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Research review paper

In vitro propagation of rose—a review

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Abstract

In vitro propagation of rose has played a very important role in rapid multiplication of cultivars with desirable traits and production of healthy and disease-free plants. During the last several years, different approaches have been made for in vitro propagation of rose. Micropropagation using apical buds or nodal segments and understanding the specific requirements at different stages has been comprehensively covered in literature. New challenges for refinements of protocols for high rate of shoot multiplication and development of cost effective methods has gained importance in the recent past. Importance of liquid static culture for shoot proliferation and root induction for rose is also discussed in the present review. Further, the development of protocol for in vitro plant regeneration which is considered as most important step for successful implementation of various biotechnological techniques used for plant improvement programmes has been adequately addressed in literature. In rose, there are several reports which indicate rapid regeneration and multiplication through organogenesis or somatic embryogenesis. On the whole, the present review gives a consolidated account of in vitro propagation in rose.

Keywords: Rose; In vitro; Liquid medium; Shoot multiplication; Root induction; Rooting vessel; Micropropagation; Regeneration; Somatic embryogenesis

Contents

Abbreviations: BAP, 6-benzyl aminopurine; IBA, indole-3-butyric-acid; NAA, α-naphthalene acetic acid; TDZ, Thidiazuron; IAA, indole-3-acetic acid.

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1. Introduction

Rose is one of the most important commercial crops. It is generally propagated by vegetative methods like cutting, layering, budding and grafting. Seeds are used for propagation of species, new cultivars and for production of rootstocks (Horn, 1992). Although propagation by vegetative means is a predominant technique in roses, yet it does not ensure healthy and disease-free plants. Moreover, dependence on season and slow multiplication rates are some of the other major limiting factors in conventional propagation.

In the last few years, in vitro propagation has revolutionized commercial nursery business (Pierik, 1991). Significant features of in vitro propagation procedure are its enormous multiplicative capacity in a relatively short span of time; production of healthy and disease-free plants; and its ability to generate propagules around the year (Dhawan and Bhojwani, 1986). Martin (1985) demonstrated that, using this technology, up to 400,000 plants could be cloned, from a single rose on annual basis. Such a method has considerable implications for the rose breeder as it allows rapid multiplication of new varieties. Micropropagated plants are well suited for cut flower production as they are more compact (Onesto et al., 1985), branch better and sometimes yield more flowers (Reist, 1985). In addition, tissue culture derived dwarf roses used for pot plant production have a faster rate of growth, early flowering, and exhibit shorter shoots and more laterals than conventionally produced plants (Dubois et al., 1988).

The history of rose tissue culture dates back to 1945, when Nobecourt and Kofler succeeded in obtaining callus and roots on the explanted buds. In the year 1946, Lamments for the first time reported the use of embryo culture in rose breeding. Studies were initiated by Nickell and Tulecke (1959) and Weinstein et al. (1962) to culture cells, cell suspension and calli with a view to understand differentiation and regeneration. The first shoot organogenesis from callus tissue was reported by Hill (1967) in a climbing Hybrid Tea rose 'The Doctor.' The earliest references of rose micropropagation were those of Jacob et al. (1969, 1970a,b) and Elliott (1970) in *R. hybrida* cv. Superstar and *R. multiflora*, respectively.

Since these pioneering efforts, a lot of data were generated and a number of papers have been published on different aspects of in vitro studies of rose with a greater emphasis on micropropagation. A consolidated account of tissue culture studies on rose is dealt with in the present review.

2. Micropropagation

The most important technique in micropropagation is meristem proliferation wherein apical buds or nodal segments harbouring an axillary bud are cultured to regenerate multiple shoots without any intervening callus phase. Work on micropropagation of rose is summarized in Table 1.

2.1. Stages involved in micropropagation

A successful micropropagation protocol proceeds through a series of stages, each with a specific set of requirements. These are (i) initiation of aseptic cultures, (ii) shoot multiplication, (iii) rooting of microshoots, and (iv) hardening and field transfer of tissue culture raised plants.

2.1.1. Initiation of aseptic cultures

2.1.1.1. Choice of explant. The choice of explant for initiation of culture is largely dictated by the method to be adopted for in vitro propagation. Explants with vegetative meristems are often suitable for enhanced axillary branching (Table 1). The most commonly used explant is a nodal stem segment, wherein the axillary bud is made to proliferate to form multiple shoots (Fig. 1a). The performance of nodal segments is much better than the shoot tips (Horn, 1992).

Different parameters influence the initial stage of micropropagation. Mederos and Enriquez (1987) found that buds taken from softwood stem were more responsive than those from hardwood. Rout et al. (1989a) and Bressan et al. (1982) observed significant differences