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BRIEF COMMUNICATION

Effect of temperature on *in vitro* pollen germination in pigeonpea

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Abstract

Pollen of pigeonpea (*Cajanus cajan* (L.) Millsp.) cultivars H-77-216 and ICPL-151 were cultivated *in vitro* at six different temperatures (12, 17, 22, 27, 32, 37 °C). Pollen of cv. H-77-216 started to germinate at 17 °C whereas the pollen of cv. ICPL-151 at 22 °C, the optimal temperatures were 22 and 27 °C, respectively. Pollen germination at different temperatures was found to be positively correlated with the tube length. Per cent pollen bursting increased with rising temperature. The indeterminate cv. H-77-216 showed a wide range of suitable temperatures (17 - 27 °C) for pollen germination while the determinate cv. ICPL-151 had optimum at 27 °C .

Legumes, particularly pigeonpea, produce flowers profusely but only a small percentage of them set pods (Sheldrake and Narayanan 1979). Pollen germination and tube length responsible for pollination and fertilization affected pod setting. Maximum pollen germination and tube length were obtained between 20 and 30 °C in *Solanum tuberosum* (King and Johnson 1958), *Dolichos lablab* and *Pisum sativum* (Vasil and Bose 1959) and in *Zea mays* (Dhingra 1984), however pollen bursting increased with the rise in temperature. James *et al.* (1987) described the composition of medium for optimal pollen germination in pigeonpea at room temperature (28 °C). The present investigations were carried out to study the effect of different temperatures on *in vitro* pollen germination in two phenotypically different cultivars of pigeonpea.

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Pigeonpea was grown on 3rd July, 1990 at the research farm of Haryana Agricultural University, Hisar. All standard agronomical practices were applied for raising the crop. The flowering started from the second week of September and ended the first week of November. Pollen grains were collected on the butter paper between 8.00 to 11.00 h from just opened flowers during the second week of October when maximum and minimum temperature was 34.0 and 18.6 °C, respectively. Since liquid medium yielded inconsistant germination and more intensive bursting of pollen grains, the semi solid media were preferred for the present study. Pollen was mixed thoroughly and equal quantity was inoculated on modified medium of James *et al.* (1987) which contained 40 % saccharose, 250 µl l^{-1} boric acid, 200 µl l^{-1} calcium nitrate and 0.7 % agar-agar. The mixture was boiled for 15 min in a waterbath and 5 ml was poured in each Petri plate immediately after boiling and allowed to cool at room temperature (25 ± 2 °C) before inoculation. Five replicates were used for each temperature treatment. Then these plates were placed in *BOD* incubators maintained at 12, 17, 22, 27 32 and 37 °C. After 4 h of incubation plates were taken out of the incubator and each plate was poured with 2 ml of killing and fixing solution consisting of glycerine, formaldehyde, glacial acetic acid and distilled water in the ratio of 20:5:3:72 (Sass 1958). These plates were observed under compound microscope (150 ×). 10 readings per plate for % pollen germination and pollen bursting and 20 readings per plate for pollen tube lengths were taken by recording on microscopic field basis. For statistical evaluation the standard errors and correlation coefficients were calculated.

Table 1. Effect of temperature on *in vitro* pollen germination in pigeonpea cv. H-77-216 and ICPL-151 (mean ± standard error)

Temperature [°C]	Pollen germination [%]		Pollen tube length [µm]		Pollen bursting [%]	
	H-77-216	ICPL-151	H-77-216	ICPL-151	H-77-216	ICPL-151
12	0.0	0.0	0.0	0.0	0.0	0.0
17	28.2±1.8	0.0	216.0± 7.6	0.0	23.8±2.3	0.0
22	39.3±3.9	9.3±0.3	250.5±11.3	51.0±2.8	31.6±3.7	39.6±5.7
27	21.6±2.3	28.6±0.8	192.0±10.2	213.0±6.9	38.8±0.9	30.6±3.8
32	10.6±0.8	9.3±0.8	80.3± 9.1	122.9±6.8	48.6±2.9	40.6±1.9
37	4.0±1.3	6.0±1.2	40.5± 3.8	75.0±5.2	49.6±8.1	61.6±3.6

Correlation coefficients for relation between pollen tube lenght and per cent pollen germination were 0.418 and 0.936 in cv. H-77-216 and ICPL-151, respectively.

Pollen germination percentage increased with rise in temperature. Maximum pollen germination occurred at 22 °C (39.2 %) and 27 °C (28.6 %) in cv. H-77-216 (Fig. 2) and ICPL-151 (Fig. 8), respectively and beyond the optimal temperatures the germination percentage of pollen declined (Table 1). Pollen of cv. ICPL-151 did not germinate at 17 °C (Fig. 6) but the pollen of cv. H-77-216 showed significant germination (28.2 %) at this temperature (Fig. 1), however there was no pollen

germination at 12 °C in both cultivars. Percentage of pollen bursting increased with rise in temperature and maximum effect was obtained at 37 °C in both cultivars. Maximum pollen tube length was observed at 22 °C (250.5 µm) and 27 °C (213.0 µm) in cv. H-77-216 and ICPL-151, respectively (Table 1). The results are in conformity with the findings of King and Johnson (1958) who also found pollen germination to be correlated with tube length in potato, and Vasil and Bose (1959) in other crops. Pollen tube length was found to be positively correlated with the % pollen germination (Table 1). Maximum % pollen germination and the maximum pollen tube length were observed at 22 °C and 27 °C, showing these being the otimal temperatures. Dhingra (1984) showed maximum pollen germination and pollen tube length in maize at 27 °C and further showed the increase in pollen bursting with rise in temperature.

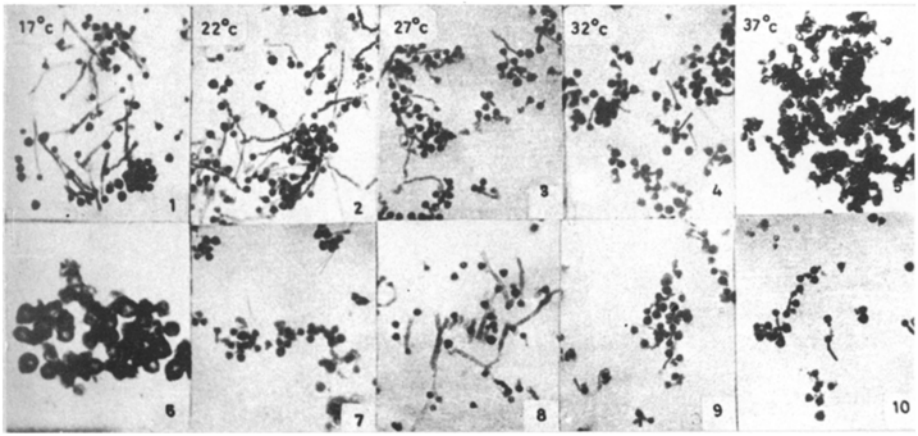

Fig. 1-10. Pigeonpea pollen germination *in vitro*. Each vertical column shows pollen grown at the same temperature; each horizontal row shows pollen germination in one cultivar (Fig. 1-5 cv. H-77-216, Fig. 6-10 cv. ICPL-151). Magnification approximately 150 ×, only Fig. 6: 300 ×.

Thus variations in temperature may play a crucial role in pollen germination and pollen tube growth and thus affecting the pollination and fertilization during the flowering period of the crop. Therefore poor pod setting in pigeonpea particularly in determinate cultivar ICPL-151 may be due to a narrow range of temperatures (Table 1) which results in failure of pollination of flowers while indeterminate cultivar (H-77-216) showed a wide range of suitable temperatures (17 - 27 °C) for pollen germination and tube growth.

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