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## Atelier : Protection des cultures

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### Studies on verticillium wilt in Andalucia - Southern Spain

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*Verticillium* wilt of cotton (*Gossypium hirsutum* L.), induced by *Verticillium dahliae* Kleb., occurs in most parts of the world and it is considered one of the most important diseases affecting cotton production. In Spain, *Verticillium* wilt was first found in some cotton fields to the northeast of the country more than 30 years ago. However, no research have been done on the disease until very recently, particularly in Andalucía, southern Spain, where most of the cotton is grown.

We present an overview of our research on *Verticillium* wilt of cotton in Andalucía, that we have carried out since 1980. Our research deals with the importance and distribution of the disease, pathogenic variability in the pathogen populations and influence of irrigation management on wilt epidemics.

Systematic disease surveys were carried out in 85 fields randomly chosen along the Guadalquivir Valley, the main cotton growing area of Andalucía, from 1981 to 1983. Disease incidence and severity were assessed in each field at the time of boll formation and detailed observations on symptoms development were made. Samples of affected tissues were taken for isolation of the pathogen in the laboratory.

Symptoms observed in affected plants closely resembled those described in the literature for *Verticillium* wilt of cotton.

*Verticillium dahliae* was consistently isolated from affected plants and a sample of isolates proved pathogenic to "Coker 310" in pathogenicity tests.

The disease was most prevalent in the upper Guadalquivir over the 3 year of the surveys. Frequency of affected fields varied 76-82% and disease incidence fluctuated 18-19%, depending upon years. Average disease severity in individual symptomatic plants was about 3.0 within a scale 1-5 (1 = no symptoms, 5 = dead plants), which corresponds to the lower 2/3 of the plant with foliar symptoms. However, some fields had a disease incidence higher than 90%, with plants almost completely defoliated or dead.

Virulence of a number of *V. dahliae* isolates representing a geographical range was investigated on several cotton cvs including "Coker 310", "PI-70-110", and "Acala cvs 4-42, SJ-2, SJ-5", and "SJC-1". Experiments were carried out in growth chambers and in the greenhouse. 3-4 weeks old plants were inoculated by injecting two drops of inoculum suspension ( $3 \times 10^6$  conidia/ml) in the hypocotyl or epicotyl with a hypodermic syringe. Disease reactions were

assessed on the 1-5 scale 4 to 5 weeks after inoculation.

Isolates of *V. dahliae* were characterized regarding their micro-sclerotium morphology and *in vitro* growth temperature. Morphology of *microsclerotia* was studied in 3 week old cultures grown on water agar (WA) at 24 C in petri plates. Colony diameter was determined at several times in cultures grown on potato-dextrose agar at 20, 24 and 27 C in petri dishes.

Disease reactions on inoculated cotton cvs allowed to differentiate three groups of *V. dahliae* isolates, i.e., a) Isolates mildly virulent, which cause foliar symptoms restricted to the lower leaves ; b) Isolates highly virulent, which cause plant death but no defoliation in cvs tolerant to mild isolates ; and c) Isolates highly virulent, which cause defoliation and early plant death in cvs tolerant to mild isolates.

Defoliating isolates form elongated, linear *microsclerotia* on WA and grow faster at 27 C than at 24 C. All other isolates form found *microsclerotia* and grow more at 24 C than at 27 C.

The influence of irrigation management on *Verticillium* wilt was investigated under field conditions. Cotton cvs "Acala SJC-1" and "Coker 310" tolerant and susceptible, respectively, to mild isolates, but susceptible to highly virulent isolates were used. Plots were infested with a virulent non-defoliating isolate at a depth of 20 cm in the row. Plots were sprinkler irrigated at each of three seasonal irrigation depths (334, 468, 581 mm) applied at high (twice a week), or low (every 10-14 days) frequency. Disease incidence and severity in

irrigated plots were determined at 10-day intervals during the crop cycle.

Incidence and severity of *Verticillium* wilt were higher for "Coker 310" than for "Acala SJC-1" irrespective of irrigation treatments. However, disease incidence and severity increased with the irrigation depth for both cvs. Overall, the epidemic development of *Verticillium* wilt was more influenced by the irrigation depth than by the irrigation frequency, although such influence varied depending upon the cvs used.

Our results indicate that *Verticillium* wilt occurs widespread in the cotton growing area of Andalucia, with moderate to high incidence. Isolates of *V. dahliae* infecting cotton vary in virulence, some of them being as virulent as those reported in the U.S. All highly virulent defoliating isolates found up to now appear to be confined to a restricted zone to the south of the Guadalquivir Valley. More research is needed regarding irrigation management disease relationships. However, our preliminary results suggest that proper management of irrigation may contribute to reduce incidence and severity of *Verticillium* wilt of cotton under condition prevalent in Andalucia.

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