Somaclonal variation

- The term was introduced by Larkin and Scowcrott 1981.
- It can be replaced by earlier terms like ‘ calliclones’ and ‘protoclones’.
- Gentic variations in plants that have been produced by plant tissue culture and can be detected as genetic or phenotypic traits.

Basic Features of Somaclonal Variations.

- **Somaclonal variation**
- Genetic variations in plants that have been produced by plant tissue culture and can be detected as genetic or phenotypic traits.
- Variations for Karyotype, isozyme characteristics and morphology in somaclones may also observed.
- Calliclone (clones of callus), mericlone (clones of meristem) and protoclone (clones of Protoplast)were produced.
- Generally heritable mutation and persist in plant population even after plantation into the field.

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Mechanism of Somaclonal Variations

1. Genetic (Heritable Variations)

- Pre-existing variations in the somatic cells ofexplant.
- Caused by mutations and other DNA changes
- Occur at high frequency.

2. Epigenetic (Non-heritable Variations)

- Variations generated during tissue culture.
- Caused by temporary phenotypic changes.
- Occur at low frequency.

Callus Tissue Organogenes is Regenerated plants Hardening and Selfing Somaclonal Variants Steps involved in induction and selection of Somaclonal Variations

Causes of Somaclonal Variations

- Physiological Cause
- Genetic Cause
- Biochemical Cause

- ❑ Physiological Cause.
- Exposure of culture to plant growth regulators.
- Culture conditions.
- ❑ Genetic Cause.
- Change in chromosome number.
- Euploidy : Changes chromosomeSets.
- Aneuploidy : Changes in parts of chromosome Sets.
- Polyploidy : Organisms with more than two chromosomesets
- Monoploidy : Organism with one chromasomes set.
- ❑ Change in chromosome structure
- Deletion.
- Inversion.
- Duplication.
- Translocation

Gene Mutation

- Tansition
- Transversion
- Insertion
- Deletion
- Plasmagene Mutation
- Transposable element activation Genetic Cause
- DNA sequence
- Change in DNA
- Detectionof altered fragment size by using Restrictionenzyme Change in Protein Loss or gain in proteinband Alterationin level of specificprotein

Detection of environmental

- Detection of environmental stress tolerant variant.
- Selection of high salt tolerant cell lines in tobacco.
- Selection of water-logging and drought resistance celllines in tomato.
- Selection of temperature stress tolerant in cell lines in pear.
- Selection of mineral toxicities tolerant in sorghum plant(mainly for aluminium toxicity)Detection and Isolation of SomaclonalVariants.

Biochemical Cause

Lack of photosynthetic ability due to alterationin carbon metabolism Biosynthesis of starch via carotenoid pathway Nitrogen metabolism Antibiotic resistance.

Detection and Isolation of SomaclonalVariants

1. Analysis of morphological characters
2. Qualitative characters: Plant height, maturitydate,flowering date and leaf size
3. Quantitative characters: yield of flower, seeds and waxcontents in different plant parts

Variant detection by cytological Studies

1. Staining of meristematic tissues like root tip, leaf tip withfeulgen and acetocarmine providethe number andmorphology of chromosomes.

Variant detection by DNA contents

Cytophotometer detection of feulgen stained nuclei canbe used to measure the DNA contents

. Variant detection by gel electrophoresis Change in concentration of enzymes, proteins and hemicalproducts like pigments, alkaloids and amino acids can bedetected by their electrophoretic pattern5. Detection of disease resistance variant Pathogen or toxin responsible for disease resistance canbe used as selection agent during culture.6. Detection of herbicide resistance variant Plantlets generated by the addition of herbicide to the cellculture system can be used as herbicide resistanceplant.Detection and Isolation of SomaclonalVariants

Advantages

- Advantages of Somaclonal Variations.
- Help in crop improvement.
- Creation of additional genetic varitions.
- Increased and improved production ofsecondary metabolites.
- Selection of plants resistant to varioustoxins, herbicides, high salt concentrationand mineral toxicity
- Suitable for breeding of tree species

Disadvantages

- Disadvantages of SomaclonalVariations.
- A serious disadvantage occurs in operations which requireclonal uniformity, as in the horticulture and forestryindustries where tissue culture is employed for rapidpropagation of elite genotypes.
- Sometime leads to undesirable results.
- Selected variants are random and genetically unstable.
- Require extensive and extended field trials.
- Not suitable for complex agronomic traits like yield, qualityetc.
- May develop variants with pleiotropic effects which are nottrue.