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FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

TECHNIQUES IN PLANT PROTECTION MSH-304

LECTURE 06

Use of tissue culture techniques in Plant Protection

Agriculture, the backbone of all developments is one of the oldest vocation pursued from time immemorial. Unfortunately, the damage caused by pathogenic fungi, bacteria and viruses is in terms of millions of dollars annually. The indiscriminate use of pesticides to control such diseases has proven hazardous to other forms of life including animals. The growing number of health problems related to these pesticides has made it imperative to look for eco-friendly and sustainable programmes to combat this global menace. Disease control through the heavy application of synthetic/chemical bactericides, fungicides, insecticides and pesticides has caused tremendous damage to the terrestrial and aquatic ecosystems. It has wiped out hundreds of ecologically important species of plants and animals, causing a tremendous loss of biodiversity (Aziz et al., 1992; Langeweg, 1989). Another problem associated with the excess use of chemotherapy in plant disease is its regular / seasonal applications which renders many pest/pathogens resistant. The thrust therefore has been to meet the most important challenges before the mankind: the production of more food, fibres and fuels from inelastic land area to feed the ever-increasing demand of growing population. It is in these endeavours that Plant Tissue Culture, an important component of Biotechnology, has come to the rescue and helped the scientists break new grounds

PLANT DISEASES

Plant diseases are the major threat to agricultural productivity. Fungi, bacteria, viruses and insect pests are the main causes of economic losses across the globe. Despite the frequent use of pesticides, 20-30% of crops are lost due to pathogens and pests annually (Estruch et a!., 1997; Peferoen, 1997). Inevitably, this has necessitated the programme for resistant varieties at global level but success has been met only in limited cases.

Tissue culture has become the crucial platform for all the genetic manipulations being carried out with plant systems. From mere callus induction and regeneration of roots and shoots, the technique has helped transformation experiment's leading to transgenics. Plant tissue culture

techniques are based on the property of totipotency (the capacity to grow and regenerate) and the exploitation of the nutritional status of variol,ls explants. This aseptic technique offers certain advantages over the conventional methods. Production of haploids, creation of usable genetic variability (somaclonal variation), somatic hybrids, genetically manipulated (genetically engineering) plants and micropropagation are some novel applications of tissue culture. In vitro methods thus offer a tool for cellular and DNA-mediated intervention, variant selection and multiplication of desired clones. The effective way to eliminate the virus has been the culture of apical meristems. Infact, repeated subcultures of tomato roots in vitro by White (1934) and subsequent work by Limasset and Cornuet (1949) led Morel and Martini (1952) to postulate that it is possible to isolate the apical meristem of systemically infected plants and grow it in vitro to raise virus free plants. Ever since, the technique of apical meristem culture has been successfully employed to a large number of valuable cultivars of different plants (Quack, 1977). In other cases, the terminal and axillary/lateral buds can also be available for meristem culture. However, there are reports that suggest the superiority of apical meristem culture over lateral-bud culture, for example Chrysanthemum (Hollings and Stone 1968). With bulbs and corms also it is possible to raise virus-free plants. However, this may not be universally applicable.

3. ERADICATION TECHNIQUES

Three methods have been recognized as efficient ways to eliminate virus and raise virus-free plants. First, by isolating the apical meristem or the root tips from infected plants. Second, use of antimetabolites either applied to the infected plant part before bud excision, or incorporation into the nutrient medium. Third, infected plants are subjected to temperature treatment (37°C) which retards or inhibits the multiplication of viruses. It has often been observed that heat-treated apical meristems are better and are even more efficient in eliminating the viruses which can't be achieved through meristem-culture only (Quack, 1977).

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