THE WEB BLIGHT PATHOGEN: ITS EFFECT ON COMMON BEAN SEED QUALITY, GERMINATION AND EARLY DISEASE DEVELOPMENT.

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Web blight (WB) of common bean, Phaseolus vulgaris L., caused by Thanatephorus cucumeris (Frank) Donk. [anamorph: Rhizoctonia solani Kuhn] is a yield-limiting disease in Central America and the Caribbean (4). We reported in the Dominican Republic (DR) in 1992 that in addition to seed yield reduction, the WB pathogen depressed seed quality by blemishing and or discoloring the seed coat of white- and colored- seeded genotypes. (7). This paper presents a 2-year laboratory and screenhouse study to determine 1) if seedborne isolates of the WB pathogen, belonging to R. solani AG-1-IB, can cause bean seed coat damage and affect subsequent seed germination and seedling establishment, and 2) if white- and colored-seeded genotypes differ in their degree of seed infection by this pathogen.

MATERIALS AND METHODS

Seeds were collected in 1992 and 1993 from pods (not in contact with soil) of WB-infected bean genotypes grown in replicated plots the San Juan Valley (400 masl), DR. The predominant WB pathogen was the AG-1-IB microsclerotia type at the experimental site. The genotypes were: Arroyo Loro and Anacaona (white seed); H-270 and HT-7719 (black seed) and PR-PC-450 and PC-50 (red mottled seed). Seeds collected from WB-infected plants were divided into two categories: 1) blemished seeds with yellow-tan spots or discolored areas on the seed coat, 2) unblemished seeds with no obvious discoloration. Seeds with normal seed coat color from healthy plants in a field without a WB history was a third seed category. All seeds were similar in size and shape.

The WB pathogen in/on seeds was isolated by placing 3800 seeds representing year-seed category-genotype combinations on semiselective media (7). Plates were incubated at 25-28 C for 48 h after which Rhizoctonia-like colonies were counted and transferred to potato dextrose agar (PDA) for AG-typing and determination of cultural characteristics (10).

Pathogenicity of T.cucumeris seed isolates was assessed as previously reported (6). The effect of seedborne T. cucumeris on seed germination and seedling survival and growth was also tested in a screenhouse. Seeds,same in type and numbers as in the pathogen isolation test, were planted in 20 cm dia. plastic pots. Each pot contained 15 seeds and pots were arranged in a randomized complete block design(RCBD) with a factorial arrangement with seven replications. Humidity was maintained above 80% and temperature below 30 C. Numbers of seedlings were counted 7-9 days after emergence. Seedling survival, height and fresh top weight and fresh root weight were determined 2 weeks after emergence.

The effect of T. cucumeris soil inoculum was determined on seedlings of PC-50, H-270 and Anacaona. Inocula of two WB isolates, BV (AG-1-IB) and LV (AG-2) and a seedborne isolate SD-SCR (AG-4) were grown on oat seeds (10). Fifteen seeds of each line/cv were planted into plastic pots containing 0, 50 and 100 oat seed propagules/kg of soil. Pots were arranged in a RCBD with a 3^3 factorial treatment arrangement of the factors isolate, inoculum level and genotype.Data collection was similar to that in the seed germination and seedling growth experiment. Weighted-least squares for categorical responses and contrasts were used to evaluate the effects of blemished/unblemished seeds and genotypes on the probability of recovery of the WB pathogen. Analysis of variance and contrasts were used to evaluate main effects and interactions from the screenhouse experiments. Data from each year were analyzed separately.

RESULTS AND DISCUSSIONS

Thanatephorus cucumeris (=R.solani AG-1-IB microsclerotia type) was isolated more often from blemished or discolored than unblemished seeds collected from infected plants ($P < 0.05$). The WB pathogen caused unusual pigmentation and/or discoloration of white and colored seeds. Therefore, T. cucumeris not only suppresses bean yield but also reduces quality and market value of bean seed.

The WB pathogen affected bean seed quality regardless of seed coat color or genotype. Previous reports (9) suggested that phenolic compounds in pigments of colored-seeded bean genotypes conferred resistance to R.solani. Our results suggest that seed coat color is not associated with or does not confer resistance to seed infection by the WB pathogen. Other factors, independent of seed coat color, may be involved in this resistance.

Low levels of the WB pathogen also were detected in apparently healthy seeds obtained from infected plants. The presence of the WB pathogen in clean seeds has implications for the spread of the pathogen from one region to another. All of the isolates obtained from the six varieties/lines were pathogenic on bean plants. Thus, the seed is a favorable ecological niche for virulent isolates of the WB pathogen.

Seedborne isolates of the WB pathogen associated with blemished/discolored seeds significantly ($P < 0.05$) reduced germination, and produced seedlings with reduced survival and growth when compared with plantings of unblemished and control seeds. Seed category-by-genotype interaction was significant in both years for all response variables except root weight. These interactions indicated that blemishing affected the genotypes differentially.

Isolates of the WB pathogen (AG-1-IB and AG-2-2) in soil did not significantly reduced either germination or seedling survival. High inoculum levels of these isolates slightly reduced seedling height and top weight. This agrees with other reports (1,11). In field studies the WB pathogen was associated mainly with the aerial portion of the plant and found at very low populations in soil (2,3,5); therefore, damage to seedlings or below ground plant parts is unlikely under field conditions.

In contrast to the WB isolates, the seed isolate (AG-4) was very detrimental to seed germination and seedling development. Isolates of this group are mainly associated with soil and damped-off plants and root rots (8).

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