IJCS INTERNATIONAL JOURNAL OF CONSERVATION SCIENCE

ISSN: 2067-533X Volume 4, Issue 1, January-March 2013: 95-100 www.ijcs.uaic.ro

A NEW PROPAGATION METHOD FOR RAPID MULTIPLICATION OF CHRYSANTHEMUM UNDER *IN VIVO* CONDITIONS

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Abstract

A new method of propagation of chrysanthemum through leaf cuttings complimentary to the conventional method of shoot tip propagation was developed under in vivo conditions. The study was conducted during 2008-2011 at the research farm of the Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana, India. Two cultivars of chrysanthemum 'Autumn Joy' and 'Garden Beauty' were used for the study. Leaf cuttings consisting of leaf blade, petiole and an attached auxiliary bud, taken from different positions of the stem were treated with the combination of plant growth regulators (IBA and Kinetin). With this method, 10-15 new plants were produced from a single stem in contrast to the conventional method of propagation through terminal stem cuttings, which yielded only one plant per stem. The complete process of regenerating plants through this method is new, quick, simple, easy, economical and highly effective and takes the same time as conventional method) under in vivo conditions. This propagation technique is particularly useful when propagating material is scarce as from a small quantity of initial propagating material, a large number of plants can be produced.

Keywords: *Chrysanthemum; propagation; leaf cuttings; growth regulators; plant regeneration.*

Introduction

Chrysanthemum is a herbaceous perennial flowering plant extensively grown all over the world for its beautiful charming flowers with an excellent vase life. It ranks second in the international flower trade after rose and was labeled as the 'divas' or 'queen' of autumn gardens. It is believed to be native of northern hemisphere, mainly Europe and Asia [1-3]. Chrysanthemum is versatile flower with a wide range of types, sizes and colors. The dwarf and compact growing types (spray chrysanthemums) are cultivated as pot plants for beautifying indoors and outdoors whereas the erect and tall growing types (standard chrysanthemums) are grown as cut flowers for making bouquets and vase decoration [4].

Chrysanthemum plants can be propagated both sexually and through vegetative means. Since chrysanthemum is highly cross-pollinated and due to its polyploidal and heterozygous nature, a wide range of variations are observed when grown from seeds. The plants also possess sporophytic self-incompatibility [5].

A commercial method of propagation is through terminal stem cuttings taken from healthy mother plants [6]. Chrysanthemums are also propagated through suckers but they produce tall plants [7], which are not suitable for decorative purpose.

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Although the rate of multiplication of chrysanthemum through micro-propagation is quite high but it is not economic for marginal and poor farmers. The availability of quality plant material at low price has always been a challenge in chrysanthemum cultivation in India. Conventional methods of propagation by terminal stem cuttings in chrysanthemum result in production of only a single plant from one stem. There was a need to develop a low cost technique of propagation of chrysanthemum to get more plants from the same quantity of initial propagating material (mother stock). In order to achieve these targets, leaf bud cuttings were used for the bigger production of regenerated plants so the problems related to the non-availability of quality planting material can be solved. Therefore, the present investigation consisted in the research work on two objectives, first, the effect of growth regulators on root and shoot regeneration from leaf bud cuttings and second, the effect of the position of leaves on root and shoot regeneration of chrysanthemum.

Materials and Methods

Field trials were carried out at the Research Farm, Department of Floriculture and Landscaping, Punjab Agricultural University, India, during years the years 2008-2011. Plant material of two varieties of chrysanthemum, 'Autumn Joy' and 'Garden Beauty' was used. From each of the two varieties, leaf bud cuttings were taken from three positions on the shoot as measured from the ground level i.e. 0-10cm(lowest), 10-20cm from ground level (middle) and 20-30cm from ground level (upper). The growth regulators used were Indole-3-Butyric Acid (IBA) at 25, 50 and 100mg/L and Benzyl adenine (BA) at 10, 25 and 50mg/L and a combination of both. Treatment T_0, is the treatment of cuttings with tap water only and was used to compare the results of the data obtained from chemically treated leaf bud cuttings with the untreated ones.

The cuttings were treated with the combinations of growth regulators by dipping basal portion of the cuttings for 15 minutes. The treated cuttings were planted in the pro trays with burnt rice husks as rooting media. There were 10 cuttings per treatment. The number of observations was recorded to evaluate the regenerated plants viz., survival percentage, days to root initiation, number of roots per cutting, length of roots (cm), days to shoot initiation, length of shoots (cm), number of leaves per shoot and plant height (cm). Statistical analysis was carried out to evaluate the significance of variations for various growth and flowering parameters of the regenerated plants, different positions of the cuttings and varieties used in the present investigation.

Results and Discussions

Leaf cuttings, taken from different positions on the stem were inserted in rooting media, with the bud, 1.0 to 2.5cm below the surface. With this method, 10-15 new plants were produced from a single stem in contrast to the conventional method of propagation through terminal stem cuttings which yielded only one plant per stem. The rooted cuttings were transplanted into the field in the second week of June (Fig. 1 and 2).

The maximum survival percentage (100%) was observed when the leaf bud cuttings were taken from the upper position on the shoot (Fig. 3). This was significantly higher than the survival percentage recorded for cuttings taken from the middle position on the shoot (88.13 %) and lower position on the shoot (64.58%). Cuttings treated with IBA 100ppm + BA-25ppm took the minimum days (16.42) to root initiation whereas the maximum days (19.97) was recorded in the untreated plants. The treatment IBA 25ppm + BA 0.0ppm recorded the maximum number (8.41) of roots per leaf whereas the minimum number (5.77) of roots was recorded in the treatment IBA 50ppm + BA 50ppm.

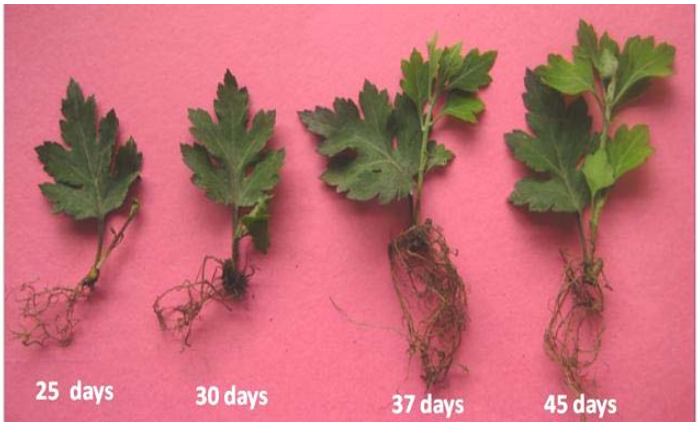

Fig. 1. Different growth stages of the leaf bud cuttings

The maximum root length (8.89 cm) was recorded when the leaf cuttings were treated with IBA 100ppm + BA 0.0ppm. The minimum root length (6.74cm) was recorded in the treatment IBA 50 ppm + BA 50ppm, followed by (6.96cm) in the treatment IBA 25ppm + BA 50ppm. Significant variations were also recorded among the treatments for days to shoot initiation. Cuttings treated with IBA 100ppm + BA 0.0ppm took the minimum days (20.11) for shoot initiation whereas the maximum days (22.45) was taken by cuttings treated with IBA 0.0ppm + BA-50ppm. The maximum shoot length (4.37cm) was obtained in the treatment IBA 100 ppm + BA 0.0ppm and the minimum shoot length (2.70cm) in the treatment of IBA 25ppm + BA 10ppm.

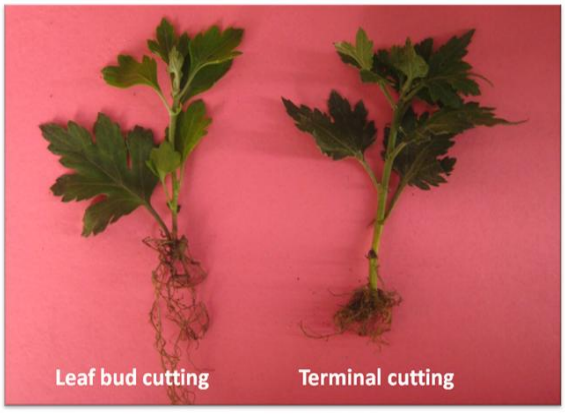

Fig. 2. Plants propagated from leaf bud cutting and terminal cutting of chrysanthemum after 21days

The maximum number (4.44) of leaves per shoot was recorded when the cuttings were treated with IBA 0.0ppm + BA 10ppm. Cuttings treated with IBA 25ppm + BA 50ppm produced the minimum number (3.70) of leaves per shoot. The available literature on chrysanthemum reported stimulated rooting in several cultivars of chrysanthemum [8]. The delay in rooting of basal cuttings in the present investigation may have resulted from the lack of nutrition, insufficient auxin level or the accumulation of resins in the stem or inhibitory substances [9]. Results on the early rooting of the cuttings taken from the top of shoots can be supported with the findings of Bharathy *et al.* [10] who also found that less time was taken to root the tip cuttings than the basal cuttings of carnation due to a higher concentration of rooting hormones. In another study, the maximum number of roots per cutting of carnation when

treated with IBA 100 ppm has also been reported [11], however, the substantial literature on the effect of IBA in chrysanthemum is not available.

The maximum root length when treated with IBA shows that it is likely that these hormones initiate synthesis of structural or enzyme proteins in the process of adventitious root formation (Fig. 5 and 6). The increase in the root length through the process of acidification caused by auxin application to cuttings was explained by Bharathy et al. [10].

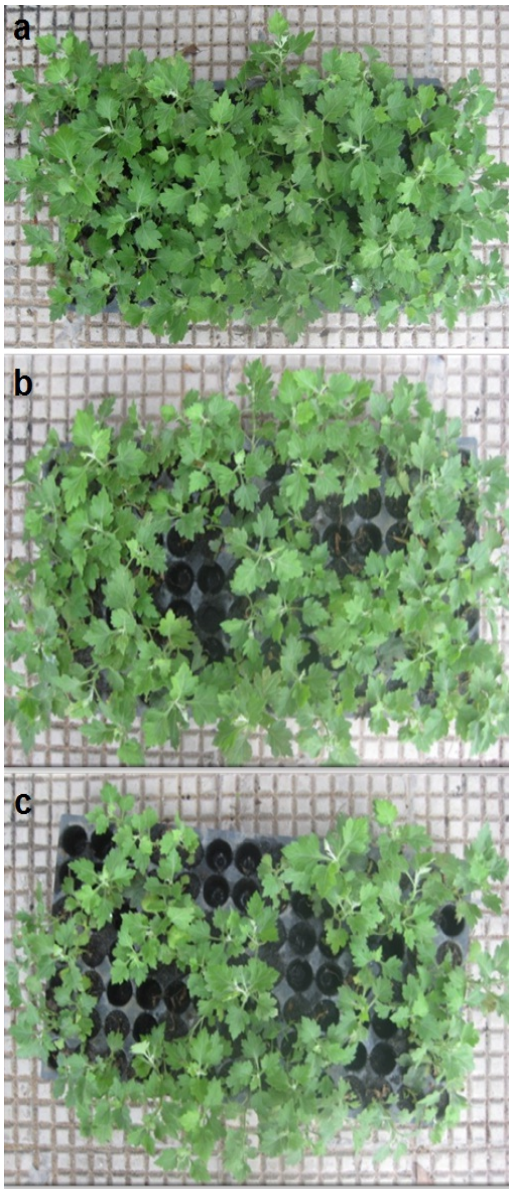

Fig. 3. Plants (Variety- Autumn Joy) regenerated from leaf bud cuttings taken from:
a - upper position of the shoot; b - middle position of the shoot, c - from lower position of the shoot

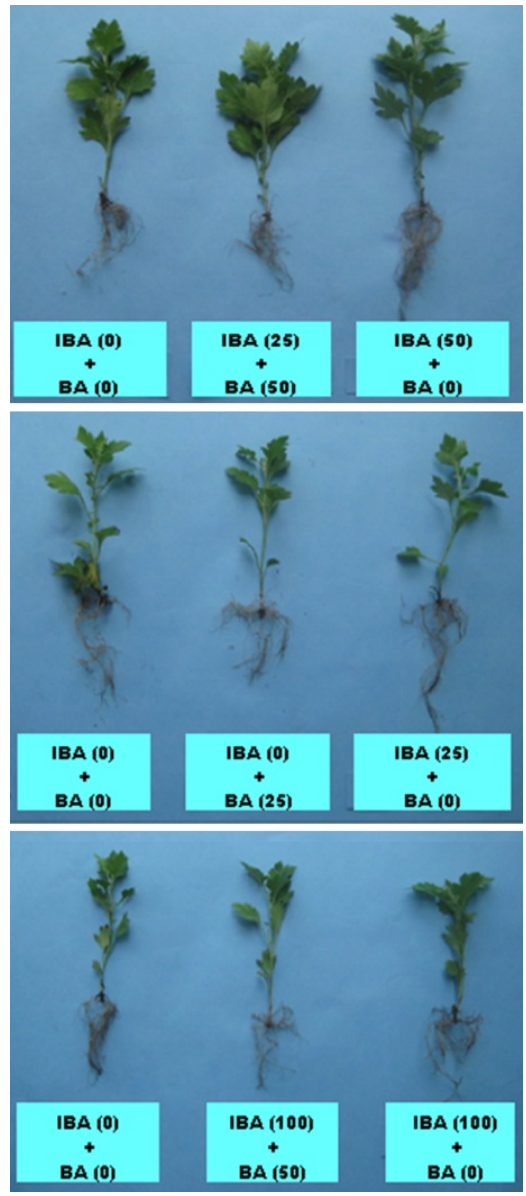

Fig. 4. Effect of growth regulators on length of roots (Variety- Autumn Joy): a - upper position, b - middle position, c - lower position

Fig. 5. Plants regenerated from leaf bud cuttings of variety 'Autumn Joy'

Fig. 6. Plants regenerated from leaf bud cuttings of variety 'Garden Beauty'

Conclusions

This new method of propagation of chrysanthemum under *in vivo* conditions through leaf cuttings increased the rate of regeneration of plants by 10-15 times as compared to the conventional method of propagation by terminal stem cuttings. This technique will open up a new vista for the multiplication of chrysanthemum plants, which will cater to the problems related to the non-availability of the quality planting material. This multiplication is simple, easy and economic for the farmers and it is particularly useful when propagation material is scarce, as in the case of introducing new cultivars for marked.

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Received: August, 18, 2012
Accepted: November, 27, 2012