

Infection and colonization of pigeonpea genotypes with different degrees of susceptibility to wilt by *Fusarium udum**

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Wilt caused by *Fusarium udum* Butler is one of the major diseases of pigeonpea in India, Nepal, Kenya, Malawi, Tanzania and Uganda (2). Breeding cultivars resistant to wilt has been the major strategy for management of the disease and several sources of resistance (<20% wilt) identified and resistant cultivars (1,3,4,5,6,7) developed. While screening the world collection of germplasm and many breeding lines at ICRISAT Asia Centre (IAC), Patancheru, some lines/cultivars were found to consistently show low wilt (<40%) compared to more than 80% wilt in the susceptible lines. To determine the role of infection and colonization of the plant by the pathogen in wilt incidence, a field experiment was conducted during 1990 and 1991 rainy seasons at IAC, Patancheru.

Four pigeonpea cultivars with different degrees of susceptibility to wilt, ICP 2376 (medium-duration, susceptible), ICP 87 (short-duration, moderately susceptible), C 11 (medium-duration, moderately susceptible) and ICP 8863 (medium-duration, resistant) were sown in a randomized block design in both Alfisol and Vertisol wilt-sick plots (at IAC, Patancheru) with three replications in the 1990 rainy

season and four replications in the 1991 season. The plot size was 30 m² with five rows of 4 m each. The inter- and intra-row spacing was 60 and 20 cm respectively. The trials were sown in the first fortnight of June in both years. To determine the extent of infection and colonization of plants by the fungus, five plants (apparently healthy) were randomly uprooted at monthly intervals from each plot starting one month after sowing until harvest. Samples from root, collar, midstem and tip regions were plated on PDA separately after surface disinfection with 2.5% sodium hypochlorite and incubated at 30°C for 4 days. The frequency of plant parts colonized by the fungus was calculated for each cultivar. Simultaneously, wilt incidence in the field was also recorded. The first observation was recorded on 15 July and the final on 15 December. After the last observation, plants of all the cultivars were split open and the extent of browning and blackening of the xylem was recorded.

Since the pattern of wilt incidence and colonization in the four cultivars used in the study was similar in the two soils and seasons, average incidence and colonization were considered for interpretation of the results. Although, the data on

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Table 1. Wilt incidence and *Fusarium udum* colonization of four pigeonpea cultivars one month after sowing and at maturity in wilt sick plots, ICRISAT Asia Center, 1990 and 1991

| Pigeonpea cultivar | Wilt incidence (%) ¹ | Frequency of plants colonized by <i>F. udum</i> (%)* one month after sowing | | | | | Mean | Wilt incidence (%) ¹ | Frequency of plant colonized by <i>F. udum</i> (%)* at maturity | | | | |
|--------------------|---------------------------------|---|---------|---------|---------|-------|---------|---------------------------------|---|---------|-----|------|--|
| | | Root | Collar | Midstem | Tip | Root | | | Collar | Midstem | Tip | Mean | |
| ICP 2376 | 8 | 64 | 78 | 31 | 24 | 49 | 83 | 62 | 60 | 49 | 42 | 53 | |
| ICPL 87 | 0 | 60 | 75 | 20 | 27 | 45 | 62 | 57 | 51 | 35 | 42 | 46 | |
| C 11 | 7 | 42 | 85 | 56 | 12 | 49 | 60 | 60 | 65 | 29 | 17 | 43 | |
| ICP 8863 | 0 | 59 | 58 | 9 | 21 | 37 | 7 | 61 | 61 | 39 | 39 | 50 | |
| Mean | | 56 | 74 | 20 | 21 | 60 | 60 | 38 | 35 | | | | |
| SE | ± 3.5 | ± 4.7 | ± 3.9** | ± 8.3* | ± 7.9** | ± 5.3 | ± 3.4** | ± 7.9 | | | | | |
| CV (%) | 185.0 | 21.0 | - | 35.0 | 30.0 | 22.1 | - | 28.0 | | | | | |

1 = Average of two seasons and two soil types (Alfisols and Vertisols).

* = Significant at P = 0.01.

** = Significant at P = 0.01.

wilt incidence and colonization was collected at monthly intervals (6 observations), data recorded after one month and 6 months after sowing only is presented in this paper, as the pattern was similar in the other observations. For the purpose of infection, the data on colonization of root region was considered.

The four pigeonpea cultivars used in the study showed significant ($P=0.001$) differences in fusarium wilt incidence at maturity but not in the seedling stage (Table 1). This was expected because the wilt does not appear in field in pigeonpea within a month after sowing; the maximum expression occurring at flowering and podding stage. The extent of colonization of mid-stem and tip in one month old plants was less than in 6 months old plants. Compared to 7% wilt in the resistant cultivar ICP 8863 at maturity, the susceptible cultivar ICP 2376 showed 83%. In the moderately-susceptible cultivars ICPL 87 and C 11, wilt incidence ranged from 60-62%. There was, however, no significant difference in the extent of infection among the four cultivars by *F. udum* either at one month after sowing or 6 months after sowing. However, the extent of colonization of different parts of the plant by the fungus in a cultivar differed significantly ($P=0.001$), both after one and 6 months of sowing. Colonization of midstem and tip was significantly less than that of the roots and collar. Low frequency of isolation of *F. udum* from roots one month after sowing compared to above collar parts was mainly due to interference by other rhizosphere microbes such as *Aspergillus* promoted by the moist soil conditions in July, a peak rainy month. The interaction between cultivars and colonization of the plant parts was also significant ($P=0.01$) at one month after sowing. Cultivar ICP 8863 showed significantly less ($P=0.01$) colonization of mid-stem and tip compared to the root and collar region.

The results of the present study clearly show that though the cultivars differed significantly in

the extent of wilting, they did not differ either in the extent of infection or colonization implying that neither the extent of infection nor colonization play a major role in subsequent wilting of pigeonpea plant. The extent of damage to the xylem indicated by the degree of blackening or browning seems to be one of the factors related to wilting. In all the cultivars, the plants were found to wilt only when the extent of browning and blackening reached mid-stem and above. In case of the resistant cultivar ICP 8863, the browning and blackening was confined to the collar region. The role of other factors such as toxins in causing wilting, however, needs to be investigated.

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