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Short Communication

Genetics of waterlogging tolerance in pigeonpea [*Cajanus cajan* (L.) Millsp.]

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Pigeonpea is an important pulse crop in south Asia especially in India, eastern and southern Africa and the Caribbean regions. In some parts of India especially in north eastern Uttar Pradesh, heavy rainfall, results in temporary waterlogging or complete flooding of fields particularly those of high water holding capacity soils, such as vertisols and Indo-Gangetic Alluvials soils [1]. In some of these regions, rainfall event can be very intensive resulting in temporary flooding of the fields. The risk of crop failure or yield reduction due to waterlogging is quite acute in extra early and early duration varieties because they have less time to recover from the stress as compared to medium / long duration cultivars [2]. The present investigation is the first attempt to report the genetical control of waterlogging tolerance in pigeonpea.

The material consisted of P_1, P_2, F_1, F_2, B_1 and B_2 generations derived from two crosses (MA 98 PTH 1 × ICPL 84023 and DA 11 × ICPL 84023) involving one waterlogging tolerant (ICPL 84023) and two susceptible genotypes (MA 98 PTH 1 and DA 11) of long duration (maturity > 200 days) pigeonpea. The pot technique [3] was used to screen the pigeonpea genotypes for tolerance/susceptible to waterlogging condition. In each perforated polythene (2 kg capacity) pot, three seeds were dibbled and single seedling per pot was maintained. Accordingly, 10 plants from each of P_1, P_2 and F_1; 20 plants each of B_1 and B_2 and 60 plants each of F_2 were maintained in the pots in two replications at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *kharif*, 2003-04. Forty days old seedlings containing pots of all six families (P_1, P_2, F_1, F_2, B_1 and B_2) were kept in water filled troughs, maintaining 3-6 cm water depth for 8 days, while a similar set of pots containing seedling were grown as control. Plant survivals were recorded two days after the date when waterlogging was relieved. The plants were classified as tolerant (living plant) and susceptible (wilted/died plant) and Chi-square test [4] was used to test the

Table 1. Segregation for tolerance to waterlogging in pigeonpea

Cross/generation	Observed segregation			Expected Ratio R:S	χ^2 value	Probability
	Total plant	Resistant	Susceptible			
P_1 MA 98PTH 1	20	0	20			
P_2 ICPL 84023	20	20	0			
F_1 (MA 98 PTH 1 × ICPL 84023)	20	20	0			
F_2 (MA 98 PTH 1 × ICPL 84023)	120	88	32	3:1	0.18	0.67
B_1 (ICPL 84023 × F_1)	40	40	0			
B_2 (MA 98 PTH 1 × F_1)	40	14	26	1:1	2.13	0.14
P_1 DA 11	20	0	20			
P_2 ICPL 84023	20	20	0			
F_1 (DA 11 × ICPL 84023)	20	20	0			
F_2 (DA 11 × ICPL 84023)	120	86	34	3:1	0.71	0.40
B_1 (ICPL 84023 × F_1)	40	40	0			
B_2 (DA 11 × F_1)	40	16	24	1:1	1.60	0.21

goodness of fit of the segregating populations with the expected phenotypic ratios.

On the basis of pot culture method, the parent, ICPL 84023 was observed to be tolerant while DA 11 and MA 98 PTH 1 exhibited susceptible reaction to waterlogging. All the F_1's plants were quite healthy after relieving the water indicating that tolerance to waterlogging is a dominant trait. Further, F_2 segregation ratio of 3:1 (tolerant: susceptible) indicated that tolerance to waterlogging is governed by single dominant gene designated as 'WR' (Table 1). The observations of segregation pattern of BC_1 (ICPL 84023 × (DA 11 × ICPL 84023) and (ICPL 84023 × (MA 98 PTH 1 × ICPL 84023) further confirmed the F_2 ratio since all the plants were observed to be tolerant to waterlogging. However, BC_2 (MA 98 PTH 1 × (MA 98 PTH 1 × ICPL 84023) and (DA 11 × (DA 11 × ICPL 84023), as expected, exhibited 1:1 (tolerant: susceptible) segregation to waterlogging, further confirmed the F_2 ratios. From the present findings, it is quite obvious that tolerance to waterlogging in pigeonpea is governed by single dominant gene which can be easily transferred by backcrossing.

However, more efforts involving large number of tolerant and susceptible parents are needed to understand the genetic control of waterlogging tolerance which may be helpful in breeding waterlogging tolerant/resistant varieties, so that the crop efficiency can be increased and the true potential of pigeonpea as a pulse crop can be fully exploited.

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