Horticulturists and herbalists know orchids for the past 400 years. Their enchanting and exquisite flowers have made them an important component of commercial exports of several countries. The tremendous international marketing opportunities have spurred in vitro micropropagation endeavours to meet both conservation and market demands. Commercial importance of orchids has put the natural diversity of orchids at stake. Some of the orchids, including those occurring in India have already found a place in the ‘Red Data Book’ of endangered plants. Further commercial exploitation of these plants from their natural habitat is therefore unwarranted. Those, which are presently available also, need to be conserved as components of native biodiversity. Thus, in vitro micropropagation techniques have come as a solution to the contrasting demands of preservation and commercialization of orchids.

The present study is an extension of this time tested scientific philosophy. After a careful analysis of the commercially important orchids of India, ten taxa belonging to Dendrobium, Cattleya, Oncidium and Phalaenopsis were selected for initial screening for their response to in vitro protocols. Finally, four cultivars viz., Dendrobium Queen Sonia, D.
Emma White, *Phalaenopsis Queen Emma* and *Cattleya Naomi Kerns* were selected for further studies.

In vitro protocols were designed after a thorough review of literature with regard to successful culture media known for orchids and organization of the substages of the protocol used. Since more than 60% of the orchids have been cultured with high rate of success on MS, VW and KC media, they were selected for the present study also and further modified depending on requirements. For instance, use of banana pulp in various concentrations has given good results at reduced financial inputs. Similarly, the generally accepted 5-stage protocol is extended to a 6-stage protocol in this study. This has helped in understanding the morphogenetic passage of explants from the inoculation stage to plantlet stage better than the earlier protocols used. Apart from these significant deviations aimed at saving costs as well as increasing the number of plantlets and their rate of survival, use of low cost, reusable glass-ware has further emphasized economy of the whole endeavor vis-à-vis the other protocols used for orchid culture.

A noteworthy aspect of this study is the incorporation of statistical analysis for evaluating results. Although, micropropagation in orchids is being conducted on a 'end justifies the means' policy, with the success measured only in terms of number of plantlets generated per explant and with little emphasis on the morphogenetic changes in the culture vessel, the
present study addresses this problem by incorporating statistical analysis of in vitro stages that are responsible for the transformation of explants into transplantable regenerated plantlets. Emphasis was also given to determine the nutritional requirements of the explants used at each stage of the protocol.

Selection of explants, like selection of suitable culture media, is a crucial aspect of micropropagation in orchids. Several sources such as meristem, shoot tip, leaf, nodal buds, internodes, inflorescence, root tip, rhizome/pseudobulb, cell and protoplast have been used as explants in orchid culture. In the present study, all these sources, excepting cell and protoplasts, have been used as explants. Meristems were avoided as explants in taxa like *Phalaenopsis* due to their monopodial nature, and excision of meristem in such cases would mean death of the plant specimen itself.

The protocols employed in this study have provided significant results, on the basis of which further selections of the best combination of explant and culture medium could be made. The salient features of these data are as below:

1) Best explants for callus initiation was in meristems as far as percent of callusing but shoot tips were better for degree of callusing. Excepting in *Phalaenopsis Queen Emma*, all hybrids shoot tips were used and obtained
results. All explants were successful in giving results, especially leaf and internodes

2) Multiplication of callus was introduced as a new stage in the culture protocol. This has yielded desired results in terms of increase in the number of plantlets obtained per single explant. However, subculturing for more than two times resulted in loss of differentiation in the callus.

3) For regeneration of PLBs and plantlets, VW medium was good for *Dendrobium* whereas MS medium proved good for *Cattleya* and *Phalaenopsis*. The requirement of growth regulators depended on the type of explant used in each orchid.

4) Wet weight of callus seemed to be correlated to percentage of PLB formation.

5) Although, both MS and VW media were good for plantlet growth in all orchids studied, VW medium is preferable, as it is more economical. Results on KC medium were moderate.

6) Banana pulp helped in rooting and plantlet growth in all the orchids studied.

7) Among the synthetic auxins used in the study (NAA, 2,4-D and IBA), NAA gave the best results. 2,4-D induced good growth but the plantlets were unusual. The possibilities of these being somaclonal variations are being examined.
Among the cytokinins used (BAP, kinetin and 2iP), BAP gave good results for multiplication of plantlets in *Dendrobium*, VW medium for *Cattleya* and MS medium for *Phalaenopsis*.

All these and other data have been summarised in Tables and supported by photographs. The relative merits of different explants in terms of their response to various in vitro conditions provided in this study have been discussed.

Micropropagation of orchids thus serves the twin objectives of commercialization and conservation. Use of reusable, low cost glassware nontraditional nutrient supplements such as banana pulp and success from explants such as internodes which are available more in quantity but seldom used because of poor response and designing suitable protocols would further economise the protocols. This aspect assumes significance because of the huge volume of *in vitro* propagation being conducted in orchids. Reduction of costs even marginally would mean savings of millions of dollars at the national level and billions at the global level. Towards this end, the present study offers certain advantages in protocol for culture of some popular Indian orchids.