

Chapter - 6

6. SUMMARY

At present floriculture has gained importance for exploiting it commercially. Economic aspects of ornamental horticulture are as important as the aesthetic ones. The floricultural products of economical importance mainly consists of cut flower and ornamental foliage plants. The world trade in flowers is estimated to be around \$ 13 billion in 1981. Developed countries account for more than 30 per cent of the total world trade in floricultural products. The majority of imports are taken by the European countries in the recent times and the major exporting countries have been the developing ones.

Dahlia, *Chrysanthemum*, rose, *Mussaenda*, azalea are some of the most important floricultural plants. Besides growing in family gardens they are also cultivated on commercial basis. All of them cannot be propagated through the seeds and these processes depend on nature of soil, weather and viability of seed and it takes time. Moreover, to maintain the quality and easy rapid cultivation they must be propagated vegetatively by using cuttings. Cuttings can be rooted by using many bioregulators including plant growth regulators and their commercial formulations. The present study was therefore undertaken to analyse the effects of different types of auxins (IBA, NAA), gibberellins (GA_3 , GA_{4+7}), ethrel and their interaction on rooting on cuttings of *Dahlia*, *Chrysthemum*, rose, *Mussaenda* and azalea plants by quick dip method.

6.1 Effect of IBA on rooting on cuttings

IBA was applied at the concentrations of 100, 250, 500, 1000 and 1,500 µg/ml (Quick Dip method).

6.1.1 Effect of IBA on Dahlia

IBA at 1000 µg/ml was optimal for induction of more number of roots. The number of roots was recorded as 13.6, 16.8, 19.8, 23.6 after 7, 14, 21 and 28 days whereas at control the number was recorded as 0, 5, 8.6 and 13.0 respectively.

6.1.2. Effect of IBA on Chrysanthemum

The number of roots produced at 1000 µg/ml of IBA (optimum) was recorded as 23.8, 46.6, 54.4 and 72.2 against 0, 6, 13.8, and 16.2 at their respective controls after 7, 14, 21 and 28 days.

6.1.3 Effect of IBA on Rose

In rose cuttings also IBA at 1000 µg/ml proved to be optimal recording 20.2, 26.2, 31.6, 33.6 number of roots against no roots at control after 7, 14, 21 and 28 days of treatment.

6.1.4 Effect of IBA on Mussaenda

The response of *Mussaenda* to the same range of concentrations of IBA was not so pronounced as was exhibited by *Dahlia*, *Chrysanthemum* and rose. Number of roots produced was also lesser than the other species tried. At the optimal

concentration of 1000 $\mu\text{g/ml}$ the number of roots was recorded as 0, 6.6, 12.4, 19.6, 21.6 and 24.8 after 7, 14, 21, 28, 35 and 42 days as against no roots at the control.

6.1.5 Effect of IBA on Azalea

In response to IBA, azalea started producing roots after 21 days of treatment. IBA 1000 $\mu\text{g/ml}$ stood as the optimal concentration producing 9.8, 17.2, 20.8 and 21.4 number of roots after 21, 28, 35 and 42 days as against no roots at the control.

6.2 Effect of NAA on rooting on cuttings

NAA was applied at the concentrations of 100, 250, 500, 1000 and 1,500 $\mu\text{g/ml}$ (quick dip method).

6.2.1 Effect of NAA on Dahlia

NAA at 1000 $\mu\text{g/ml}$ was applied for induction of rooting on cuttings. The number of roots was recorded as 10.8, 14.4, 16.8, 20.4 after 7, 14, 21 and 28 days whereas at control the number of roots was recorded as 0, 5.0, 8.6, 13.0 respectively.

6.2.2 Effect of NAA on Chrysanthemum

The number of root produced at 1000 $\mu\text{g/ml}$ of NAA (optimum) was recorded as 26.2, 31.4, 40.8, 46.9 after 7, 14, 21, 28 days. The number of roots at control for the respective period of time was only 0, 6, 13.8 and 16.2.

6.2.3 Effect of NAA on Rose

In rose cuttings also NAA at 1000 $\mu\text{g/ml}$ was optimal recording 6.6, 8.6, 11.0, 13.8 number of roots against no roots at control after 7, 14, 21 and 28 days of treatment.

6.2.4 Effect of NAA on Mussaenda

Mussaenda did not respond well to the same range of concentrations of NAA. Number of roots produced was also lower than the other species tried. At the optimal concentration of 1000 $\mu\text{g/ml}$ the number of roots was recorded as 0, 5.2, 9.0, 12.4, 13.8, 15.2 after 7, 14, 21, 28 35 and 42 days as against no roots at the control.

6.2.5 Effect of NAA on Azalea

In response to NAA *azalea* started producing roots after 21 days of treatment. NAA 1000 $\mu\text{g/ml}$ stood as the optimal concentration producing 6.0, 4.8, 11.2, 12.0 12.8 number of roots after 14, 21, 28, 35, 42 days as against no roots at the control.

6.3 Effect of Rootex on rooting on cutting

Rootex was applied at the concentrations of 100, 250, 500, 1000 and 1,500 $\mu\text{g/ml}$ (quick dip method).

Rootex is commercial rooting agents of IBA and the results of Rootex was also similar with IBA. Out of the five concentrations tried 1000 $\mu\text{g/ml}$ was optimum.

in all the five species viz. tried *Dahlia*, *Chrysanthemum*, rose, *Mussaenda* and azalea. At 1000 µg/ml the number of roots was recorded in *Dahlia* as 8.8, 14.0, 21.2, 24, in *Chrysanthemum* as 24.8, 37.8, 50.8, 61.4, and in rose cuttings as 11.4, 17, 24.2, 27.4 after 7, 14, 21, 28 days respectively. In *Mussaenda* the number of roots produced was 5.6, 12.6, 15.4, 21 and in azalea 6.2, 13, 17.4 20.4 after 21, 28, 35, 42 days.

6.4 Effect of Rootone on rooting on cutting :

Rootone is a commercial formulation of IBA and NAA (0.1% IBA and 0.2% NAA). Rootone was applied at the concentrations of 100, 250, 500, 1000, 1500 µg/ml. Out of five concentrations applied 1000 µg/ml was optimum in all the five experimental species, viz, *Dahlia*, *Chrysanthemum*, rose, *Mussaenda*, azalea. The number of roots was recorded at optimal concentration as 15.3, 20.6, 24, 26.6 in *Dahlia* 12.6, 23.3, 26.6, 39.6 in *Chrysanthemum* and 18.0, 25.0, 20.3, 33.0 in rose after 7, 14, 21, 28 days respectively. At optimal concentration the number of root was recorded as *Mussaenda* 9.3, 14.6, 15.0 and 16.6 for *Mussaenda* after 21, 28, 35, and 42 days and 6.3, 11.6, 15.6, 18.6, 21.0 in azalea after 14, 21, 28, 35 and 42 days.

6.5 Interaction

6.5.1 Interaction between IBA with GA₃

GA₃ alone caused inhibition on rooting. But the combined effect of IBA and GA₃ revealed root promotion to some extent. GA₃ was applied at the same concentration

of 50 µg/ml and IBA was applied at 100, 250, 500, 1000, 1500 µg/ml. Out of five concentrations the combination GA₃ 50 + IBA 1000 µg/ml was optimum in all the five species viz. *Dahlia*, *Chrysanthemum*, rose, *Mussaenda* and azalea. At GA₃ 50 + IBA 1000 µg/ml the number of roots was 10.6, 13.3, 18.6, 20.3, in *Dahlia* 14.3, 16.6, 21.6, 25.3 in *Chrysanthemum* 5.0, 10.6, 14.6, 15.6 in rose 0, 7.3, 12.3, 13.0 in *Mussaenda* and 0, 7.6, 10.0 in azalea after 7, 14, 21, 28 days.

6.5.2 Interaction between NAA with GA₃

GA₃ was applied at the same concentration of 50 µg/ml and NAA was applied at 100, 250, 500, 1000 and 1500 µg/ml. GA₃ alone was inhibitory on rooting on cuttings but the combined effect of GA₃ and NAA proved to be stimulatory. Out of five concentrations GA₃ 50 + NAA 500 µg/ml was optimal for *Dahlia*, *Chrysanthemum*, and azalea. But the combination GA₃ 50 + NAA 250 µg/ml was optimal for rose cuttings and GA₃ 50 + NAA 1000 µg/ml for *Mussaenda*. In optimal concentration recorded number of roots was in *Dahlia* 7.0, 13.3, 14.0, 17.3, in *Chrysanthemum* 7.0, 12.0, 13.3, 15.6 in Rose 0, 5.6, 9.6, 10.6 in *Mussaenda* 0.0, 5.0, 7.6, 9.6, and in azalea 0, 5.3, 7.3, 9.6 after 7, 14, 21, 28 days.

6.5.3 Interaction between GA₄₊₇ and IBA

GA₄₊₇ alone did not impart any significant positive effect on rooting in cuttings but the combined effect of GA₄₊₇ and IBA proved to be stimulatory to some extent. GA₄₊₇ was applied at the same concentration of GA₃ (i.e. 50 µg/ml) and IBA was applied at the 100, 250, 500, 1000, 1500 µg/ml. The combination of GA₄₊₇ 50 +

IBA 500 $\mu\text{g/ml}$ and GA_{4+7} 50 + IBA 1000 $\mu\text{g/ml}$ reported as optimal in all the five plant cuttings of *Dahlia*, *Chrysanthemum*, rose *Mussaenda* and azalea. In optimal concentration at GA_{4+7} + IBA 500 $\mu\text{g/ml}$ the number of roots recorded was 0, 8.3, 12.3, 15.0 in *Dahlia* 7.0, 13.3, 13.3, 15.3 in *Chrysanthemum* 0, 0, 5.6, 8.3, in rose 0, 0, 5.6, 7.6, 8.6 in *Mussaenda* 0, 0, 0, 5.3, 6.6 in azalea after 7, 14, 21, 28, 35 days.

6.5.4 Interaction between GA_{4+7} and NAA

GA_{4+7} was applied at the same concentration of 50 $\mu\text{g/ml}$ and NAA was applied at the concentration of 100, 250, 500, 1000, 1500 $\mu\text{g/ml}$. Out of five concentrations GA_{4+7} 50 + NAA 250 $\mu\text{g/ml}$ and GA_{4+7} 50 + 500 $\mu\text{g/ml}$ proved to be stimulatory in all five species tried. At the combination GA_{4+7} 50 + NAA 500 $\mu\text{g/ml}$ the recorded root number was in *Dahlia* 0, 6.6, 9.6, 10.6, in *Chrysanthemum* 5.3, 8.3, 9.6, 15.6 in rose 0.0, 5.0, 8.3 in *Mussaenda* 0, 0, 7.3, 8.6, 6.6 and in azalea 0, 0, 0, 6.2, 7.3 after 7, 14, 21, 28 35 days.

6.5.5 Interaction between ethrel and IBA

Ethrel exhibited no effect on rooting in cuttings but the combined effect of ethrel and IBA proved to be stimulatory to some extent. Ethrel applied at the same concentration of 50 $\mu\text{g/ml}$ and IBA was applied at the concentrations of 100, 250, 500, 1000, 1500 $\mu\text{g/ml}$. Out of five combinations ethrel 50 + IBA 500 $\mu\text{g/ml}$ proved to be optimal for all the five species tried and recorded root number was in *Dahlia* 16.3, 30.6 34.3, 36.3, in *Chrysanthemum* 23.3, 28.3, 33.3, 35.3, in rose 0, 19.3,

24.6, 30.3, 33.3, in *Mussaenda* 0, 8.3, 15.3, 22.6, 26.6, in azalea 0, 0, 8.3, 11.6, 14.6 after 7, 14, 21, 28 and 35 days.

6.5.6 Interaction between ethrel and NAA

Ethrel was applied at the concentration of 50 µg/ml and NAA was applied at 100, 250, 500, 1000, 1500 µg/ml. NAA proved to be stimulatory in rooting in cuttings but ethrel had no effect in rooting in cutting. But the combined effect of ethrel and NAA was stimulatory in rooting in cuttings of *Dahlia*, *Chrysanthemum*, rose, *Mussaenda* and azalea. The combination of ethrel 50 + NAA 500 µg/ml proved to be stimulatory in all the tried species. Recorded root numbers in optimal concentration for *Dahlia* was 10.6, 18.3, 25.3, 35.3 for *Chrysanthemum* 24.3, 29.6, 35.3, 38.3, for Rose 6.3, 8.6, 13.3, 20.6 for *Mussaenda* 0, 4.3, 8.6, 11.3 13.6 for azalea was 0, 5.3, 9.6, 11.3, 13.6 after 7, 14, 21, 28, 35 days.

6.6 Anatomical studies :

Double stained permanent slides were prepared from the root producing zones for anatomical study to examine the origin of adventitious roots in response to the treatments.

(1) Modification of normal cell to trichoblast cell have been seen near vascular bundles in all stem cuttings in all the treatments.

(2) Adventitious roots in herbaceous plants (*Dahlia Chrysanthemum*) originated just outside the vascular bundles.

(3) In woody (or semi hard) plant (rose, *Mussaenda*, azalea) adventitious roots in stem cuttings originated from living parenchyma cells of vascular bundle.

(4) Some cells behind the protective layer at the base of the cuttings divided and formed callus in rose.

The results obtained are expected to be exploited by the entrepreneurs on commercial basis.