First Report of the Natural Occurrence of Soybean Bacterial Wilt Isolates Pathogenic to Dry Beans in Nebraska

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Dry Bean Wilt

Bacterial wilt of dry edible beans, caused by Curtobacterium flaccumfaciens pv. flaccumfaciens (Cff), was an endemic problem in Nebraska dry bean production in the 1970s, but essentially disappeared (i.e. would only sporadically appear in seed and had no detectable effect on yield) with implementation of seed sanitation and crop rotation. Over the last 4 years, the pathogen has re-emerged in the Central High Plains (Nebraska, Colorado, and Wyoming) and has been identified from more than 300 fields of multiple dry bean market classes and seed sources (1,2). Affected plants exhibit field symptoms consisting of wilting and/or interveinal necrosis surrounded by yellow borders (Fig. 1) (1,2).

Soybean Wilt

Three separate bacterial wilt diseases of soybeans have been reported from several locations in the world (4), but they are extremely uncommon in soybean production. These include two wilt-type diseases caused by the seedborne pathogen Curtobacterium flaccumfaciens pv. flaccumfaciens (Cff), or Ralstonia solanacearum, and a third referred to as bacterial tan spot, also caused by Curtobacterium flaccumfaciens pv. flaccumfaciens (4).

During the 2005-2006 growing seasons, soybean plants exhibiting yellowing and wilting (Fig. 2A) and leaf necrosis (“firing”) with yellow borders (Fig. 2B) were observed in irrigated western Nebraska production fields. Isolations on nutrient-broth yeast extract (NBY) medium from symptomatic plants yielded gram-positive bacteria closely resembling (morphologically, culturally, and biochemically) pathogenic isolates associated with bacterial wilt of dry beans (2).
Testing Pathogenicity

Four soybean isolates collected from separate western Nebraska soybean fields and counties (Box Butte, Keith, Perkins, and Scotts Bluff) were tested for pathogenicity on soybeans and dry beans. The dry beans tested included light red kidney (‘776’), Great Northern (‘Orion’), and yellow (‘Enola’). Sterile needles were dipped into bacterial colonies from 48-h cultures and inserted into stems just below the first fully expanded trifoliolate. Plants punctured with needles dipped in sterile water served as controls. Plants were incubated in growth chambers with a 12-h light/dark cycle and a temperature of 27.5 ± 2°C.

Symptoms on dry beans inoculated with soybean isolates first appeared within 7 days after inoculation followed by wilting and mortality within 2 weeks (Figs. 3A and 3B). Symptoms on soybeans were slower to develop (3 to 4 weeks), and isolates from both soybeans and dry beans caused wilting and firing (Fig. 4) but no plant death. In comparison, a highly virulent Great Northern isolate (positive control) caused wilting and death of dry bean within 10 to 14 days (Fig. 3C) and wilting of soybean, as shown in Figure 4, within 18 to 20 days. Although Koch’s postulates were fulfilled with soybean and dry bean bacterial isolates for both crops, the relationship among isolates is unclear. This species includes a group of closely-related pathogens, subdivided into pathovars based on host range differences. A high degree of variation among Cff isolates has been reported from molecular-based studies (3), further complicating interpretation of these results.
None of the soybean wilt pathogens are commonly found in midwestern soybean crops. This is the first report of naturally-infected US soybean fields in at least 25 years and the first ever for Nebraska. This is also the first report of naturally-occurring soybean wilt isolates being pathogenic to dry beans. The severity of the damage on dry beans has been well documented (1,2). However, the potential for future problems in soybean production in Nebraska and elsewhere is unknown. Crop rotation may affect disease severity and pathogen survival in these two crops, since there are several regions in Nebraska where the two crops may overlap. Currently, the source of inoculum is not established, but the unique presence of both dry bean and soybean pathogens in production fields warrants investigation of the relationships among isolates.

**Literature Cited**