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Root Induction and Vegetative Development from Avocado Plantules (*Persea americana* Mill.)

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SUMMARY

Stem segments of *P. americana var. americana R. antillana* cultivated from seeds were pretreated under three light conditions (darkness, partial, and total light), and incubated in a M.S. medium with different solutions of IBA alone or in combination with K. Root formation was induced in totally illuminated segments in a medium of 7.5 or 10 mg/l of IBA. The growth of axilary buds from non-etiolated segments was observed in a medium made up of 0.3 mg/l of IBA and 0.1 mg/l of K. Complete plantules were generated in a medium with 7.5 mg/l and 10 mg/l of IBA.

INTRODUCTION

The cultivation of tissues and cells is an interesting alternative, not only to the sexual reproduction of trees, but also to vegetative propagation through stem cuttings. Traditionally, the most efficient form of propagation is through seeds. However, this method can produce a natural variability that makes it difficult to conserve valuable genotypes. These circumstances present themselves in the case of the avocado, in which the "commercial" tree is composed of two elements: the stock which has been propagated from seeds, and the graft of the desired cultivar. In this relationship, and because of ignorance of the genetic character of the plants originated through seeds, the trees are subject to great variation in the nutritional aspect, in longevity, vigor, resistance to the cold, and to the. diseases transmitted mainly by the stocks, according to Gustafson and Kadman (2) and Frolich and Platt (1). In the present study, the conditions were established for root induction and the sprouting of axilary buds in stem segments of *Persea americana var. americana R. antillana* as a possible way to assure identical stocks (clones).

MATERIAL AND METHODS

The material used in this experiment was provided by the Fruit Research and Development Unit of the Puebla Plan, which belongs to the Training and Research Center for Regional Agricultural Development of the Colegio de Postgraduados located in Atlixco, Puebla. The seeds were germinated throughout the year and separated according to the seasons.

P. americana var. americana R. antillana plantules grown from seeds to a length of 30 cm with 20 to 30 buds were distributed in groups of 10 and given the following pretreatments: continuous illumination (8500 lux), partial illumination (500 lux), and darkness, each for a thirty-day period.

The stems of the plants were submerged in ethanol at 70% (v/v) for 1 minute, sterilized in calcium hypochloride at 4% (v/v) for 20 minutes and rinsed well with distilled, sterilized water. The aseptic stems were divided into 1 cm segments with one bud and placed in a Murashige and Skoog medium (4) complemented with indolebutyric acid (IBA) in combination only with Kinetin (K) in 0.01, 0.1, 1.0, and 10 mg/l concentrations. Each treatment consisted of 100 tubes with one bud each and with 3 repetitions.

The stem segments were incubated at a temperature of 27°C± 1°C. The etiolated segments were kept in darkness; those with partial or total illumination were exposed to respective light intensities of 500 and 8500 lux, each with a photoperiod of 16 hours of light and 8 hours of darkness.

RESULTS

The best response was obtained in the partially illuminated plantule stem segments.

IBA concentration of 0.01, 0.1, and 1.0 mg/l produced 0.6, 10, and 15% root formation, and this was increased to 60 and 70% in concentrations of 7.5 and 10 mg/l (Figure 1). Even when in some stem segments a proliferation of callus material was not clearly observed, root formation was accompanied by the formation of callus material, in general. Occasionally cell division was massive, covering the agar surface. This root formation was induced in plantule stems produced in the fall and winter.

The addition of IBA to a Kinetin medium induced the development of axilary buds. In general, the buds grew to a size of 1.5 to 2.0 cm in 20 days. The average of developed buds was 90% in the following concentrations (mg/l): AIB (0.3) + K (0.01), AIB (0.3) K (3.0), and AIB (10)+ K (0.1). Occasionally, multiple budding was achieved (Figure 2). In the 7.5 and 10 mg/l treatments, not only was root formation induced, but bud growth as well, achieving complete plantules of 50 and 55%, respectively (Figure 3).

DISCUSSION

The results observed in this study agree with the data offered by Schroeder (9), in that root induction is accompanied by the formation of callus material at the base of the inoculant. However, the root induction mentioned by Schroeder was occasional (9), compared to the 50 to 60% achieved in this study. Apparently, the formation of callus material is necessary for root induction. Gustafson and Kadman (2) and Kadman and Gustafson (3) obtained a higher percentage of root induction (60%) in stems cuttings of the antillana type using AIB and the same concentrations employed in this study (7.5 and 10 mg/l).

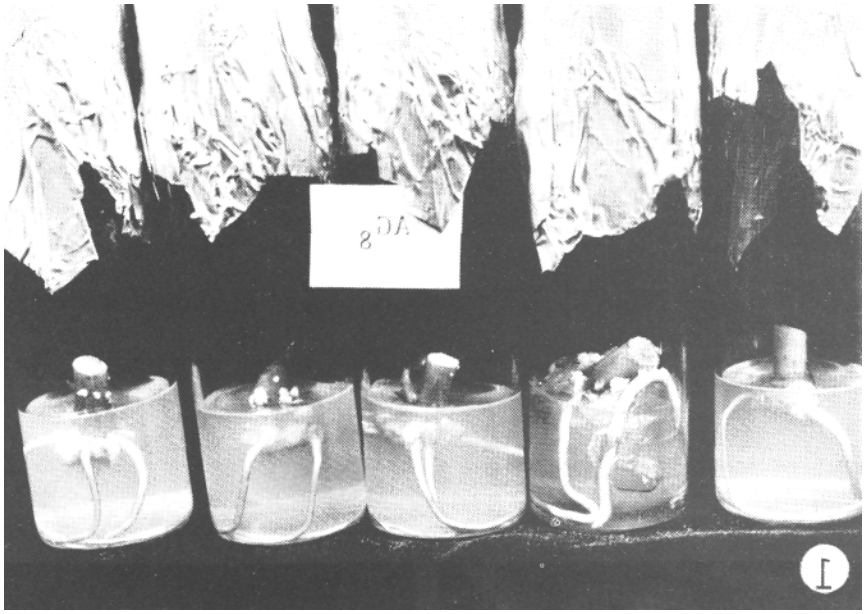

Figure 1. Partial illuminated stem section showing root formation arising from callus developed.

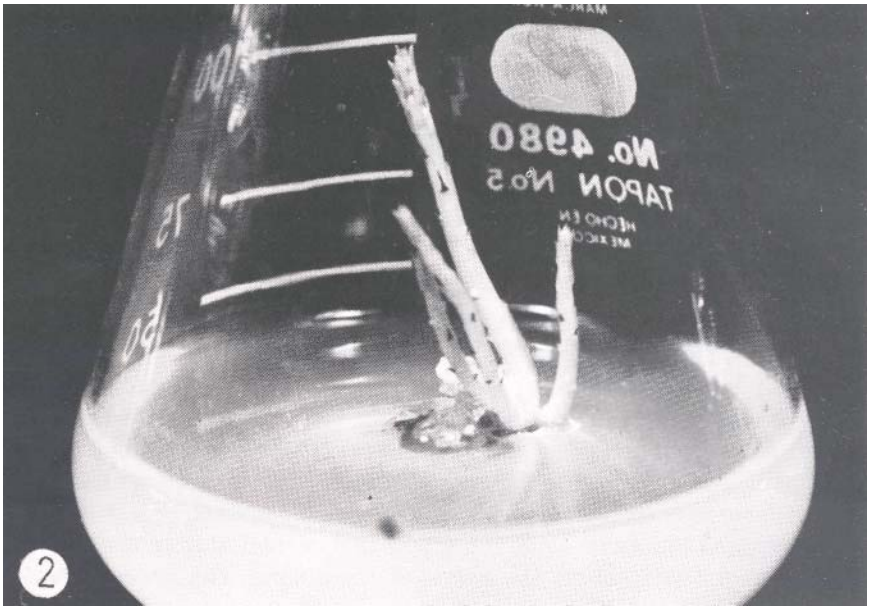

Figure 2. Partial illuminated stem segment showing multiple budding.

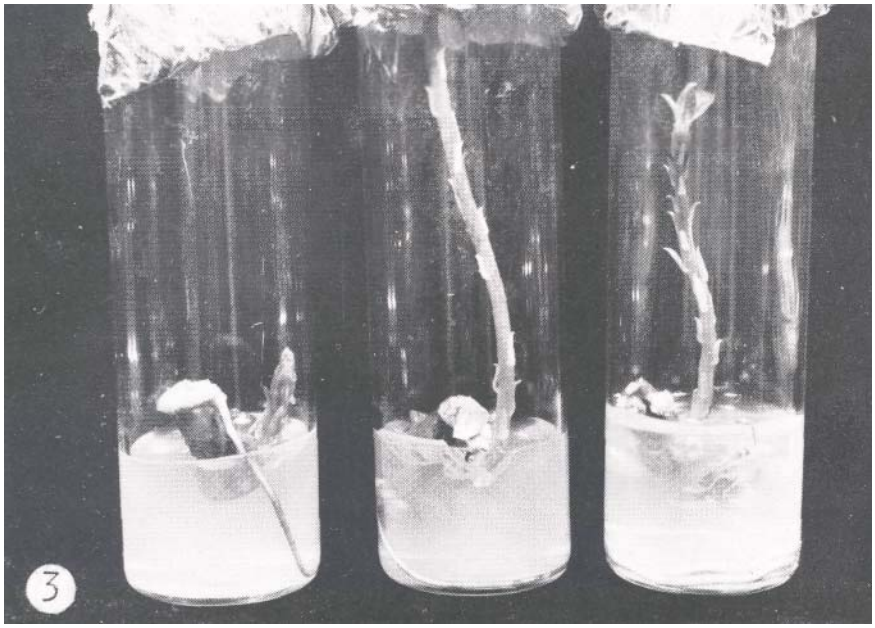

Figure 3. Root induction and bud growth were observed on partial illuminated stem segment.

Axilary root bud development of 60 to 70% was obtained; higher than the percentage mentioned by Schroeder (5, 6, 7 and 9).

Another interesting aspect is that of the pretreatments received by the plantules before culturing them *in vitro*. The conditions under which they were germinated and pretreated, as well as the results obtained with respect to root formation, coincide with the data published by Kadman and Gustafson (3), who pointed out that root formation increased during the winter months. These authors concluded that the response may be due to the presence of root induction promoters. On the other hand, in the present study it was found that, of the three pretreatments applied to the plantules, partial illumination obtained a positive response. It could be thought that the amount of light affects, on the one hand, the presence or absence of the root promoter inhibitors (possibly endogenous auxins); and that, upon being exposed totally to light, the production of inhibitors in the explant would be such as to affect the action of the auxins. The opposite effect would occur upon etiolating the inoculants and causing both the disappearance of such compounds, as well as auxin levels surpassing the concentrations that normally produce roots. Perhaps for this reason, when the plantules are under partial illumination, adequate conditions of light intensity in relation to the inhibitors of root and hormone formation are found.

On the basis of the preliminary information obtained in this study, it would be possible to produce complete plantules from stem segments. This knowledge could be applied to the massive vegetative propagation of genotypes with the goal of conserving genetic uniformity of the vegetable material to be used as stocks. By the same token, budded stem segments would turn out to be better material for root induction than the floral apexes and buds used by Schroeder (8).

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