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Variability Analysis of Traits Related to Callus Growth and Plant Regeneration in Drought Resistant Local Land Races of Rice (*Oryza sativa* L.)

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Abstract: Seed Explants of ten drought resistant local land races were studied in a replicated experiment for traits related to callus growth and plantlet regeneration. Among the characters, number of green spot and number of root fibrils recorded high heritability coupled with moderate and high genetic advance, respectively, indicating preponderance of additive gene action in these traits. Selection of genotypes for these traits would lead to greater plant regeneration efficiency.

Key words: Rice, genetic variability, *in vitro* culture, heritability, callus growth, plant regeneration

Introduction

The conventional breeding methods are the most widely used for crop improvement. But in certain situation, these methods have to be able to achieve the objective, which is not possible through the conventional methods. Among the different techniques of biotechnology, plant tissue culture is the one being applied in crop improvement programme (Prakash *et al.*, 1994). There is an increasing awareness of the potential application and limitation of plant cell and tissue culture technology, for production of novel genotypes with valuable attributes particularly in relation to water and salt stress tolerance (Srivastava *et al.*, 1995). Resistance to certain types of stress like drought has potentially large agricultural value (Kavikishore and Reddy, 1985). To exploit genetic variation for callus growth and plant regeneration, an understanding of nature and magnitude of genetic variability and the extent to which it is heritable is required (Pandey and Ramesh, 1996).

The present investigation has been undertaken to generate such information from drought resistant local land races, hence land races have more genetic diversity, wider adaptability and high degree of resistance to biotic and abiotic stresses.

Materials and Methods

Dehusked seeds of ten drought resistant local land races of Ramnad viz, Nutripattu, Sivappuchitraikar, Kulliyadichan, Norungan, Mattaikar, Varappukudanchan, Kallrundaikar, Poongar, Chandaikar and Karumkuruvai were taken for *in vitro* culturing. Seeds were surface sterilized using 70 percent ethanol for one minute followed by 0.1 percent mercuric chloride for three minutes, then the seeds were washed three times throughly with double distilled water and inoculated in MS callus induction medium with 2 mgl^{-1} 2,4-D + 0.5 mg l^{-1} kinetin. The callus of all races were forwarded to regeneration studies by using regeneration medium made up of MS based medium + 2.0 mg^{-1} BAP + 1 mg^{-1} kinetin + 1.0 mg^{-1} IAA. Callus growth and plantlet regeneration were studies in factorial completely randomized block design with five replications in the tissue culture laboratory of the Department of Agricultural Botany, Agricultural College of Research Institute, Madurai. The detailed procedure for callus growth and plantlet regeneration has been described elsewhere (Pandey *et al.*, 1995). Observation on diameter, volume and weight of callus were recorded 40 days after sub culturing. For plantlet regeneration, observation on the number of green spots were recorded 15 days after the transfer to calli to regenerate medium and those on number of shoots regenerated, length of the longest shoot using scale from outside the flask and number of root fibrils in each flask recorded 40 days after the transfer.

Genotypic coefficient of variation (GCV), phenotypic co efficient of variation (PCV), broad sense heritability (h^2) and genetic advance were calculated as per the standard procedures described by Burton and Devane (1953) and Johnson *et al.* (1955).

Results and Discussion

The estimates of PCV were generally higher than those of GCV for all the characters studied (Table 1). The number of roots fibrils recorded maximum GCV (32.50%), which was very close to its PCV estimate, suggesting little influence of the environment on its expression (Pandey and Ramesh, 1996).

Heritability estimates ranged from 18.5% callus diameter to 79.5% for number of green spots. Very high estimates of heritability (79.5%) and genetic gain (54.60) for the number of root fibrils indicated very little influence of the environment. Similar findings were observed by Pandey and Ramehs(1996). The character was mostly governed by additive gene action. Thus selection could offer great scope of improvement in the number of root fibrils. The length of the longest shoot exhibited moderate heritability with poor genetic gain expected which was largely due to one of the longest GCV estimates recorded for it. This indicated a little scope of improvement in this character selection. Similarly, the callus diameter and volume exhibiting low estimates of all the three

Table 1: Estimates of genotypic and phenotypic coefficients of variability (GCV and PCV) heritability (h^2) and genetic advance (GA) for traits related to callus growth and plant regeneration in local land races of rice

Characters	GCV(%)	PCV(%)	h^2 (%)	GA (% of mean)
Callus diameter	16.47	36.50	18.5	12.82
Callus volume	21.50	42.21	28.8	22.78
Callus weight	22.50	36.28	35.6	26.78
Number of green spot	18.23	20.5	79.5	32.26
Number of shoots	22.50	28.56	50.6	30.26
Length of longest shoot	16.23	22.32	44.20	21.26
Number of root fibrils	32.5	36.26	74.60	54.60

genetics parameters did not suggested much scope for their improvement through selections. This findings was also in agreement with Pandey and Ramesh (1996).

The heritability estimates in combination with genetic gain are more useful than heritability alone (Johnson *et al.*, 1955). Thus it is evident from this study that selection based on the number of root fibrils, green spot and shoots for plant regeneration and callus weight for callus growth will be more effective. It would be offer opportunity for creating and recovering callus growth and plant regeneration for higher frequency of drought resistant somaclonal variants.

Understanding of genetic variability is very essential for attempting any breeding programme. In the present study the land races showed more heritability coupled with more genetic advance for most of the traits studied. Hence these land races can be utilized to create somoclonal variation for drought resistance in future.

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