

PLANT TISSUE CULTURE – THEORY AND TECHNIQUES

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FOREWORD

This book is an elegant piece of work which combines the research experience in plant tissue culture with the extensive knowledge of the needs of undergraduate and post graduate students for a subject that is increasingly pervading the public and private sector and offers a vast scope for future. This book provides a clearly written, well documented text that covers all the basic and applied aspects of plant tissue culture and enables the students to formulate their experiments independently. The illustrative text and references of this book enables the reader to follow up the points of interest in greater detail.

The coming years will see the spread of plant tissue culture in all the fields of Agriculture, Botany, Genetic manipulations, Environmental science and in varied industrial applications, which requires better understanding of the subject. This book titled “ Plant tissue culture – theory and techniques” by Shailesh Kumar, Sweta Mishra and A.P. Mishra, will undoubtedly contribute significantly by inspiring students in this direction.



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PREFACE

The purpose of this book is to introduce a basic experimental method for each of the major areas of investigation involving the isolation and culture of plant cells, tissues and organs. Each chapter is devoted to a separate aspect of plant tissue culture and the chapters are arranged in the order of increasing technical complexity. This book is mainly written for the undergraduates and postgraduate students and also for the research workers working in this area. The book is designed keeping in mind the problems faced by the scientists and research scholars working with plant tissue culture, however, it can be used as a supplementary text for developmental botany and biology.

The opening chapters present a brief historical survey of the field of plant tissue culture, a background in sterilization techniques. Various components of the nutrient medium have been dealt in greater detail. The text deals with the experimental details of each and every technique. Several chapters introduce diverse approaches to plant propagation by *in vitro* techniques. The protocols have been simplified legibly to include details and notes that we hope will help the user avoid unnecessary errors and confusion. All the applications of plant tissue culture have been very well discussed and the techniques associated with them described in detail. The various sections have been written with safety in mind, but users should ensure that they are fully familiar with all safety requirements of the equipments and media. Plant tissue culture is not without risk to the experimenter.

Tissue culture, however, is still sometimes more art than science. It has been said that the greatest thing that anyone can achieve is to make a difference. We hope that, in writing this book, we will, in some small way, do just that.

The authors acknowledge all the contributions made by the scientists of the present and past era who have been working in the field of plant tissue culture due to which the science has gained such an importance today.

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Plant tissue culture is one of the most rapidly growing areas of biotechnology because of its high potential to develop improved crops and ornamental plants. With the advances made in the tissue culture technology, it is now possible to regenerate species of any plant in the laboratory. To achieve the target of creating a new plant or a plant with desired characteristics, tissue culture is often coupled with recombinant DNA technology. Seed culture is the type of tissue culture that is primarily used for plants such as orchids. For this method, explants (tissue from the plant) are obtained from an in-vitro derived plant and introduced in to an artificial environment, where they get to proliferate. In the event that a plant material is used directly for this process, then it has to be sterilized to prevent tissue damage and ensure optimum regeneration. Embryo Culture. Plant Tissue Culture is the process of growing isolated plant cells or organs in an artificial nutrient media outside the parent organism. In other words, it is an in vitro culture of plant cells or tissues on artificial nutrient media under aseptic conditions, in glass containers. This is a technique by which new plants can be raised on artificial nutrient media by the use of plant parts or cells. These small parts can be pollen, leaves, seed, root tip, embryo, etc.

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Embryo Culture. Plant Tissue culture is the in vitro aseptic culture of cells, tissues, organs or whole plant under controlled nutritional and environmental conditions often to produce the clones of plants. It refers to a collection of techniques used to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium of the known composition. The resultant clones are true-to-type of the selected genotype.

Principle of Plant Tissue Culture. Open access peer-reviewed chapter. Plant Tissue Culture: Current Status and Opportunities. By Altaf Hussain, Iqbal Ahmed Qarshi, Hummera Nazir and Ikram Ullah. Submitted: December 13th 2011Reviewed: June 9th 2012Published: October 17th 2012.

Tissue culture involves the use of small pieces of plant tissue (explants) which are cultured in a nutrient medium under sterile conditions. Using the appropriate growing conditions for each explant type, plants can be induced to rapidly produce new shoots, and, with the addition of suitable hormones new roots. The new plants can then be placed in soil and grown in the normal manner. Many types of plants are suitable for use in the classroom. Cauliflower, rose cuttings, African violet

Definition : Plant tissue culture is a technique with which plant cells, tissues or organs are grown on artificial nutrient medium, either static or liquid, under aseptic and controlled conditions.

Father of Plant Tissue Culture : Gottlieb Haberlandt. PTC depends these two factors mainly: Cellular Totipotency : The inherent potentiality of a plant cell to give rise to all cell types (including a whole plant), a capacity which is often retained even after a cell has undergone final differentiation in the plant body, is described as ' cellular totipotency '. Plant Tissue Culture is the process of growing isolated plant cells or organs in an artificial nutrient media outside the parent organism. In other words, it is an in vitro culture of plant cells or tissues on an artificial nutrient media under aseptic conditions, in glass containers. This is a technique by which new plants can be raised by the use of plant parts or cells. These small parts can be pollen, leaves, seed, root tip, embryo, etc. Plant tissue culture depends on the ability of plant tissue to give rise to an entire new plant when provided with a growth medium and appropriate environment. This ability of plant cells or tissues is termed "totipotency."™

The fundamental steps of plant tissue culture are fourfold:

- Select a healthy parent plant (explant).
- Eliminate any microbial contamination from any exposed explant surfaces.
- Inoculation the explant in an adequate culture medium.