
Germination of Chlamyospores of *Fusarium udum*, the Causal Organism of Pigeonpea Wilt

A. CHAKRABORTY AND PRASANTA K. SEN GUPTA

Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya,
Kalyani 741235

Chlamyospores of *Fusarium udum*, the causal organism of wilt of pigeonpea, failed to germinate in distilled water and only a very few germinated in tap water. In 0.5% dextrose solution percentage of germination was very high (93.75%) and in 1—2% solution it was 100%. A very high percentage (86—95%) of chlamyospores also germinated in 0.1-0.2% solutions of amino acids L-glutamic acid, DL-aspartic acid and L-alanine. Root exudates of some crops supported chlamyospores germination, the effect being very pronounced in the root exudate of susceptible cultivar of pigeonpea. In the root exudate of resistant pigeonpea cultivar, as well as in those of rice and jute, chlamyospores germination was comparatively lower.

Key Words : Pigeonpea wilt, *Fusarium udum*, Chlamyospore.

INTRODUCTION

Pathogenic soil borne *Fusarium* spp. are known to perennate for quite a long period in soil in the absence of a suitable host. Existence of pathogenic fusaria as chlamyospores in soil have been demonstrated by several workers (Nash *et al*, 1961; Trujillo and Snyder, 1963; French and Nielson, 1966; Cook, 1968) and ready formation of chlamyospores by *Fusarium udum* Bult. under stress conditions has been demonstrated by Chakraborty (1987). These resting chlamyospores germinate only under certain favourable conditions. The present paper gives an account of the effect of some nutrients, root exudates and humidity on the germination of chlamyospores of *F. udum*, the causal organism of wilt of pigeonpea.

MATERIALS AND METHODS

An isolate of *Fusarium udum* Bult., isolated from the roots of a wilt infected pigeonpea plant was used for this study. For chlamyospore production a 6 mm disc of the fungal isolate, cut from a 7-day-old culture grown on PDA in petridishes, was inoculated into 15 ml of sterilized potato dextrose broth in 150 ml Erlenmeyer flasks. The flasks were incubated at 28°C for 15 days during which period most of the hyphal cells were transformed into chlamyospores. The culture mat from a flask was collected by filtering through folded bandage cloth, washed twice in sterilized water for removing adhering nutrient and then blended in a waring blender with 100 ml distilled water for 1 minute for separation of the chlamyospores. The chlamyospore suspension thus obtained was centrifuged at 1000 rpm for 2 minutes. The supernatant was discarded and the chlamyospores setting at the bottom were collected and suspended in sterile distilled water to get a suspension having 8-10 chlamyospores under the low power of the microscope.

For collection of root exudate the method described by Dasgupta and Sen Gupta (1988) was followed.

For studying chlamyospore germination a drop of the test fluid was placed in the cavity of a double grooved glass slide by means of a sterilized 1 ml pipette. The test solution was allowed to dry up. A drop of chlamyospore suspension was then placed in the cavity containing the dried test chemicals.

As control, tap water and distilled water were used in place of test fluids. The grooved slides were then rested on two glass rods in moist chambers prepared by lining petridishes with moistened filter papers and incubated for 24 h at 28°C. The germination of chlamyospores was observed under the microscope.

For studying the effect of humidity on chlamyospore germination, chambers with different humidities (%) were prepared by adding 20 ml of different concentrations (in water of glycerol in sterilized petridishes according to the humidity chart given by Scharpf (1964)). As chlamyospores failed to germinate in distilled water, chlamyospore suspension in 0.1% dextrose was used for studying the effect of humidity.

RESULTS AND DISCUSSION

Chlamyospores, perennating in dormant condition in soil in absence of a suitable host, require some energy in the form of nutrients for their germination and to initiate the active phase of the pathogenic *Fusarium* species. Toussoun and Snyder (1961) observed that chlamyospores of *F. solani* f. sp. *phaseoli* formed in

Table 1. Effect of dextrose and some amino acids on the germination of chlamyospores of *F. udum*

| Treatment | Dose (%) | Chlamyospore germination (%) \pm SE |
|------------------|-----------------|--|
| Dextrose | 2.0 | 100.00 (90.00) ¹ \pm 0.00 |
| | 1.5 | 100.00 (90.00) \pm 0.00 |
| | 1.0 | 100.00 (90.00) \pm 0.00 |
| | 0.5 | 93.75 (82.50) \pm 6.25 |
| | 0.1 | 22.55 (28.25) \pm 2.63 |
| | L-Glutamic acid | 0.2 |
| | 0.1 | 86.94 (74.67) \pm 7.70 |
| DL-Aspartic acid | 0.2 | 95.00 (83.35) \pm 5.00 |
| | 0.1 | 92.67 (78.82) \pm 4.46 |
| L-Alanine | 0.2 | 94.79 (80.46) \pm 3.12 |
| | 0.1 | 89.58 (76.47) \pm 6.25 |
| D-Valine | 0.2 | 66.33 (54.66) \pm 4.50 |
| | 0.1 | 54.16 (47.44) \pm 4.16 |
| Control : | | |
| Tap water | | 1.38 (3.43) \pm 0.48 |
| Distilled water | | 0.92 (2.77) \pm 0.03 |
| C. D. (P=0.05) | | 9.13 |

¹Figures in parentheses are transformed angular values

unsterilized soil did not germinate in presence of water alone. In the present study it has been observed that chlamyospores of *F. udum* failed to germinate in distilled water, and only a negligible percentage of chlamyospores germinated in tap water (Table 1). Dextrose and some amino acids were found to have profound stimulating effect on the germination of chlamyospores of *F. udum*. Cent percent germination of chlamyospores occurred in 1-2% dextrose solution and a very high percentage (86.94-95.83) germinated in 0.5% dextrose and 0.2-0.1% solution of the amino acids, namely, L-glutamic acid, DL-aspartic acid and L-alanine.

In soil the stimulus for chlamyospore germination, in case of *F. solani* f. sp. *phaseoli*, has been demonstrated to be provided by the nutrients present in the root exudates of the crops growing in the vicinity or by the decomposition product of the crop residues (Schroth and Snyder, 1961 ; Schroth *et al* 1963 ;

Toussoun *et al*, 1963). In the present study also root exudates of several crops were found to enhance germination of chlamydospores, the effect being different in roots exudates of different crops (Table 2). Germination of chlamydospores in the root exudate of the susceptible cultivar in pigeonpea (cv. ICP 11286) was remarkably higher, nearly 2.5 to 3 times more than those of the resistant cultivar (cv. ICP 8863) and some other crops studied. Differential growth

Table 2. Effect of root exudates on germination of chlamydospores of *F. udum*

| Crop | Germination of chlamydospores (%) \pm SE | |
|---|--|-----------------------------|
| | 7 days | 15 days |
| Pigeonpea (Cv ICP 8863) (resistant) | 26.54 \pm 1.19 (31.01) ¹ | 29.66 \pm 6.07 (32.67) |
| Pigeonpea (Cv ICP 11286) (susceptible) | 83.64 \pm 2.37 (66.31) | 88.79 \pm 1.03 (70.48) |
| Rice (Cv IR-36) | 18.56 \pm 2.38 (24.37) | 23.80 \pm 6.62 (28.52) |
| Jute (Cv IRO-632) | 17.33 \pm 5.42 (23.55) | 23.85 \pm 5.25 (28.75) |
| Chilli (Cv Jwala) | 27.20 \pm 1.27 (31.41) | 33.75 \pm 6.88 (41.45) |
| Mustard (Cv Varuna) | 31.03 \pm 10.55 (33.04) | 36.25 \pm 5.54 (36.86) |
| Control: | | |
| Tap water | 1.38 \pm 0.48 (3.42) | 1.38 \pm 0.48 (3.42) |
| Distilled water | 0.92 \pm 0.03 (2.77) | 0.92 \pm 0.03 (2.77) |
| C. D. (P=0.05) | 16.96 | 17.65 |

¹Figures in parenthesis are transformed angular values.

response and chlamydospore germination of some *Fusarium* spp. in the root exudates of susceptible and resistant cultivars have been demonstrated by Buxton (1962), Satyaprasad and Ramarao (1983) and Haware and Nane (1984).

Stimulatory effect of root exudates on the germination of chlamydo-spores is apparently due to the presence of a diverse number of chemicals, including amino acids and sugars, in the root exudates.

Although host root exudations may have some influence on chlamydo-spore germination and initial stimulus for selective growth and host colonization, the basis for post infection host specificity and ramification of the fungus within the host is needed to be searched elsewhere.

Table 3. Effect of relative humidity on germination of chlamydo-spores of *F. udum*

| Relative humidity (%) | Germination of chlamydo-spores (%) + SE |
|-----------------------|---|
| 100.00 | 22.55 (28.25) ¹ ± 2.63 |
| 92.00 | 15.83 (23.75) ± 2.41 |
| 80.00 | 14.65 (22.25) ± 2.60 |
| 65.00 | 14.55 (19.46) ± 5.61 |
| 45.00 | 12.78 (20.78) ± 1.89 |
| 25.00 | 7.31 (13.44) ± 2.51 |
| C.D. (0=0.05) | 5 10 |

¹Figures in parenthesis are transformed angular values.

High humidity favoured good germination of chlamydo-spores. However, between 45% and 92% relative humidities the differences in germination percentage were not significant. At 25% R. H. germination was low (Table 3).

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