lines were screened using sequence characterized amplified region (SCAR) markers to identify genes and QTLs for resistance to disease. The SR2 SCAR (Blair et al., 2007; Urrea et al., 1996) showed the presence of the bgm gene for resistance to BGYMV in PR0443-48. PR0443-48 carried the SAP6 SCAR (Miklas et al., 2000) but not the SU91 SCAR (Pedraza et al., 1997) markers linked to independent QTLs for common bacterial blight resistance.
PR0443-48 was mechanically inoculated with the NL3 strain of Bean common mosaic necrosis virus in a greenhouse at the UPR Mayaguez Campus. The lethal hypersensitive reaction suggested PR0443-48 had the dominant I gene for resistance to BCMV. The presence of the I gene was confirmed by the SW13 SCAR marker (Melotto et al., 1996).

PR0443-48 was screened for reaction to common bacterial blight in a greenhouse at the USDA-ARS Tropical Agriculture Research Station using Xanthomonas axonopodis pv. phaseoli (Xcp) strains 484a and 3353. The multiple needle method was used to inoculate the leaves and laceration with a pipet tip on the pod surface for pod inoculation (Zapata et al., 2007). The lines were screened for leaf reaction in the first trial and evaluated for both leaf and pod reaction in a second trial conducted in a greenhouse at the USDA-ARS Tropical Agriculture Research Station during winter 2004–2005. A randomized complete block design with two replications in the first trial and four replications in the second trial was used. The experimental unit was two bean plants planted in a 20-cm-diam. pot in the first trial and a single plant in a 15-cm pot in the second trial. At 9 d after inoculation, leaves were evaluated for common bacterial blight (CBB) reaction using a scale of 1 to 9, where 1 = no symptoms and 9 = systemic infection causing complete infection of the leaf (van Schoonhoven and Pastor-Corrales, 1987). A score ≤ 3 was considered to be a resistant reaction. Least significant differences (P ≤ 0.05) were used to compare mean CBB reactions of the bean lines. VAX 6 was used as a resistant check. When inoculated with Xcp 484a, Verano had a mean leaf score of 2.8 for both the first and second evaluation and a mean pod score of 1.0 (Table 1). When inoculated with Xcp 3353, Verano had a mean leaf score of 2.8 for the first and 1.8 for the second evaluation and a mean pod score of 1.1 (Table 1). Verano did not develop CBB symptoms on pods or leaves in field trials conducted at Isabela, Puerto Rico.

**Characteristics**

The performance of Verano was evaluated in seven seed yield trials conducted in Puerto Rico. The trials used a randomized complete block design with six replications. Least significant differences (P ≤ 0.05) were used to compare mean seed yields of the lines. Verano produced a mean seed yield of 2241 kg ha⁻¹ compared with a mean seed yield of 1792 kg ha⁻¹ for the white-seeded cultivar Morales (Beaver and Miklas, 1999; Table 2). When planted at the Isabela Substation during the hot (>30/20°C day/night, Goyal et al. [1988]) and humid (>125 mm mean monthly precipitation, Ravalo et al. [1986]) summer growing season, Verano produced a mean seed yield of 1912 kg ha⁻¹, whereas Morales produced a mean seed yield of 1325 kg ha⁻¹. Mean temperatures for the summer plantings exceeded 30/20°C (maximum/minimum) (Table 3). Singh (2001) noted that in the tropical lowlands (<650 m in elevation) maximum day temperatures greater than 30°C and minimum night temperatures greater than 20°C can severely reduce bean seed yield. We have observed that bean cultivars from the United States and Canada generally have very poor pod set when planted in Puerto Rico during the summer months. In a higher-yield environment (November 2005, Table 2), Verano averaged 3179 kg ha⁻¹, and Morales produced a mean seed yield of 2586 kg ha⁻¹. In field trials conducted at the Isabela Substation during winter 2006–2007, Verano was susceptible to an endemic race of bean rust caused by Uromyces appendiculatus (Pers.) Unger. However, the level of infection during pod fill was low (3%). The only white-seeded line with resistance to rust during that growing season was BelMiDak RMR 12, which combines the Ur-11 and Ur-4 rust resistance genes (Pastor-Corrales, 2003).

Verano has an indeterminate, upright, Type IIb to Type IIIa growth habit with a short vine. It flowers 35 d and matures 74 d after planting. It has an ovoid seed,
averaging 22 g 100 seed⁻¹. Verano has a white seed coat color that is commercially acceptable in Puerto Rico and other Caribbean countries.

**Availability**

Small amounts of seed of Verano may be obtained from the corresponding author. Plant variety protection will not be sought for this cultivar.

**References**


