

वार्षिक प्रतिवेदन

# ANNUAL REPORT

2006-2007



राष्ट्रीय अर्किडस अनुसन्धान केन्द्र  
( भारतीय कृषि अनुसन्धान परिषद )  
पाक्योंग, पूर्व सिक्किम-737 106

NATIONAL RESEARCH CENTRE FOR ORCHIDS  
(Indian Council of Agricultural Research)  
PAKYONG, EAST SIKKIM- 737106





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## Executive summary

The research programme of the institute have been carried out with a multi disciplinary approach covering different aspects of orchids and liliiums.

Random amplified polymorphic DNA (RAPD) markers were used to evaluate genetic diversity among 8 species of Dendrobium orchids. Eight randomly selected decamer primers produced 90 amplified fragments among which 80 were polymorphic. The genetic distance measured based on Squared Euclidean Distance ranged from 5-23%.

Cluster analysis classified 8 germplasms into two major clusters.

Random amplified polymorphic DNA (RAPD) markers were used to evaluate genetic diversity among 8 species of Paphiopedilum orchids. Eight randomly selected decamer primers produced 90 amplified fragments among which 77 were polymorphic and 11 were unique to some germplasms. By Ward's Method of cluster analysis 8 germplasms were classified into two major clusters.

A and B.

Protocorms excised from embryo cultured of three *Cymbidium* species were cultured in MS and Nitsch

media with different concentration and combination of BAP, Kinetin and Triacontano and NAA for further multiplication. The Protocorms of *Cymbidium whitae* cultured on MS supplemented with 0.5 mg/l BAP or 0.5 BAP + 0.25 NAA showed fastest multiplication and early plantlet formation.

The F1 progeny of *Epidendrum radiacans* and *Epidendrum xanthinum* were evaluated for flowering traits for 2<sup>nd</sup> year and shown even colour variation with different colour gradient with sepal and petals variation

Growing of *Cymbidium* in cuttus bark + Maize cob + Leaf mould (1:1:1) media and application of water soluble fertilizer- Nitrophoska (19:19:19) at 1g/l weekly twice improved vegetative as well as reproductive growth

Growing of *Cymbidium* in 75% shade produced maximum number of leaves and leaf length followed by 50% shade.

Application of 50% (300ml) and 75% water (450 ml) in 6" size pot improved vegetative growth of *Cymbidium* orchids. This water level produced more than 4 shoots per pot.



Calcium Nitrate, Aluminium Sulphate, Boric acid and Silver Nitrate each at dual concentrations of 0.01% and 0.05%, Sucrose (2%) along with control were used to evaluate the effect of chemicals on vase life of *Cymbidium* hybrids. Most of the chemicals increased the vase life except silver nitrate. Application of Silver Nitrate caused blackening of stem.

A new rust disease caused by *Puccinia* sp. on *Satyrium nepalense* was isolated and characterized

About 15 orchid samples comprising *Cymbidium* species and hybrids, *Coelogyne* and *Phaius wallichii* were tested for indexing of *Cymbidium* mosaic virus. Both symptomatic and asymptomatic leaf samples were studied by DAS- ELISA (Double antibody sandwich-ELISA) using CymMV antibody (Agdia, USA). All the samples exhibited positive result for *Cymbidium* mosaic virus infection except *Cymbidium* hybrid Fancy Free and one *Cymbidium* species.

A new scale *Diaspis boisduvalii* and mite *Brevipalpus essigi* were observed in *Dendrobium Nobile*

New aphid *Macrosiphum luteum* observed in *Vanda coarctata* from bud stage to flowers withered.

*Cymbidiums* infested by two spotted spider mites respond to some acaricides, neem products and bioagent

Treatments of infested *cymbidiums* with chloropyriphos 20 EC@ 2.5 ml/lit and imidacloprid @2.5 ml/lit resulted in greatest percent shoot survival

The partially degraded saw dust of soft wood was found as best medium for propagation of liliium.

The outer and middle bulb scales of mother bulb produced greater number of bulblets, more biomass/scale and higher fresh weight than inner bulb scales in propagation of liliium

The centre produced seedlings of Marigold-8000 and seeds -10kg, Chrysanthemum seedlings 12000, Gladiolus corms-12000, cormels-1.20 lakh, Freesia corms-2500 and Seasonal flowers seeds 12 kg.

The centre organized five training programme on various topics of orchids.



## कार्यकारी सारांश

डेन्ड्रोवियम और पेफियोपेडिलम की ८-८ प्रजातियों की आनुवंशिकी विविधता का रेन्डम एमप्लीफाइड पालीमोर्फिक डी.एन.ए. (आर.ए.पी.डी.) मार्कर द्वारा आंकलन किया गया। आठ चयनित डीकेमर प्राईमर द्वारा ९० प्रवर्धित खण्ड प्राप्त किए। डेन्ड्रोवियम प्रजाति में ८० बहुरूपी पाए जिन्हें सक्वायर्ड इयूसिलडियन दूरी से मापने पर उनकी आनुवंशिक दूरी ५-२३ प्रतिशत पाई गई और समूह विश्लेषण के आधार पर उपर्युक्त ८ जनन द्रव्य को दो मुख्य समूहों में वर्गीकृत किया गया। पेफियोपेडिलम प्रजाति में ७७ बहुरूपी तथा ११ अद्वितीय (यूनीक) पाए गए। वार्डस विधि द्वारा इन ८ जनन द्रव्य को दो मुख्य समूहों, ए और बी में वर्गीकृत किया गया।

सिम्बीडियम इलीगेन्स, सिम्बीडियम पेन्डुलम और सिम्बीडियम वाइटे का प्रोटोकार्म निकालकर उन्हें एम.एस. एवं निश्च संवर्धन माध्यमों में उगाया गया तथा संवर्धन माध्यम में बी.ए.पी., काइनेटिन और ट्राइकोन्टेनो ०.२५, ०.५०, १.००, १.५० और २.०० मिली/ली. तथा एन.ए.ए. ०.२५ और ०.५० मिली/लि. मात्रा में मिलाया गया। सिम्बीडियम वाइटे के प्रोटोकार्म की वृद्धि एम.एस. संवर्धन माध्यमों में ०.५० मिली/ली बी.ए.पी. अथवा ०.५ बी.ए.पी. + ०.२५ एन.ए.ए. डलने से सबसे अधिक पादपक (प्लान्टलेट) प्राप्त हुए।

इपिडेन्ड्रम रेडिकेन्स और इपिडेन्ड्रम जेन्थियम की एफ-१ संतति का दूसरे वर्ष पुष्पन गुणों के लिए अध्ययन किया गया और पेटल और सेपल में विभिन्न रंगों की विविधता पाई गई।

सिम्बीडियम प्रजाति को कटूस छाल + मेजकोब + लीफमोल्ड १:१:१ के अनुपात में तथा नाइट्रोफोसका १९:१९:१९ एक ग्राम/ली सप्ताह में दो बार डालने से पौधों की कायिक वृद्धि और जनन वृद्धि में काफी सुधार पाया गया।

सिम्बीडियम प्रजाति को ७५ प्रतिशत छाया में उगाने से सबसे अधिक पत्तियां (१०) तथा पत्तियों की लम्बाई ५५.२५ सेमी. प्राप्त हुई जबकि बिना छाया वाले पॉलीहाउस में पत्तियों की संख्या ६ और पत्तियों की लम्बाई में कमी देखने को मिली। पॉलीहाउस प्रयोग में ६ इन्च गमलों में ५० प्रतिशत एवं ७५ प्रतिशत पानी डालने से कायिक वृद्धि में महत्वपूर्ण सुधार पाया गया। उपर्युक्त जल स्तर में पौधों में चार से अधिक प्ररोह प्राप्त

हुए जिनकी औसत चौड़ाई ३.१० सेमी थी।

कैल्शियम नाइट्रेट, एल्युमीनियम सल्फेट, बोरिक एसिड और सिल्वर नाइट्रेट का ०.१० प्रतिशत व ०.०५ प्रतिशत और सुक्रोज २ प्रतिशत सान्द्रता का फूलदान में जीवनकाल पर अध्ययन किया गया। उपर्युक्त प्रयोग में पाया गया कि कैल्शियम नाइट्रेट डालने से जल अधिग्रहण ज्यादा पाया गया। सभी रसायनों में केवल सिल्वर नाइट्रेट को छोड़कर बाकी सभी में जल अधिग्रहण ज्यादा देखा गया।

सिम्बीडियम की विभिन्न प्रजातियों तथा सीलोगायनी और फायस वलीची का डी.ए.एस.- एलाइजा द्वारा विषाणु की उपस्थिति जात करने के लिए टेस्ट किया गया। इस विधि से सिम्बीडियम मोजिक विषाणु अधिकतर प्रजातियों में पोजिटिव पाया गया।

डेन्ड्रोवियम नोविली में एक नया पीडक कीट डायसपिस बोयसडुवलाई तथा माईट ब्रेवीपाल्यस एस्सिगाई पाया गया। इसके अलावा वंडा सीरूलिया में एक नया एफिड भी रिपोर्ट किया गया।

सिम्बीडियम के दो प्रमुख शत्रु-धब्बेदार मकड़ी एवं माइट को नियंत्रित करने में एकेरिसाइड, नीम उत्पाद तथा जैव कारक प्रयोग में लाए गए। इनको नियंत्रित करने में कीटनाशक क्लोरोपायरीफॉस २० ईसी @ २.५ मिली/ली. तथा इमीडाक्लोप्रिड @ २.५ मिली/ली. की दर से का सफल प्रयोग किया गया।

लिलियम के प्रवर्धन हेतु ९ पोटींग मिक्चर को प्रयोग में लाया गया तथा यह पाया गया कि सॉफ्ट बुड का निम्नीकृत बुरादा लिलियम के प्रवर्धन हेतु सर्वोत्तम है।

लिलियम के मदरबल्ब के बाहरी और मध्य बल्ब स्केल्स से ज्यादा बल्बलेट उत्पादित किए गए और इनका बायोमास और भार भी अन्दर वाले बल्ब की अपेक्षा ज्यादा पाया गया।

गत वर्ष में केन्द्र ने मेरीगोल्ड - ८००० का १० किग्रा. बीज, गुलदावदी के १२००० पौधे, ग्लेडियोलस बल्ब १२०००, कोरमेल्स के १.२० लाख बल्ब, फ्रीजिया कोर्म २५०० और अन्य फूलों का उत्पादन १२ किग्रा. किया गया।

केन्द्र ने इस वर्ष विभिन्न विषयों में पांच प्रशिक्षण कार्यक्रमों का सफल आयोजन किया।



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**In-vitro plantlets under MM-I**



**Plants ready for distribution**





## INTRODUCTION

### The Institute

The National Research Centre for Orchids was established by the Indian Council of Agricultural Research (ICAR), New Delhi on 5th October 1996 to organize research programme for improvement the productivity, quality and utility of orchids and bulbous flowering crops. Sikkim state authorities handed over 22.19 acres of land belonging to Regional Agricultural Centre along with all other assets to ICAR for the establishment of the centre. In October 1997 the centre also took over the Darjeeling campus from C.P.R.I. and established a sub centre for research work on temperate orchids and other bulbous flowering crops.

In the initial years of the establishment the major focus of research was on collection, evaluation, characterization and utilization of available germplasm in the north eastern region in particular, and in the country in general. With the changing scenario of floriculture in the country, the centre has modified its approach and thrust areas of research to meet the challenges. Today the focus is on development of exportable varieties/hybrids, molecular characterization, standardization of agro-techniques, post harvest management, production of quality planting materials through tissue culture and creation of repository of information related to all aspects of orchids. On the recommendations of RACs all the research projects have been modified on the mission oriented research programme on crop improvement, crop production, crop protection and post harvest management.

### Mandate

- Collection, evaluation, characterization and conservation of germplasm of orchids and other bulbous flowering plants.
- Molecular characterization to check biopiracy of orchids
- Development of protocol for mass multiplication and production of quality plant materials for large scale cultivation
- Development of hybrids/ varieties suitable for domestic and export market.
- Development of production, protection, and post-harvest technologies for orchids and flowering bulbous plants.
- To act as a National repository for scientific information on mandate flower crops
- To coordinate research with other scientific organizations and act as centre for training.

The research work is being carried out under 09 projects. In addition to these, research work is also carried out under externally funded projects- Technology Mission on Integrated Development of Horticulture in North Eastern States including Sikkim, Uttranchal, Himachal Pradesh and Jammu & Kashmir (Mini-Mission- 1), project on Distinctiveness, Uniformity and Stability of Orchids (DUS Project), and mega seed project-Seed production in Agricultural crops and Fisheries.

### Salient Research Achievements

#### Crop Improvement

The main strategy of research under crop improvement is the development of protocols for mass propagation of orchids, development of



varieties/ hybrids of superior quality to capture export market and characterization of orchids using important horticultural traits, biochemical parameters and molecular DNA markers.

Protocols developed for mass propagation of *Cymbidium* hybrids and other commercially important orchids. Development of superior varieties are under progress.

Near about 200 orchids species were characterized using morphological and biochemical traits. Genetic diversity assessment of *Cymbidium*, *Dendrobium* and *Paphiopedilum* species were done using RAPD markers.

### **Crop Production**

With the objective of development of technologies for large scale production of orchids, research programmes set up to identify suitable low cost growing media, shade and water requirement, nutrient regime etc. Growing *Cymbidium* orchids in Cattus bark + Maize cob + Leaf mould (1:1:1) and application of Nitrophoska (19:19:19) at 1g/l weekly twice improved both vegetative and reproductive growth.

Module containing Leaf mould + FYM + Charcoal + Coconut husk and rotten logs (2:1:1:1:1) and spraying with N 200 ppm, P 100 ppm, K 100 ppm, + BA 100 ppm + GA 100 ppm helps in production of highest number of shoot, spike length and number of flowers in *Cymbidium* hybrids.

Soaking of bulb lets of Asiatic lily in aqueous solution of ethylene (50 mg/l) increased the weight of bulb nearly double.

### **Crop Protection**

Survey and monitoring of orchid diseases were done in Sikkim and adjoining areas. The most important fungal diseases prevalent in this area are black rot disease caused by *Pythium aphanidermatum* and

*Phytophthora pamivora*. Besides black rot, another important disease was found was anthracnose caused by *Colletotrichum gleosporioides*. *Sclerotium rolfsii* and *Sclerotinia sclerotium* were also found in Darjeeling and Mirik area on several orchid species. *Cymbidium* mosaic virus (CymMV) and odontoglossum ring spot virus (ORSV) are the major viral diseases associated with orchids.

Several aphid fauna like *Microsiphum lutium* and *Toxoptora aurantii* and scale insect *Diaspis boisuvalii*, *Pinnaspis buxi*, and shoot borer, *Peridaedala* sp, mite *Tetranychus urticae*, thrips *Frankiniella* sp. are the major pests associated with orchids. Various chemicals and botanicals are being standardized for the control of these pests.

### **Extension and Transfer of Technology**

The Centre organized six training programmes on various topics and trained 20 trainers from State Department of Agriculture/Horticulture and also trained 71 farmers from different regions to full fill the demands of North eastern states during last year.

### **Farm Development**

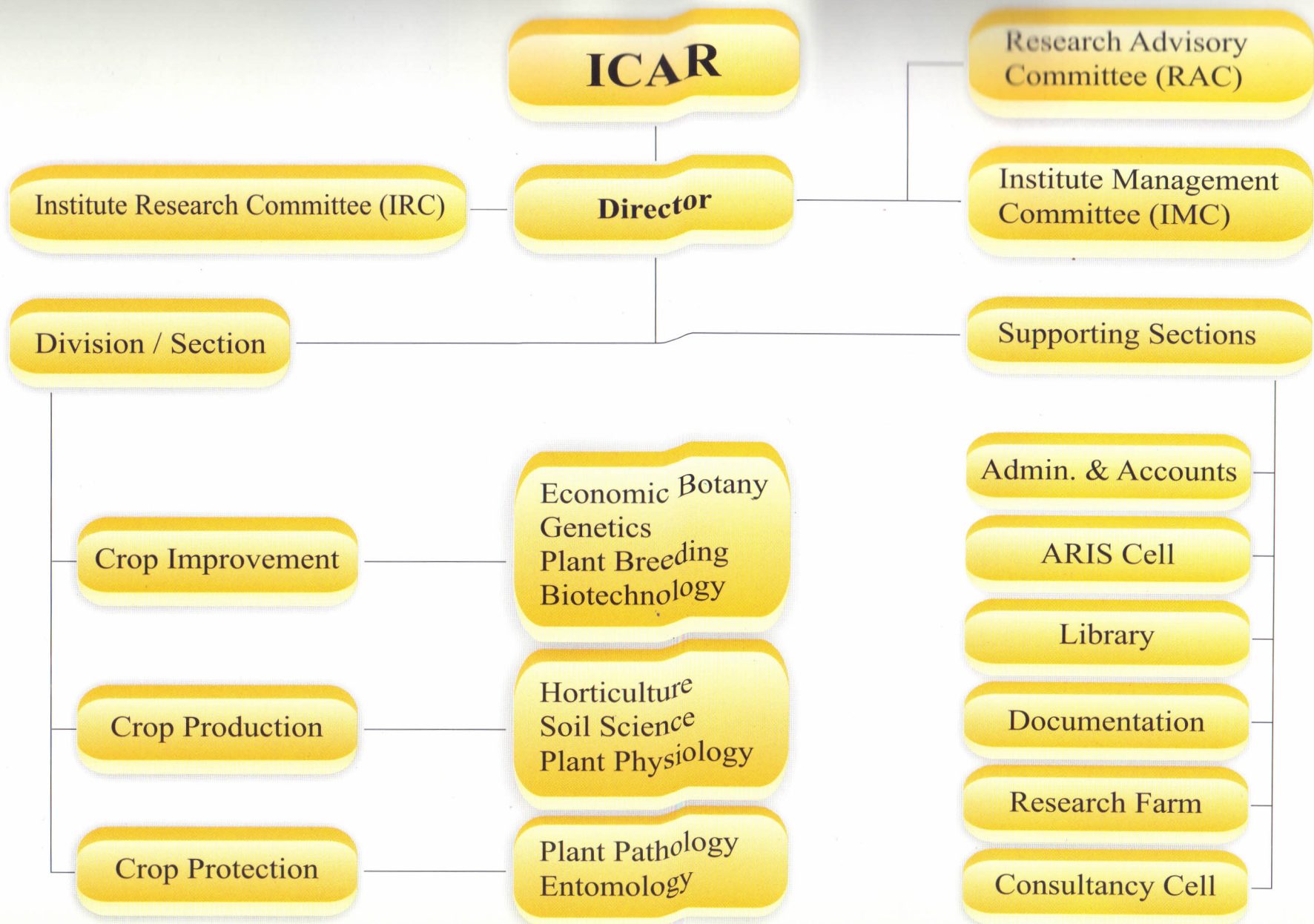
The maximum area under farm for research experiments are narrow strip/ terrace. The narrow strip/ terrace were developed in broad lands to put under different experiments and establishment of poly house. The forest area under farm developed for *ex situ* conservation of epiphytic orchids.

### **Planting and Seed materials**

The centre has well established infrastructure for production of seed and seedlings for distribution to the farmers. The Centre produced seedlings of *Cymbidium* orchids 2093, Marigold 6000, Chrysanthemum 10,000, Seeds of Marigold- 4 Kg. Seasonal flowers 8 Kg., Corms 10,000; Cormels 1 lakh of Gladiolus, corm of Fressia 2000 during last year.



# ORGANIZATIONAL SET UP





**Staff strength  
(As on 31.03.2007)**

Staff	Sanctioned	In Position
Director	1	1
Scientific	15	8
Technical	6	6
Administrative	6	5
Supporting	6	5
<b>Total</b>	<b>32</b>	<b>24</b>

**Financial statement  
(2006-07)**

Financial Statement		(Figure in Rupees)		
Head of Account	Non-Plan		Plan	
	Sanctioned	Utilized	Sanctioned	Utilized
Establishment charges	5900000	5859553	-	-
Labour wages	-	-		
Traveling allowances	200000	181728	237367	237367
Other charges	1095000	975310	5885050	58855050
Works	100000	24185	8862333	8862333
HRD	-	-	15250	15250
<b>Total</b>	<b>72,95,000</b>	<b>7040776</b>	<b>1500000</b>	<b>1500000</b>

Revenue generation	
Particulars	Amount (Rs)
Sale of farm produce	19559
Sale of tender forms	600
Training	10500
Others	287468
<b>Total</b>	<b>318127</b>



# 4

## RESEARCH ACHIEVEMENTS

Main Centre Pakyong





## Crop Improvement

### Genetics Division

#### Molecular Characterization of orchids

##### RAPD analysis of *Dendrobium* Orchids

Random amplified polymorphic DNA (RAPD) markers were used to evaluate genetic diversity among 8 species of *Dendrobium* orchids. Eight randomly selected decamer primers produced 90 amplified fragments among which 80 were polymorphic. The genetic distance measured based on Squared Euclidean Distance ranged from 5-23%.

Based on the estimated genetic dissimilarity matrix the highest genetic dissimilarity matrix 23% was noticed in *D. nobile*. The lowest genetic dissimilarity 5% was noticed in *D. fimbriatum*.

Cluster analysis classified 8 germplasms into two major clusters. Three species namely *D. aphyllum*, *D. densiflorum* and *D. moschatum* exclusively formed the cluster 'A'. The *D. nobile* and *D. fimbriatum* showed the closest proximity at a distance of 18 units and formed a separate cluster. In cluster 'B' there were 2 sub-clusters B-1 and B-II separated by a distance of 69 units. The species namely *D. chrysanthum*, *D. loddigesii* and *D. acinaciforme* formed the cluster B-1. The other species were grouped under another cluster forming a sub group B-II viz. *D. nobile* and *D. fimbriatum* hence establishing a distinct genetic identity from the other species and also among themselves

#### 1.2 RAPD analysis of *Paphiopedilum* Orchids

##### Random amplified polymorphic DNA (RAPD)

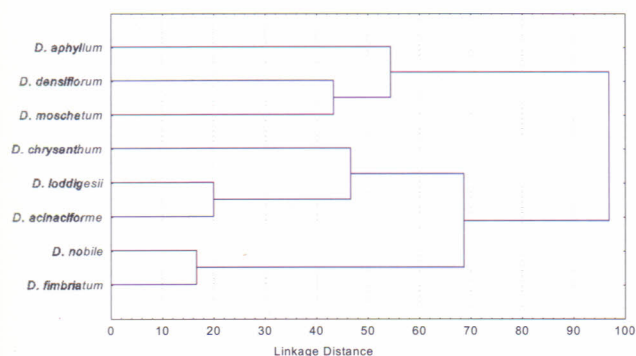


Fig. I: Genetic relationship (dendrogram) among eight *Dendrobium* species

markers were used to evaluate genetic diversity among 8 species of *Paphiopedilum* orchids. Eight randomly selected decamer primers produced 90 amplified fragments, among which 77 were polymorphic and 11 were unique to some germplasms. Based on the estimated genetic dissimilarity matrix the highest genetic dissimilarity matrix 21% was noticed in *P. druyri*. The lowest genetic dissimilarity 8% was noticed in the hybrid (*P. lawrenceanum* X *P. winston Churchill*). The result clearly indicated a less genetic diversity among the different species of the genus.

By Ward's Method of cluster analysis 8 germplasms were classified into two major clusters. A and B.

In cluster 'A' there were 2 sub-clusters A-1 and A-II separated by a distance of 65 units. The species namely *P. hirsutissimum* and *P. spicerianum* formed the cluster A-1. The other species were grouped under another cluster forming a sub group A-II viz. *P. insigne*, *P. villosum* and *P. venustum*, establishing a distinct genetic identity from the other plants and also among themselves. The species namely *P. fairieanum*, hybrid (*P. lawrenceanum* X *P. winston Churchill*), and *P. druyri* exclusively formed the cluster 'B'. The P.hybrid and *P. druyri* showed the closest proximity at a distance of 28 units and formed a separate cluster. The cluster had a distance from the other species of *P. fairieanum* at about 58 units.

The RAPD markers confirmed the distinction of close genetic diversity of the species and also the inter relationship among the different races of the genus that can be used for genetic improvement of the crop in this region.

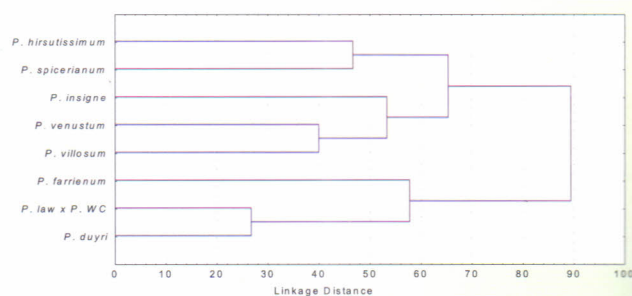


Fig. II: Genetic relationship (dendrogram) among eight *Paphiopedilum* species



## Biotechnology Division (Tissue Culture)

### *In vitro* propagation of Orchid: *Cymbidium* and important, rare and endangered species

Protocorms excised from embryo cultured of *Cymbidium elegans*, *Cymbidium pendulum* and *Cymbidium whiteae* were cultured in MS and Nitsch media with different concentration and combination of BAP, Kinetin and Triacotano (0.25, 0.5, 1.0, 1.5 & 2.0 mg/l) and NAA (0.25 & 0.5 mg/l) for further multiplication. The Protocorms of *Cymbidium whiteae* cultured on MS supplemented with 0.5 mg/l BAP or 0.5 BAP + 0.25 NAA showed fastest multiplication and early plantlet formation. *Cymbidium elegans* and *Cymbidium pendulum* cultured on Nitsch media with 1.0mg/l Kinetin + 0.25mg/l NAA showed better respond for early shoot and root development.

## Plant Breeding Division

### Breeding for superior hybrids of *Cymbidium* and other important Orchids

For understanding the crossability behavior among orchids the 2<sup>nd</sup> year data during 2006-07 was summarized for more reliable conclusion on breeding program. It was noticed that self incompatibility was existing among the many species of *Dendrobium* like, *Dendrobium densiflorum*, *Dendrobium moschatum*, *Dendrobium apiculatum*, *Dendrobium aduncum*, *Dendrobium densiflorum*. The success of crossing was achieved only 45 % in *Cymbidium* crosses. The overall success of crossing among the genera and species was achieved with 41.6 %. The culturing advanced on nine (self) and forty two (crossed) capsules of *Cymbidium* done from previous year were under different stages.

## Present status of F<sub>1</sub> hybrids under hardening stage

The F<sub>1</sub> hybrids of different crosses developed earlier years were under different stages and evaluation. The selection will be done in among these crosses for identifying the best F<sub>1</sub> lines for registration. The list of the crosses was mentioned below.

S No.	Status of endangered species multiplied	Under <i>in-vitro</i> hardening (Tissue culture Lab)	Under <i>ex-vitro</i> hardening (Hardening house)	No. of Plantlets in the hardening house (in pots & beds)
1	<i>Cymbidium whiteae</i>	44	10	363
2	<i>Cymbidium pendulum</i>	-	-	285
3	<i>Cymbidium elegans</i>	76	15	-

## Embryo culture:

The embryos excised from mature, unburst pods of *Cymbidium*, *Dendrobium*, *Vanda* and *Mokara species* and crosses were cultured on MS media supplemented with 1.5 gm/l activated charcoal (AC) and various concentration and combination of BAP (0.25, 0.5, and 1.0 mg/l) and NAA(0.25mg/l).

The embryo of PBX-05-857, PBS-06-0417, PBS-06-0473, PBX-06-0864, PBX-06-0283, PBX-06-0221, PBX-06-0194 and PBX-06-0308 are in the process of development structure followed by greening and PLB formation and differentiation. The crosses of the following *Cymbidium*, PBX-05-10, PBX-05-34, PBX-05-29, PBX-05-56 and PBX-05-39 are in protocorms and plantlet stage.



Direct differentiation of seeds (PBX-05-857)



Cross	Parentage	Plants in hardening
ABxSG	<i>Cymbidium</i> Oriental Legend x <i>C.</i> Showgirl Cooksbridge	396
Cym-A	<i>C.</i> Amesbury x <i>C.</i> Showgirl Cooksbridge	57
PBX-05-10	<i>C.</i> Fancy Free x <i>C.</i> Tetraploid Oklahoma	115
PBX-05-34	<i>C.</i> Red Star x <i>C.</i> Fancy Free	438
PBX-05-29	<i>C.</i> Golden elf x <i>C.</i> Red Beauty	189
PBX-05-56	<i>Cym lowianum</i> x <i>C. tigrinum</i>	52
PBX-05-67	<i>C.</i> Amesbury x <i>C.</i> Red Beauty	03
PBX-05-39	<i>C.</i> Red Star x <i>C.</i> Fancy Free	24
PBX-05-01	<i>Zygopetalum intermedium</i> x <i>Peristeris elata</i>	479
PBX-05-178	<i>Epidendrum xanthum</i> x <i>Renenthera inschootiana</i>	137
MD-01	-	30
NRC-42	-	10

### F<sub>1</sub> progeny evaluation of *Epidendrum* cross

The F<sub>1</sub> progeny derived from *Epidendrum radicans* and *Epidendrum xanthinum* were evaluated for flowering traits for 2<sup>nd</sup> year has shown eleven color variation with different color gradient (N30C, 169B, N25B, N25A, N163C etc) with petals and sepal variation. The selected three lines will be proposed for variety release.

### *Epidendrum radicans* and *Epidendrum xanthinum* cross



*E. radicans*



*E. xanthinum*



Progeny variation

### Progeny evaluation of *Paphiopedilum* cross:

The promising *Paphiopedulum* cross (*P. lawrenceanum* x *P.* 'Winston Churchill') was flowered with large flower size during the first year and progeny will be evaluated for 2<sup>nd</sup> year.



*P. lawrenceanum* x *P.* 'Winston Churchill'

### Evaluation of Freesia:

The F<sub>1</sub> plants of freesia cross derived from earlier cross were evaluated for characterization for 2<sup>nd</sup> year for understanding the uniformity and stability. The new F<sub>1</sub> plants were with a new flower color and appealing. The selected plants were harvested for multiplication in bulk in coming years and will be proposed for release.



Comparison of F<sub>1</sub> with parents



F<sub>1</sub> Plant flower color



## Conservation of Orchid germplasm

As recommended by 7<sup>th</sup> RAC (2005-06), the horticultural traits were recorded on 300 accessions from germplasm collections. The present status of germplasm collections belonging to different genera and species is 500. The initiative was taken for *ex-situ* conservation of orchids in the forest area. In this regard, the 75 tree species were identified in the farm area for training and establishment for *ex-vitro* conservation. The proposal on *in-vitro* conservation will be taken up with collaboration with NBPGR in future. The endangered and threatened species like, *Cymbidium whitae*, *Cymbidium pendulum* and *Cymbidium elegans* were multiplied in good number.

## Crop Production

### Horticulture Division

#### Development of Agro-techniques for Commercial Scale Production of Orchids in Protected Condition

#### Effect of growing media and interval of nutrient spraying on growth and flowering of *Cymbidium* under low cost poly house.

The experiment was carried out with 14 treatments consisting various growing media viz. T<sub>1</sub> - Perlite + Cocopeat + Brick pieces, T<sub>2</sub> - Cocopeat + Brick pieces + Leaf mould, T<sub>3</sub> - Perlite + Brick pieces, T<sub>4</sub> - Thermocol + Cocopeat + Brick pieces, T<sub>5</sub> - Rotten log + Sand + Coconut husk + Brick pieces, T<sub>6</sub> - Cattus bark + Maize cob + Leaf mould, T<sub>7</sub> - Leaf mould + Sand + Brick pieces + Coconut husk + Charcoal (Farmer's practice) with foliar application of polyfeed viz. N<sub>1</sub>-NPK(19:19:19) 1 g/l weekly once and N<sub>2</sub>-NPK(19:19:19) 1 g/l - weekly twice.

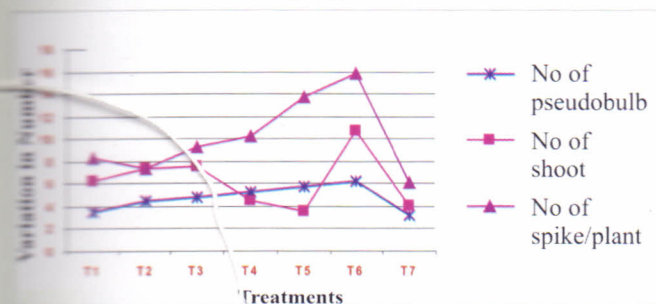


Fig 1. Effect of growing media in spraying of nutrients on vegetative and flowering of *Cymbidium*

It was recorded that growing of *Cymbidium* in cuttus bark + Maize cob + Leaf mould (1:1:1) media and application of water soluble fertilizer- Nitrophoska (19:19:19) at 1g/l weekly twice improved vegetative as well as reproductive growth. About 16 spike per m<sup>2</sup> was recorded in that media followed by Rotten log + Sand + Coconut husk + Brick pieces (13.75) as compared to farmer's practice (6) Fig-1

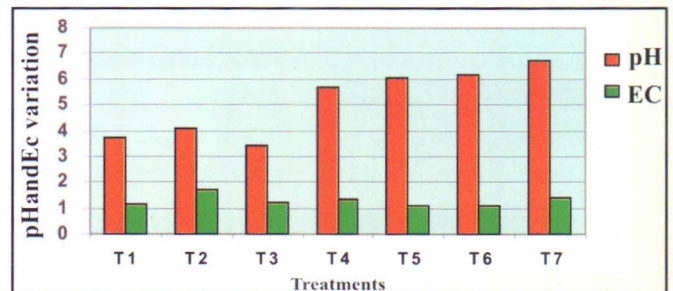


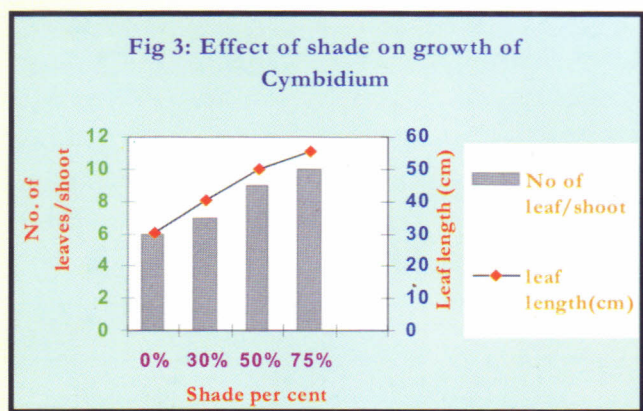
Fig2. Physical condition of the media

A higher level of pH (6.69) was recorded at farmer's practice media whereas media comprised of Cattus bark + Maize cob + Leaf mould (1:1:1) recorded 6.14. The EC of that media was recorded 1.07 ms/cm (Fig. 2). The same media consisted of higher nutrient content of N: 2.68%, P: 1.73% and K: 2.52% followed by Rotten log + Sand +Coconut husk + Charcoal (N : 2.42%, P: 1.13% and K : 2.10%) whereas the nutrient level of N : 1.88%, P: 0.80% and K : 1.50%) recorded at farmer's practice.

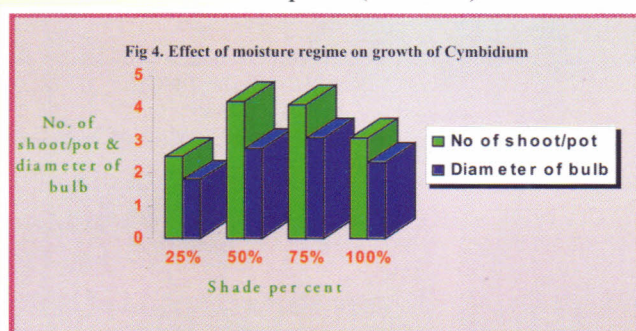
#### To study shade requirement and moisture regime for growth and flowering of *Cymbidium*.

The experiment consisted of four shade levels (0%, 30%, 50% and 75%) and four moisture regimes (25 %, 50%, 75% and 100 %). The moisture level of the media calculated on the basis of water holding capacity and the water was applied at 10-15 days interval depending on the weather and moisture content. The experimental results showed that growing of *Cymbidium* in 75% shade produced maximum number of leaves (10.00) and leaf length (55.25 cm) followed by 50 % shade. However the plant grown without shade produced less number of leaves (6) and leaf length (30.25 cm) Fig-3.





Application of 50% (300ml) and 75% water (450 ml) in 6" size pot improved vegetative growth. This water level produced more than 4 shoots per pot. Maximum diameter of plant (3.10 cm) was recorded



at 75% moisture regime Fig 4.

### Project: Post harvest studies of *Cymbidium*

#### Evaluation of Hybrids

10 hybrids were evaluated in order to assess the post harvest life of *Cymbidium* during the period of January to May. During this period the temperature ranges from 6°C-25°C. It was recorded that hybrids Show girl, Fancy Free and H. C. Aurora showed a longer vase life of more than 50 days, whereas Soul Hunt lasted around one month.

#### Effect of chemicals on post harvest behavior of *Cymbidium* hybrid *H. C. Aurora*.

The experiment consisted of Calcium Nitrate, Aluminium Sulphate, Boric acid and Silver Nitrate each at dual concentrations of 0.01% and 0.05%, Sucrose (2%) and Control. The treatments are replicated 5 times. The experiment results revealed that total water uptake was higher in case of Calcium Nitrate 0.01% (17.39g) followed by borax 0.05% (16.49g). In both the case the water uptake

and water loss ratio is more (1.1). Most of the chemical increased the vase life except silver nitrate. Application of Silver Nitrate caused blackening of stem. More than 40 days vase life was recorded in case of Calcium Nitrate, Aluminium Sulphate in both the concentrations. However a minimum vase life of 27 days was recorded in case of control plant. Further Calcium Nitrate and Aluminum Sulphate reduced the flower discoloration percentage as 20 days.

## Crop Protection

### Plant Pathology Division

#### Investigation on Fungal Diseases of Orchids

#### Studies of Teleutospore and Characterization of Rust on *Satyrium nepalense* as a new orchid disease

Fresh leaf samples were collected and taken to the laboratory for microscopic study for identification and characterization of the rust fungus. When transverse section of infected leaf was viewed under the microscope, teleutospores were distinctly found on the lower side of the leaf. Several teleutospores were observed to come out rupturing the lower epidermis. Teleutospores were cylindrical, elongated, deep brown in colour, two celled, thick walled with prominent single germ pore at the top. Germ pore of the lower cell obscured. Teleutospores always pedicelate (stalked) and measuring 24 - 35 µm. Teleutospores varied from 64.22 - 77.54 µm, side wall thickness 3.2 µm, top wall thickness 5.8 µm. Production of basidium and basidiospores were not observed.

Urediospores were also observed in the same pustules. Urediospores were light brown, spherical to oval or pear shaped, subglobose, echinulate, thick walled. Urediospores varied from 24.76 - 32.26 µm in size and wall thickness 4.1 µm. Germ pore obscure. Young pustules first produce urediospores abundantly. As the pustules became matured, the frequency of teleutospore production increased as compared to urediospores in the same pustules. The rust was identified as *Puccinia* sp.



### Studies on the yellow leaf rust of *Phaius tankervilleae*

Yellow leaf rust on *Phaius tankervilleae* was kept on continuous vigilance and leaf samples were collected and transverse section were made and observed under microscope for the presence of teleutospore stage at 30 days interval. But telial stage was not observed on *Phaius tankervilleae* and this stage may be produced on some other unknown natural host.

### Monitoring the occurrence of orchid wilt

Orchid wilt caused by *Sclerotium rolfsii* was monitored in our collected germplasm through out the reported year. The disease was recorded on *Vanda stangeana*, three *Cymbidium* species and one hybrid in the orchid house at NRC for orchids, Pakyong. The pathogens were isolated on PDA and identified.

### Studies on the Occurrence of Anthracnose on the orchid germplasms

Occurrence and incidence of anthracnose on orchid germplasms has been carried out in regular intervals and percent incidence of the disease was recorded on the following orchid species in the germplasm house at Pakyong. *Arachnis rubra* (100), *Agrostophyllum brevipes* (66.66), *Agrostophyllum callosum*(100.00), *Bulbophyllum guttulosum*(66.66), *Bulbophyllum scabratum*(100.00), *Coelogyne corymbosa* (100.00), *Coelogyne barbata* (33.33), *Coelogyne fuscescens* (71.87), *Coelogyne elata*(42.10), *Coelogyne flaccida* (81.25), *Coelogyne flavida* (100.00), *Coelogyne nitida* (42.10), *Coelogyne ovalis* (42.88), *Dendrobium hookerianum* (66.66), *Dendrobium nobile* (25.00), *Dendrobium densiflorum* (36.36), *Dendrobium chrysotoxum* (21.42), *Dendrobium chrysanthum* (82.75), *Dendrobium moschatum* (48.00), *Dendrobium kingianum* (50.00), *Dendrobium fimbriatum* (70.00), *Dendrobium thysiflorum* (16.66), *Eria amica* (55.00), *Eria bamboosifolia* (100.00), *Eria graminifolia* (77.77), *Eria pamila* (75.00), *Eria pubescens* (12.50), *Eria radiata* (76.92), *Eria spicata* (81.81), *Eria vitata* (85.71), *Epigenium rotundatum* (75.00), *Flickengeria fugax* (50.00), *Liparis viridifolia* (83.33), *Liparis hotanensis* (77.77), *Liparis longipes* (74.41), *Liparis plantaginea* (100.00), *Pholidata articulate* (92.10), *Pholidata nuda* (41.17), *Otochilus sp* (61.53), *Thalasis longifolia* (40.00)

### Management of Black rot of *Cymbidium* through fungicides

One experiment was laid out in the *Cymbidium* house at NRC for Orchids, Pakyong for the fungicidal management of black rot with six treatments [Metalaxyl (0.1%), Indofil M 45 (0.2%), Dithane Z 78 (0.2%), Carbendazim (0.2%), Thiophanate methyl (0.1%) and Cheek (water)] and five replications. Each replication consisted of 5 pots and spraying was given as soil drenching at an interval of 15 days as follows 3.6.06, 8.6.06, 5.7.06, 20.7.06, 5.8.06 and 20.8.06. Disease incidence was recorded at 15 days intervals.

### Monitoring and Management of virus diseases in orchids

#### Indexing *Cymbidium* mosaic virus on orchids

About 15 orchid samples comprising *Cymbidium* species and hybrids, *Coelogyne* and *Phaius wallichii* were tested for indexing of *Cymbidium* mosaic virus. Both symptomatic and asymptomatic leaf samples were studied by DAS- ELISA (Double antibody sandwich-ELISA) using CymMV antibody (Agdia, USA): Out of them, all the samples were tested strongly positive for *Cymbidium* mosaic virus infection except *Cymbidium* hybrid Fancy Free and one *Cymbidium* species, but *Coelogyne* sp which was apparently symptom less



*Diaspis boisduvalii* infestation on *Dendrobium nobile*

was also found strongly positive for CymMV infection.

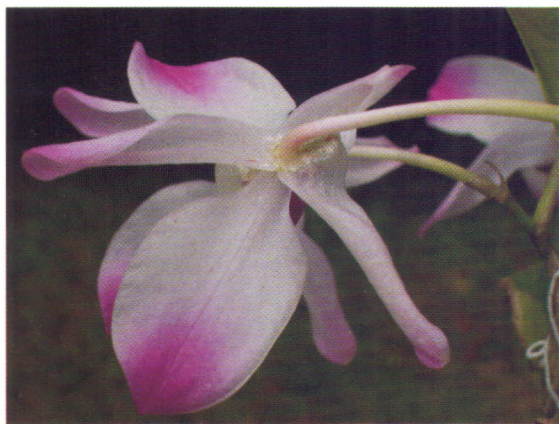


## Pest management in orchids and bulbous flowering plants

### Monitoring pests on orchids

A new record of the scale *Diaspis boisduvalii* (Signoret) (Hemiptera: Diaspididae) infesting the orchid *Dendrobium nobile*

The orchid *Dendrobium nobile* which grows naturally on tree trunks in the wild flowers during March to May and is used in commercial *Dendrobium* hybrids as parents. The orchid is conserved at National Research Centre for Orchids, Pakyong, Sikkim in Polyhouse made up of polycarbonate sheet, along with other orchid germplasm including *Cattleya* which were previously infested with biosduval scale *Diaspis boisduvalii* (Signoret) (Hemiptera : Diaspididae). It was observed that *D. nobile* was severely infested by the scale *Diaspis boisduvalii*. Out of 98 plants observed 79 were infested (80.6%). Due to infestation, health of the plant deteriorated and flower quality and quantity drastically reduced. Biosduval scales multiplied round the year but their number was low in winter. Scale infestation was noticed on leaves, canes, roots and flowers and caused loss of vigor, deformation of infested plant parts, yellowish spots on leaves, loss of leaves, and even death of the plant. Toxic saliva injected while feeding causes necrosis of tissue at the feeding site and small infestations on orchids cause extensive discoloration and large populations usually kill the host. Since scales are spread by introduction of



Mite infestation at the base of flower

infested material, they are a quarantine problem on exported potted plants, cut flowers, and cut foliage. Infestation on the orchid *Dendrobium nobile* is a new report from India.

### Occurrence of Mite *Brevipalpus essigi* Baker (Acari: Tenuipalpidae) on Orchid *Dendrobium nobile* in Sikkim, India.

False spider mite *Brevipalpus essigi*, has been discovered in large numbers on orchid *Dendrobium nobile*. *B. essigi* measuring about 260  $\mu\text{m}$  in length is flattened, reddish in colour, slow moving, and not readily detected because of their small size and sluggish behavior. Mites feed first along midribs of leaves and then disperse outward. They puncture epidermis of the leaf and suck out plant juices. The damaged leaves were severely discolored with large necrotic areas either side of midrib. Closer observations determined these to be individual sunken spots caused by the mites feeding which had coalesced into a fine red/ brownish speckling over the leaf surface. On several leaves these speckling formed a distinctive diamond pattern increasing in intensity from the center outwards. Remaining portions of the leaf surfaces were distinctively chlorotic. These mites also infest flowers and make them abortive. False spider mites do not produce webbing. Out of 216 plants observed 54 were severely infested with mites. Occurrence of *B. essigi* on Orchid *D. nobile* in Sikkim, India is the first record.

### Aphid *Macrosiphum luteum* (Bukton) Infests the Orchid *Vanda coerulea* -A New Report

The aphid *Macrosiphum luteum* (Bukton) has been found to infest the flowers of *Vanda coerulea* from remained till the flowers withered. The aphid suck the juice from buds as well as from opened flowers and simultaneously excrete honeydew which support the growth of black sooty mould an unsightly fungus that mars the beauty of flower. Honeydew secretions also invite black ants, which clearly indicate aphid infestation. Aphids are winged or wingless and formed small colonies. Aphid infestation on *Vanda coerulea* has been seen



starting from September to December under open polyhouse conditions. Worldwide, eight species of aphid from orchids: *Aulocorthum solani*, *A. dendrobii*, *A. circumflexum*, *Sitobion anselliae*, *S. indicum*, *S. luteum*, and *Cerataphis orchidearum* and *Toxoptera aurantii* have been recorded. However, the occurrence of *Macrosiphum luteum* (Bukton) on host orchid *Vanda coerulea* from India is the first report of this kind. This new report of Aphid *Macrosiphum luteum* (Bukton) infests the orchid *Vanda Coerulea* will help to study further in diagnosis of pest problems and management in commercial cultivation of Orchid *Vanda coerulea* and its hybrids.

### **Pest Interception in Northeastern Himalayan Orchid Germplasm**

The orchid flowers exhibit exquisite magnificence and diversity have contributed considerably to the international trade both in cut flower and potted plants. Knowing the immense value of Northeastern Himalayan Orchids, germplasm have been collected and conserved for further utilization at National Research Center for Orchids, Pakyong, Sikkim. Pest invasion is known to significantly impair the conservation of orchids; therefore an investigation was carried out to know the pest interception and damage caused by them. Visual observations have been recorded on pest interception; damage caused by them, and stay on the host plants during the year. Observations showed that scale insects *Coccus hesperidum*, *Diaspis boisduvali*, *Pinnaspis buxi*, *Lecanium* sp., infest orchids round the year. Mealybug *Pseudococcus* sp, aphids *Macrosiphum* sp. and *Toxoptera aurantii* suck the juice and deteriorate the health and reduce flower production. Shoot borer *Peridaedala* sp. observed to cause damage by boring into the shoot of many orchid hosts. Black weevil *Sipalinus* sp. recorded to cause serious damage on many orchid species. Mite *Tetranychus urticae* dwell under dry and warm conditions and feed on leaves by sucking sap from epidermal layer. Snail *Cryptaustenia verrucosa* and *C. heteroconcha* damage the orchids by gnawing pseudobulbs,

leaves, stem as well as inflorescence during night hours of rainy season. As some of these pests have been seen to damage orchid germplasm for the first time, it receives significant importance in orchid conservation and utilization for commercial trade. The observations on pest interception in orchid germplasm are summarized in Table 1 and described as followed.

**Soft Brown Scale *Coccus hesperidum*:** In low to moderate numbers does not significantly affect most plants. Heavy infestations, however, can reduce overall plant health and cause yellow leaves, leaf drop, and stunted new growth.

**Boisduval scale *Diaspis boisduvali*:** Scale suck plant juices from leaves, canes, roots and flower and cause loss of vigor, deformation of infested plant parts, yellowish spots on leaves, loss of leaves, and even death of the plant. Toxic saliva injected by these scale while feeding causes necrosis of tissue at the feeding site.

**Ti Scale *Pinnaspis buxi*:** Scales suck the juices from leaves, petioles, pseudobulbs and cause loss of vigor, deformation of infected plants. Yellowish spots on the leaf, loss of leaves and even death of plant has been observed.

**Lecanium Scale *Lecanium* sp.:** Scales are common soft scale on a wide range of woody ornamental plants and fruit trees. This scale insect also feeds on a wide variety of ornamental foliage and flowering plants. Removal of sap from host plants causes plant stress. The excreted honeydew coats the surfaces on infested host plant.

**Mealybug *Pseudococcus* sp:** Both young and adult suck the sap from leaves, petioles and flowers. Attacked plants look wilted and growth arrested.

**Yellow aphids *Macrosiphum luteum*:** Both the nymph and adults suck the sap from new shoot, flower bud and opened flower.

**Black aphid *Toxoptera aurantii* :** Aphid suck the juice from bud as well as from open flowers and simultaneously excrete honey dew which support the growth of black sooty mould an unsightly fungus



that mars the beauty of flower. Honeydew secretions also invite black ants, which clearly indicate aphid infestation. The aphid infestation lowered the marketable price of flower.

**Shoot borer *Peridaedala* sp.:** Observed to cause damage on many orchids during rainy season and they disappear at the end of the season. Eggs are laid on new shoot and emerging larvae bore downward, feeding on stem/ cane. Larval excreta can be seen coming out from the hole made by larvae. Pupation takes place inside the tunnel. Further growth of plant arrested and flower production gets affected. Dead shoots or yellow shoots flag on the stem observed.

**Black weevil *Sipalinus* sp. :** Grub after hatching from egg feeds on young leaves and cause considerable damage to the plant. Thereafter it enter into the shoot and then pseudobulb and feed on plant tissue resulted into hallowing of pseudobulb. Adult weevil also observed to cause serious damage by feeding on plants parts and mainly prevalent during rainy season. Feeding of black weevil on plant parts of orchids results into considerable reduction of quantity and quality of flowers.

**Mites *Tetranychus urticae*:** Both nymph and adults of mites dwell under dry and warm conditions feed on leaves by sucking sap from epidermal layer. The injuries due to feeding can be seen as silvery marks left on the abaxial surface of leaf which usually turn brown or black after a period of time. The affected leaves get weakened and exhibit severe mottling and wilting. Growth of plant stunted and loss of foliage occurs in the infected plant.

**Snail *Cryptaustenia verrucosa* and *C. heteroconcha*:** Have been found to damage the many species of orchids by gnawing pseudobulbs, leaves, stem as well as inflorescence (spike) during night hours and hide under dark during day light and thereby destroy the crop. Snails are more prevalent in moist and moderate temperature of rainy season.

**Response of two spotted spider mite (*Tetranychus urticae*) infesting *Cymbidium* to some acaricides, neem products and bioagent**

*Cymbidiums* are highly susceptible to two spotted spider mite (*Tetranychus urticae*), which feed on leaf underside and suck the chlorophyll out of plant cells. The feeding causes leaves to appear pin poked, with yellow dots that give characteristics silvery stippled appearance. Later leaves turn yellow and sometimes fall off. They thrive when plants are stressed under warm, dry conditions preferably found on new succulent growth and the infestation result in reducing considerable yield. Ability of mite to rapidly develop resistance to acaricides after few applications poses major constraints in controlling mite because of their high reproductive potential and short life cycle. Due to congenial conditions under polyhouses damage by mite was noticed in *Cymbidium* grown in hilly areas of Sikkim and Darjeeling. Growers of this region are excessive reliance on sole chemicals leading to resistance and serious environmental upsets. It was suggested that development of resistance can be prevented by developing appropriate strategies. Therefore an attempt was made to study the response of two spotted spider mite *Tetranychus urticae* infesting *Cymbidium* to some acaricides, neem products and a bioagent *Paecilomyces fumosoroseus*

Eighteen months old tissue cultured seedlings of *Cymbidium* Sleeping Nymph 'Glaciers' were grown in pot under open polyhouse. Required agronomical practices were followed as recommended. Eight treatments consisted of Propargite, Ethion, Profenofos, Clorfenapyre, Kelthane, Neem oil, Neem Seed Kernel Extract (NSKE) and *Paecilomyces fumosoroseus* were replicated thrice in CRD. Twelve plants were kept in each treatment out of which five were randomly selected for taking observations. Pretreatment population count one day before treatment and post treatment 2, 4, 6 days after treatment (DAT) was taken on whole plant to assess the response of mite to different treatments. In total two sprays were applied one month apart and pooled data were analyzed using Duncun's Multiple Range Test (DMRT).



Fig 1 describes the response of two spotted spider mite *Tetranychus urticae* infesting *Cymbidium* to acaricides, neem products and a bioagents *Paecilomyces fumosoroseus*. On two DAT Clorfenapyre and Kelthane reduced greater than fifty per cent mite population. Where as rest of the treatments were below fifty per cent. Response of *Tetranychus urticae* to acaricides Ethion and Profenofos and neem products Neem oil, NSKE was statistically at par. On four DAT also Clorfenapyre results better in reducing mite number followed by *Paecilomyces fumosoroseus*. Remaining treatments viz., Propergite, Ethion, Profenofos, Kelthane, Neem oil and NSKE were significantly not different. Clorfenapyre continued to show its effectiveness and reduced cent percent mite population on six DAT indicated best treatment in controlling mite population. There were not found any statistical difference in remaining treatments. Thus it indicated that Clorfenapyre is the best treatment in controlling mite population infesting *Cymbidium*. Neem oil, NSKE and *Paecilomyces fumosoroseus* were also effective in reducing mite population and can be useful tool in eco friendly mite management as an IPM component.

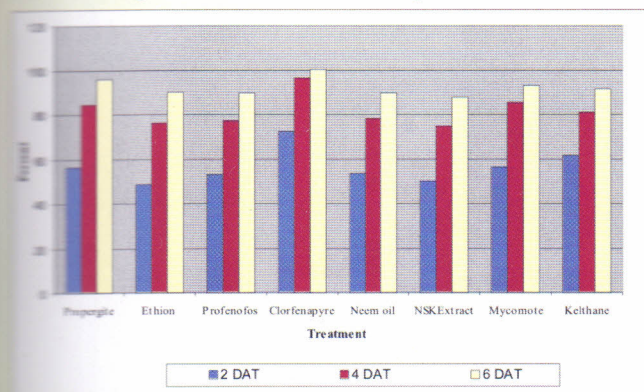


Fig 1. Percent reduction in mite population with acaricides, neem products and bioagent

### Insecticidal trial against Black Weevil (*Sipalinus* sp.) on *Cymbidium*

Slow moving black weevil *Sipalinus* sp. (Coleoptera: Curculionidae) observed to cause damage on many species and hybrids of orchids. In *Cymbidium* weevil grub after hatching from egg

feeds on young leaves and cause considerable damage to the plant. Thereafter grub enter into the shoot and then pseudobulb and feed on tissue resulted into hallowing of pseudobulb. Adult weevil also observed to cause serious damage by feeding on leaves and mainly prevalent during May to October, however, it can be seen in lesser number throughout the year. Feeding of black weevil on plant parts of *Cymbidium* results into considerable reduction in yield of flowers. This pest has been seen to damage *Cymbidium* for the first time in this area; therefore no work has been done so far on management aspect. Considering the economic damage caused by the pest, an attempt has been made to evaluate the insecticides against black weevil infesting *Cymbidium*.

The experiment has been conducted under open polyhouse following required agronomic practices as recommended to raise four years old plants of *Cymbidium*. The experiment was planned in 6 treatments, replicated thrice in CRD. In each treatment 12 plants were kept and observations were recorded on all plants. Insecticides were applied at fortnight interval. Pre treatment observation one day before treatment on shoot damage and Post treatment observations on survival of shoot 6 days after treatment were recorded as the pest feeds internally. Six insecticides viz., metacid 1.5 ml/l, econeem 2.0 ml/l, chlorpyriphos 20 EC 2.5 ml/l, imidacloprid 2.5ml/l, dimethoate 30 EC 2ml/l and monocrotophos 2 ml/l were applied on *Cymbidium* plants at fortnight interval. The results showed that treatment of chlorpyriphos 20 EC, 2.5 ml/l and imidacloprid 2.5ml/l resulted in greatest percent shoot survival (Fig 2).

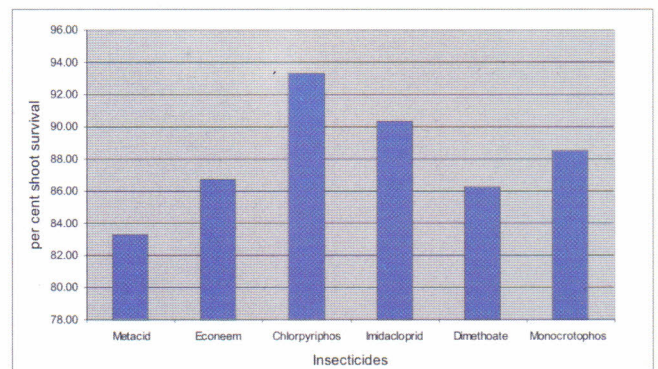


Fig 2. Percent shoot survival after application of insecticides



# RESEARCH ACHIEVEMENTS

## Sub Centre Darjeeling





## Collection, Conservation, Characterization, Evaluation and Maintenance of High Altitude Orchid Germplasm

### Collection of Orchid Germplasm

#### Collections from the wild

During the year two explorations were undertaken in Darjeeling district of West Bengal and Sikkim to collect the species of orchids. The explorations resulted in collection of 108 accessions. On the basis of their morphological characters 14 species were identified. The other accessions would be identified on their flowering.

#### Collections from the Farmers' Field

38 *Cymbidium* hybrids/ cultivars were collected from different locations of Darjeeling district of West Bengal and Sikkim and maintained in the conservatory for evaluation..

#### Conservation of wild Species and cultivars

The collected species were grown in plastic pots or tied on the tree trunks with plastic ropes. The *Cymbidiums* were planted only in plastic pots.

#### Evaluation of Orchid Species

The species were evaluated for their horticultural traits include *Liparis mannii*, *Liparis bootanensis*, *Cymbidium lowianum*, *Coelogyne nitida*, *Coelogyne oculata*, *Coelogyne corymbosa*, *Calanthe yucksomensis*, *Calanthe brevicornu*, *Calanthe chloroleuca*, *Cremestra appendiculata*, *Eria spicata*,

## Collection, Conservation, Evaluation and Multiplication Bulbous Ornamentals

### Collection of Bulbous Ornamental

The 5 cultivars of Oriental lily namely Soldera, Yelloween, Fonopoli, Concordia, Siberia and 5 cultivars of Asiatic lily viz. Navona, Tinos, Farfalla, Makino, Voltage were introduced during this year.

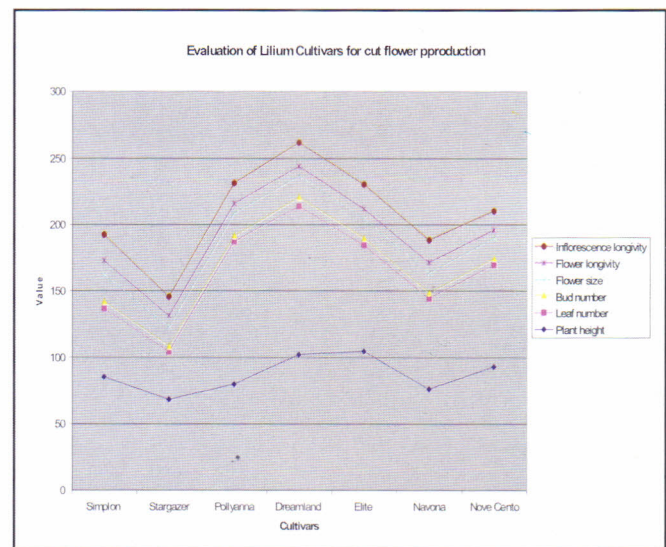
#### Evaluation

The seven cultivars of Liliium were evaluated for cut flower production. The maximum stem length (104.47 cm) was observed in Elite followed by 102.02 cm in Dreamland. The dreamland produced highest number of leaves (111.60) whereas stargazer

produced only 36 leaves per stem. The number of buds/ stem was highest in Dreamland followed by Elite and Simplon. Individual flower longevity (10.89 days) and whole inflorescence longevity was maximum in Simplon.

#### Studies on Bulb Production of Liliiums

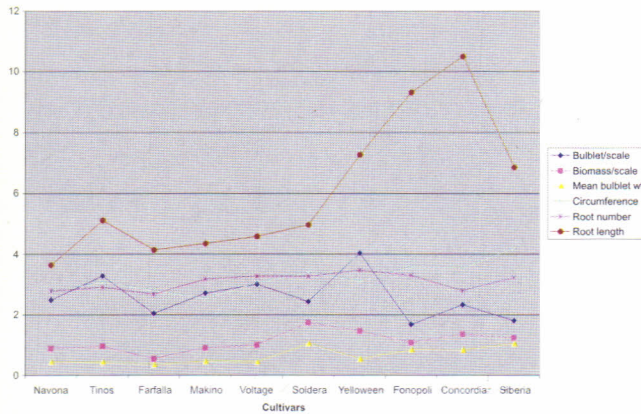
### Reproductive Ability and Bulblet Quality of Liliium Cultivars Propagated Through Bulb Scales



An experiment was laid out to study the reproductive ability of Liliium cultivars. The outer scales of 5 Oriental and 5 Asiatic cultivars were removed and planted in sawdust. The number of bulblet per scale, bulblet weight, circumference, root number, and root length were found to affect by the genotypes. Yelloween produced highest number (4.03) of bulblets/ scale followed by Tinos (3.27), Voltage (3.00). Fonopoli, an Oriental lily cultivar produced lowest number (1.67) of bulblets/scale. The maximum biomass/ scale (1.74 g) was recorded in Soldera followed by 1.46 g in Yelloween and 1.36 g in Concordia. In general, the Oriental cultivars recorded higher biomass than Asiatic cultivars. The mean bulblet weight was higher in Oriental lily cultivars than Asiatic ones. The bulblets of Siberia and Soldera were recorded the heaviest whereas bulblets obtained from the Farfalla were the lightest.



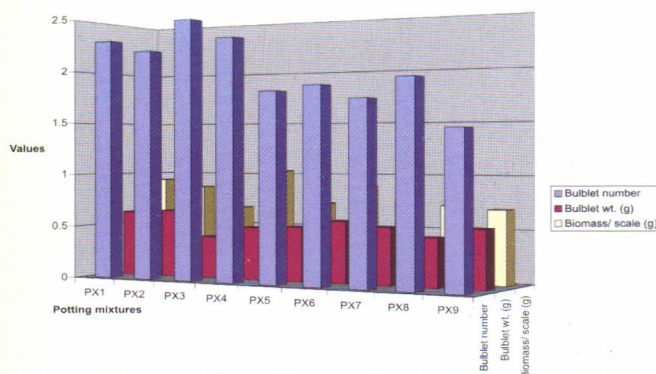
Reproductive ability and bulblet quality of Lilium cultivars propagated through bulb scales



### Standardization of Potting Mixture for Propagation of Lilium Through Bulb Scales

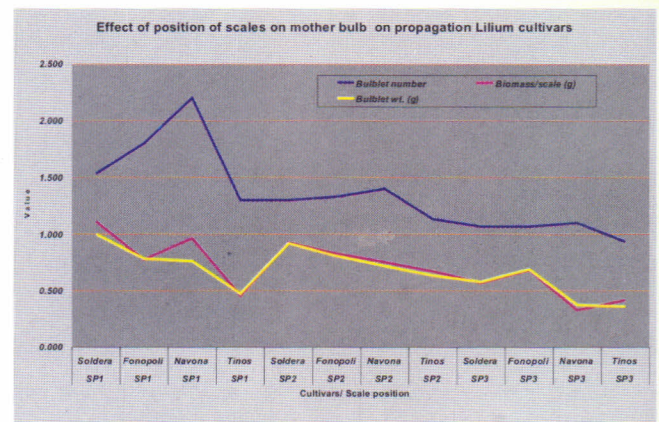
Nine potting mixtures (soft wood sawdust (PX1), partially decomposed soft wood sawdust (PX2), partially decomposed hard wood sawdust (PX3), PX2 + Vermiculite (40:60), PX3 + Vermiculite (40:60), PX2 + Vermiculite + Sphagnum peat moss (20:60:20), PX3 + Vermiculite + Sphagnum peat moss (20:60:20), PX1 + Vermiculite (40:60), PX1 + Vermiculite + Sphagnum peat moss (20:60:20)) were tested as potting mixture for propagation of Lilium. The potting mixtures significantly influenced the bulblet number, bulblet weight and biomass per scale. The greatest number of bulblet/ scale (3.46) was obtained from Yelloween on PX1 medium followed by 3.2 on PX3 medium. The lowest number of bulblet/scale (1.70) was recorded on PX9 medium. The Novana recorded highest bulblet number (2.36) when propagated on PX3 medium followed by 2.13 on PX2 medium. The heaviest bulblets were obtained in Soldera on PX2 medium. Thus PX2, partially degraded saw dust of soft wood was found as best medium for propagation of Lilium. The addition of Vermiculite did not help increasing bulblet number and bulblet weight.

Effect of potting mix on bulblet number and bulblet quality of Lilium propagated through bulb scales



### Effect of Position of Scales on Mother Bulb on Bulblet Formation during Propagation of Lilium

The bulb scales of Lilium cultivars namely Soldera, Fonopoli, Navona and Tinos were separated in three groups (outer, middle, inner) on the basis of anatomical position on the mother bulb. The bulb scales were planted in sawdust and incubated for 10 weeks. The outer and middle bulb scales produced greater number of bulblets, more biomass/ scale and higher fresh weight than inner bulb scales. The inner bulb scales produced lower number bulblets of smaller size hence, may be excluded during propagation of programme.



### Does fortification of potting mixture with fertilizers increases bulblet number and improves the size of bulblets?

In order to increase bulblet size during scale propagation of *Lilium*, the potting mixture of was enriched with NPK (10:10:10) and NPK (10:25:25) @ 5, 10, and 20 gm/ liter. The outer bulb scales of four cultivars namely Siberia, Voltage, Farfalla, and Concordia were planted and the bulb scales were incubated for 13 weeks. The enrichment of potting with fertilizers had no significant effect on bulblet number, bulblet weight and biomass/scale. It appears that bulblet weight, bulblet number and biomass is determined by the reserve food in the scales. The roots formed on the bulblets play no role in absorption of nutrient from the medium.



## Externally Funded Projects

### Development of conventional and micro-propagation techniques

Shoot-tip of *Cymbidium* 'Miss Sandose' and *Cymbidium* 'Sunderland' were cultured on MS media supplemented with BAP (0.5 & 1.0 mg/l) and NAA (0.25 & 0.5 mg/l) for regeneration of protocorms for further multiplication. The media with 1.0 mg/l BAP + 0.5 mg/l NAA showed early response. The protocorms were separated and cultured in MS media with 1.00 mg/l BAP for further proliferation and differentiation.



Shoot-tip of *Cymbidium* 'Miss Sandose'



Shoot initiation

### Multiplication of *Cymbidium* hybrids

The protocorms of *Cymbidium* hybrids viz. *Cymbidium* 'Soul Hunt I', *Cymbidium* Showgirl 'Cooks bridge', *Cymbidium* 'Golden Girl', *Cymbidium* 'Lunavian Atlas', *Cymbidium* 'Sleeping Nymph', *Cymbidium* 'Star Gold McAngel' and

*Cymbidium* 'Pine Clash' are in various development stage of protocorms proliferation, differentiation and *in vitro* and *ex vitro* hardening stages. The *in vitro* harden plants with 4-5 leaves and well developed root were transferred to community pot filled with potting mixture up to two third with leaf mold, coco pit, coconut husk, charcoal and bricks pieces. A trial was also carried out by planting the *in vitro* harden plants in bed comprising leaf mold, leaf mold + bricks, leaf mold + charcoal and leaf mold + bricks + charcoal. Observation reveals that leaf mold singly showed better survivability % and fastest acclimatization. After six to seven month in the community pots and bed, fully grown and harden plant were transferred to plastic pots.



Plantlets in the-bed



Harden plantlets in the pots

S. No.	Hybrids/Species multiplied under Mini Mission-I	Under <i>in-vitro</i> hardening (Biotech. Lab)	Under <i>ex-vitro</i> hardening (Hardening house)	No. of Plantlets in the hardening house (in pots & beds)
<b>Cymbidium Hybrids</b>				
1.	<i>Cymbidium</i> Soul hunt -I (A)	270	12	174
2.	<i>Cymbidium</i> Golden Girl (B)	45	-	105
3.	<i>Cymbidium</i> Show girl Cooksbridge (SG)	27	-	6
4.	<i>Cymbidium</i> Lunavian Atlas (D)	200	240	442
5.	<i>Cymbidium</i> Pine Clash (J)	176	64	603
6.	<i>Cymbidium</i> Star Guard MCym. Angel (G)	82	40	447
7.	<i>Cymbidium</i> Sleeping Nymph (H)	120	65	2093
8.	<i>Cattleya labiata</i> X <i>Cattleya aurentica</i> .	45	40	321
9.	(HBD- V- 19.5-10-SPT) MM-2	42	10	142
<b>MATERIALS FROM ARUNACHAL PRADESH</b>				
10.	<i>Cym.</i> Miss Sandose	-	-	639
11.	<i>Cym.</i> Pink Heater	-	-	126
12.	<i>Cym.</i> Christmas beauty	-	-	15



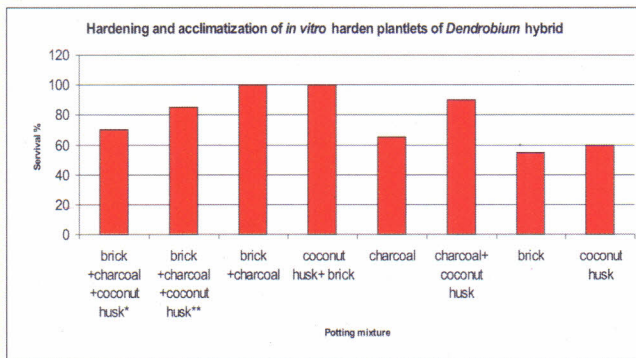
## Hardening and acclimatization of *in vitro* raise seedling of *Dendrobium* hybrid (HBD-V-19.5-10-SPT)

Transferring without proper *in vitro* hardening resulted high mortality. An effort was therefore made towards devising ways and means to overcome the mortality problems. The two leaf stage plants were used as explants for the experiment. They were cultured in half strength Nitsch basal media lacking of sucrose, vitamins and organic component, but having sterilized bricks pieces, charcoal and coconut husk. They were of 1 cm (appx) in size and sterilized twice before mixing in the culture media (25g of each-bricks pieces, charcoal and coconut husk or in combination (1:1) *i.e.* bricks pieces + charcoal, bricks pieces + coconut husk, coconut husk + charcoal and control with and without activated charcoal (AC) is used. Further 1.5 g/l of AC was added in all the treatments. After six month, plantlets were transferred to community pot containing respective potting mixture as that of *in vitro* hardening. Plantlets from the control treatment were potted in potting mixture comprising brick + charcoal +coconut husk (1:1:1). Survival % was recorded after three month.



**In vitro hardening**  
(brick + coconut husk)

**Ex vitro hardening**  
(brick + charcoal)



\* Plantlets from the media without activated charcoal

\*\* Plantlets from the media with activated charcoal

## Distinctness, Uniformity and Stability of Orchids Characterization done during the period (2006-07) to fulfill DUS guidelines:

### *Dendrobium* species studied:

***Dendrobium fimbriatum*:** Medium sized plant. Each spike bears 6-12 flowers, 5-7.5 cm. across and pure orange-yellow in colour. The lip is also orange and beautifully fringed at edges. Blooms in the month of April.

***D. williamsonii*:** Small plant of about 20-25 cm in height possessing black pubescence on pseudostem. Inflorescence arises on the top portion of pseudostem, 2-3 flowers per inflorescence with absence of peduncle. General appearance of sepal & petals are incurved and reflexed type. White flower with netted pattern. Circular lip with yellow stripes. Flowering period is early April.

***D. densiflorum*:** Densely and drooping flowered inflorescence between the leaves. 30-40 flowers per inflorescence. Flowers are golden-yellow, 2.5-3.5 cm. across and lasts for a week. Blooms in the month of April.

***D. crepidatum*:** Plant height (14 -16 cm). Pseudostem attitude is semi-erect. Flower emerged from top node of pseudostem, 4-6 flowers per inflorescence. Flowers are purple in colour with shades of white and sepals & petals are spreading in appearance. Lip is circular with orange eye. Flowers in the month of April-May.

***D. chrysotoxum*:** Medium sized plant with a height of 18-22 cm. Leaves are elliptic in shape. Inflorescence emerged from top part of pseudostem. Peduncle is semi-erect, 14-18 cm long and 0.2-0.3 mm thickness. Number of flowers in spike varies from 10-20. Sepal and petals are yellow in colour. Flower possesses a strong fragrance. Lip is in shades of yellow and orange. Blooms in the month of April-May.

***D. loddigesii*:** Small plant with a pseudostem length of 17-20 cm. Leaves are small with a length of 2-3 cm and width of 0.8-1.0 cm. 1-2 flowers arises from the node of pseudostem. Mauve flower with yellowish orange colored eye. Flowers in late April.

***D. devonianum*:** Medium sized plant with 30-32 cm



height, semi-drooping pseudostem with 2.3-2.6 mm thickness, narrow elliptic, medium green leaves with 8-12 cm and 1.2-1.5 cm length & width respectively. Two flowers emerged from node of pseudostem with 2-2.5 cm pedicel length and 0.1-0.2 mm thickness. Spreading type sepals and petals with a mentum length 0.6-0.8 cm. Fragrant flowers with 4-4.5 cm length and 4.5-5 cm width. Colour of flower is white with red-purple stripes. Lip is white, purple and yellow coloured with 3-3.5 cm length and 2.5-3 cm width with moderate fringing. Eye is in orange color. Blooms in the month of May.

***D. parishii***: Small sized plant with a pseudostem length of 11.2 cm. During the flowering leaves shred-off. Inflorescence emerges directly from node of pseudostem. Flowers are purplish-white in colour. Edge of the petal is finely fringed. Anther cap is purple in colour. Flowers in the month of May.

***D. pierardii***: Elliptical and white coloured sepals, with petals in obovate shape. Lip is elliptical in shape with moss greened eye. It flowers during the last week of May to first week of June.

***D. thrysiflorum***: Flowers contain floral bracts. The inflorescence is produced in graceful arches with off-white sepal and petal with orange lip which make the whole bunch very attractive.

***D. moschatum***: Large plant with a height of 90-120 cm. Pendulous flower, spike 18-25 cm. long, develops from near the apex of leafy or leafless stem carrying 10-20 across flowers of 6-8 cm. They are uniformly orangeyellow tinged with purple-pink and reddish veins. The flowers are musk-scented. The lip is slipper-shaped bearing two dark maroon blotches at the base. Flowers in summer season.

***D. bensonae***: Plant height 28-30 cm with pseudostem drooping in attitude. General appearance of sepals and petals are incurved. White colour sepals and petals with orange-yellowish lip. Blooms in rainy season.

***D. gibsonii***: Plant size medium and erect in nature. Pseudostem longitudinal section is linear and cross-section is angular. Leaves shred at the time of flowering. Inflorescence position is on the top of pseudostem. Flower number/inflorescence (8-10). Peduncle attitude is drooping. General appearance

of sepals and petals are some incurved and some spreading type. Flowers measures 1.51.8cm in length and 2.42.8cm in breadth. Flower possesses a pleasant smell. Colour of sepal and petals are orange (RHS-17A & N 25C) and selfcoloured. Lip shape is circular and the main colour of lip is orange and maroon. Colour of lip eye is grayish-purple (187 A) with fine fringing of margin. Flowers during early July.

***D. aduncum***: Plant is large which measures about 80-85.5 cm and drooping in nature. Inflorescence arises on whole length of pseudostem. No of inflorescence/pseudostem is 4-5 with flowers ranging from 4-6 in number. Peduncle attitude is horizontal in nature. General appearance of sepals and petals are spreading type. Mentum measures about 0.8-1.0 cm. Flower length is 2.8-3.2 cm and width is 1.8-2.0 cm. Shape of lateral sepals is triangular which is in shades of purple and mauve. Petal curvature of longitudinal axis is straight to slightly recurved and ovate in shape. Lip possesses an off-white base with violets dots. Presence of callus with intermediate pubescence. Flowers during late July to early August.

***D. acinaciformae***: Plant is small (17-20cm) and drooping in nature. Leaves are modified to flat and pointed in nature. Inflorescence position is on top pseudostem. Flowers borne along the peduncle. No. of flowers varies from 14-22 per inflorescence. Peduncle attitude is erect to semi-erect. Flower length and breadth are 0.6-0.8 cm and 0.8-1.0 cm respectively. General appearance of sepals and petals are some incurved & spreading. Sepals are yellow (4 D) and self coloured. Lip length is 0.7-0.9 cm which is circular in shape. Main colour of lip is yellow (4.D). Flowers in the last week of July.

***D. crumenatum***: Medium sized plant with horizontal attitude of pseudostem bearing inflorescence on the top part. Leaves narrow elliptic in shape having 7.0-7.8 cm & 1.2-1.6 cm length & width respectively, sepals & petals all spreading & white in colour. Lip length 2.2-2.5 cm with broad trapezoid lateral lobe, anther cap off-white, Flowering time mid August.

***D. hookerianum***: Large size plant with semi-



drooping pseudostem. Leaves are elliptical to narrow ovate in shape & medium green coloured. Inflorescence arises on whole length of peduncle. Some incurving & some spreading sepals and petals are found with mentum in length 0.6-1.0 cm. Circular Lip with elliptic apical lobe & yellow to maroon coloured with fine fringing of margin. Time of flowering is third week of September.

#### **Hybrids:**

***Dendrobium "Pompador"*:** Plant height usually ranges from 53-55 cm, erect pseudostem, and semi-erect peduncle attitude. Inflorescence emerged from top part of pseudostem bearing 10-14 flowers. General appearance of petals and sepals are spreading type, purple with white shades. Shape of petal is spatulate. Purple colour lip with elliptic shape apical lobe and broad trapezoidal lateral lobe. Flowering time winter and summer.

***D. "A. Abraham"*:** Hybrid with flowers in bright purple colour. Flower spike semi-erect, 25-30 cm long and 5-8 flowered. Flower remains fresh for 20-25 days after opening of first flower. Flowering time winter and summer.

***D. "Emma White"*:** Medium size (25-30 cm) plant with erect pseudostem. Leaves droops during flowering. Inflorescence emerges from the top part of pseudostem. Flowers are borne in raceme. The number of flowers per inflorescence varies from 6-10. Flower measured about 3-4 cm in length and 4-6 cm in breadth. Colour of flower is grayish-green. Presence of lip callus is prominent. Lip eye is absent. Blooms in the month of April. Flowers remain fresh for few weeks.

***D. "Burana Stripe"*:** Plant measures about 28 - 32 cm, erect in nature. Leaves are narrow ovate in shape. Inflorescence position is on the top part of the pseudostem and flowers along the peduncle. No. of inflorescence/pseudostem varies from 2 - 3 and flower/inflorescence 4-6. Peduncle attitude is erect. General appearance of sepals and petals are spreading and some reflexed type. Flower length 5.8 - 6.2 cm & breadth 5.8 - 6.0 cm. Dorsal sepal is obovate in shape. Sepals and petals are white & violet in colour, which are shaded and striped. Shape

of petals is spatulate. Lip shape is circular and lateral lobe is broad trapezoid. Lip is in the shades of violet, purple and white. Lip callus is present with intermediate pubescence. Flowers during September. Flower remains fresh for 30 - 35 days.

#### ***Vanda species studied***

***Vanda stangeana*:** Flower spike semi-erect in nature with flower measuring 4-6 cm across. Flowers are green, tessellated with dark purplish-brown spots. Lip is contrasting white with yellow spots.

***V. parviflora*:** Small size plant with strap leaves. Apex of leaf is three lobed. General appearance of sepals and petals are some spreading and reflexed. Yellow colour small flowers with a length 1.5-2 cm and width 1-1.5 cm; 8-12 numbers in a spike. Lip possesses spots of white, yellow and purple colour. Blooms in the month of May.

***V. cristata*:** Small sized plant with 45-48 cm height and 30-35 cm spread. Roots show secondary branching habit. Leaf apex is asymmetric, three lobed. There are 6-8 spikes/plant. Nature of peduncle is semi-erect. Flowers are borne along the peduncle in 3-5 numbers. Sepals and petal nature are incurved type which is yellowish green in colour. The most distinct part of the flower is the shape of lobules. Anther cap is yellow -green in colour. Blooms during April-May.

***V. pumila*:** Small plant with a height of 12-15 cm. Plant is stout in nature. Strap leaves with three lobed apex. General appearance of sepals and petals are all incurving. Spur length is 0.8-1.0 cm, small flowers with a length of 2-3 cm and width of 1.5-2.0 cm, pale white colour flowers with maroon spots. Apical lobe of the lip is triangular in shape. Flowers during May.

***V. bicolor*:** Small sized plant with 12-15.0 cm height, 28-30 cm spread with secondary rooting habit, medium green leaves with 10-15 cm length and 1.5-2 cm width. Strapped leaves with emarginate apex, stout peduncle with 15-17 cm length and 0.2-0.4 thickness. Inflorescence - raceme type emerged from top of plant and flowers are present along the peduncle with 5-8 flowers. Flowers are spreading type. In flowers there is



tessellation of grey and orange colour. Lip is purple to violet in colour. Colour of anther cap is orange to white. Flowers in May.

***V. coerulescens*:** Medium sized plant with a height of 28-30 cm, plant stout in nature. Roots show secondary branching; leaves are 15-18 cm long, strapped shaped. Inflorescence-raceme with as many as 12-15 flowers. General appearance of sepal and petals is spreading type. Spur 0.6-0.8 cm long; flower with 2-2.5 cm diameter on twisted pedicels of 4-5 cm long, Sepals and petals obovate to spatulate in shape with medium twisting with shaded and tessellated colour pattern of grayish-purple. Lip auricles absent, linear apical lobe, violet in colour, anther cap yellowish-white hue. Blooms in the early June to late August.

***V. coerulea*:** Plant size is large with height of 52-55 cm with spreading 30 - 32 cm. Plant is stout in nature. Roots show secondary type branching habit. Strap type leaves with emarginate leaf apex margin. No. of spike/plant is 4-6 with 5-7 flowers/inflorescence. Peduncle attitude is erect. Floral bract present. Inflorescence attached to the pseudostem from the leaf node. General appearance of sepals and petals are all spreading. Spur measures about 0.6 - 0.8 cm, with compressed in shape & recurved curvature. Flower measures about 6.4-6.8 cm in length and breadth. Sepals are in shades of white, lilac and purple (tessellated). Petal shape is transverse elliptic. Petal twisting is very strong with strong undulation of margin. Lobules are present. Lip shape of lateral lobe are triangular in shape. Lip curvature is recurved. Flowers during September.

#### **Hybrids:**

***Vanda coerulea X V. roxburghii*:** Large plant with a height of 50-55cm. Plant is stout in nature. Leaf length 10-12 cm with width 2.0-3.0 cm and strapped. Peduncle attitude is horizontal & flexible in nature. Floral bract present. Inflorescence arises from node and flowers along the peduncle. No. of spikes/plant is 3-5 with flowers 6-8. General appearance of sepals and petals are some spreading and some reflexed. Spur is 0.6-0.8 cm, compressed and straight in curvature. Flower length 5.86.2 cm and breadth 4.0-4.5 cm. Undulation of lateral sepal margin is very

strong. Sepals are in shades of lime green & grayish-purple. Petal twisting is very strong. Lip shape of lateral lobe is triangular. Lip main colour is violet (N 88B). Flowers during September.

#### ***Cymbidium* species studied:**

***Cymbidium tigrinum*:** Possesses showy and large flower with a length of 4-6 cm and width of 5-7 cm. Petal contains maroon spots. Apical lobe of lip is white to creamy yellow striped with distinct brownish-red bands akin to the stripes on a tiger stripes. Flowers during April.

***C. devonianum*:** Peduncle attitude is pendulous with raceme type inflorescence. The number of flowers in a spike varies from 22-34. Flower type is single with shades of maroon and greenish-yellow. Flowering time is April.

***C. aloifolium*:** Medium sized plant with 45-47 cm height, leaf length 42-45cm. Raceme inflorescence, 40-45 flowers per inflorescence. Peduncle attitude is pendulous with anthocyanin colouration. General appearance of sepals and petals are incurved and spreading type. Flower length and width 3-5 cm & 1-2 cm respectively; sepal colour is yellow with maroon stripes. Petal shape elliptic, yellow and maroon colour, apical lobe oblate, lateral lobe-broad trapezoid. Flowering time 1st week of June.

***C. dayanum*:** Large plant ranges from 60-72 cm. Pseudobulb shape in longitudinal section is elliptic. Leaf is linear in shape and emarginated shape of apex. Flower number varies from 6-13. Peduncle is pendulous in nature. General appearance of sepals and petals are all incurving. Flower length is 4.5 - 5.4 cm and width 1.5 - 2.4 cm. Sepal colour is white base with shades of maroon. Lip recurvature of margin is strong. Lip border between colour zones is abrupt. Lip stripes present. Flowers during August.

***C. irridioides*:** Plant medium size having pseudobulb of 5.0-7.0 cm in length. Leaves linear in shape with acute apex. Inflorescence-raceme bearing 8-10 flowers. Sepals & petals incurved and maroon-greenish coloured. Lip circular in shape & spotted, yellow to maroon coloured. Anther cap yellow coloured. Flower blooms in late November.

#### **Hybrids:**



**Cymbidium "Golden Elf"**: Small plant (35-40 cm), leaf is linear in shape. Pseudobulb shape in longitudinal section is ovate. No. of flowers/spike is 5-8. Peduncle attitude is erect. General appearance of sepal and petals are incurved and reflexed. Length of flower is 5.8-6.0 cm and breadth is 6.5-6.8 cm. Presence of lime fragrance. Colour of sepal and petal is yellow (7A). Lip shape is triangular. Lip curvature of margin is weak. Flowers in the third week of July.

**C. "Nonina Paleface"**: Medium size plant having height of about 60-80 cm bearing ovate to oblong pseudobulb in longitudinal section. Leaves are narrow lanceolate with acute apex. Inflorescence-raceme with 10-18 flowers/inflorescence. Sepals & petals-partial incurving & partial spreading with greenish-yellow coloration. Lip-trapezium in shape & yellow coloured. Flowers during late October.

**C. "Red Beauty"**: Medium size plant with ovate pseudobulb in longitudinal section. Narrow lanceolate leaves with acute apex. Raceme inflorescence bearing 3-9 flowers. Sepals & Petals some incurving some spreading, light to dark maroon in colour. Triangular Lip with grayish-purple cuneate area & small to medium sized spots. Flowering time mid December to early January.

**C. "Concerto"**: Plant medium size with linear shape leaves bearing acute symmetric apex & medium green coloured. Inflorescence-raceme with 8-10 flowers & semi-erect to horizontal peduncle possessing medium to large bract. Sepals-oblong to obovate in shape, yellowish green coloured. Lip-triangular to trapezium in shape, yellow to maroon coloured with reddish purple stripes & spots. Flowers during late November.

**C. "H.C. Aurora"**: Plant size 53-65 cm with ovate pseudobulb in longitudinal section. Leaves linear in shape with symmetric acute apex & medium green colour with anthocyanin coloration. Semi-erect peduncle with 4-6 flowers/inflorescence. Incurved Sepals & Petals with maroon & yellow coloration with presence of small reddish-purple spots. Lip triangular in shape with off-white to maroon coloration. Anther cap yellow coloured. Flowering time early December.

**C. "Soul Hunt"**: Medium size plant with linear shaped leaves. Erect peduncle bearing 7-10 flowers in raceme type inflorescence. Some incurving & some spreading sepals & petals, light to dark pink in colour. Triangular shaped lip with medium to large grayish-purple spots. Yellow coloured anther cap. Flower blooms in late December.

**Digitalization:**

(A) *Cymbidium devonianum*



General appearance of Flower



Color & shape of Dorsal & lateral sepals



Color & shape of Lip

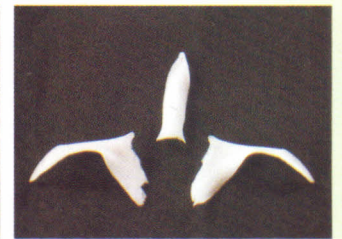


Column color & anther cap

(B) *Dendrobium crumenatum*



General appearance of flower



Color and shape of Dorsal & lateral Sepals



Color & shape of Lip



Column color & anther cap



### **Mega Seed Project:**

The quality seed/planting material is the important component and pivotal in increasing the area as well production in any crop. The both public and private sectors has played an important role in seed production to meet demand of plating material. But, the quality seed material or seed supply is still a constraint in orchids and other floricultural crops.

To meet the future demands and consumer preferences in both traditional and modern floriculture enterprises, the 'Mega Seed Project' is initiated in increase the Seed Replacement Rate (SRR) with an objective to supply quality planting material of orchids, gladiolus and lillium especially in northeastern areas. The production achieved against targets during 2006-07 given below.

<b>Particulars</b>		<b>Target</b>	<b>Production achievement</b>
<b>Horticulture</b>			
<b>Gladiolus</b>		50,000	10,000
<b>Orchids</b>	Pseudobulbs	1,000	500
	Keikis	1,500	1,500
	Tissue Culture Plants	5,000	7,000





## Technology assessed and transferred

The major transfer of technologies taken up by the Centre were

- Frontline extension through training programmes.
- Technology transfer through demonstrations, trials and linkage programmes.
- Promotion of technologies through print media, extension literature.

### Training programmes

The centre organized five tailor made training programmes on various topics and trained govt. officials from different State Department of Horticulture / Agriculture and farmers to cater the specific needs and demand. The details are given below.

Title of the programme	Date	No. of participants	Location
Production Technology of Tropical Orchids	October,10-12,2006	40	Kokrajhor,assam
Production technology of Cymbidiums	October,29-31,2006	3	NRC for Orchids, Pakyong
Integrated vegetable production technologies	October 28-31,2006	43	NRC for Orchids, Pakyong
Production Technology of Temperate Orchids	November14 16 ,2006	28	Meghalaya
Production Technology of Tropical Orchids	November28 30, 2006	19	NRC for Orchids, Pakyong

Technology transfer through mass media

### Exhibitions

Name and place	Date
Second International flora expo, exhibition and conference, .New Delhi	7-10 <sup>th</sup> September2006



Trainees from different regions of North Eastern states





## Education and training

### Education

Four students of B. Tech. (Biotechnology) - 2 from Allahabad Agricultural Institute - Deemed University, Allahabad, U.P. and 2 from Bengal College of Engineering & Technology, Durgapur, West Bengal were given one month summer training in molecular biology at Genetics laboratory of the Centre.

Two final year students of B. Tech. (Biotechnology) of Allahabad Agricultural Institute - Deemed University, Allahabad, were given four months training in Molecular Biology at Genetics Laboratory to do their project work.

### Training Scientist

Name	Topic	Duration	Institution
S. Chakrabarti	Training programme of Senior Scientists on Multidisciplinary Perspectives on Science and Technology organized by DST, Govt. of India	October 29-November 11, 2006	NIAS, IISC Campus, Bangalore-560012
V S Nagrare	Winter School on Biosystematics of Agriculturally Important Insect and Mite Biodiversity	November 8-28, 2006	TNAU, Coimbatore

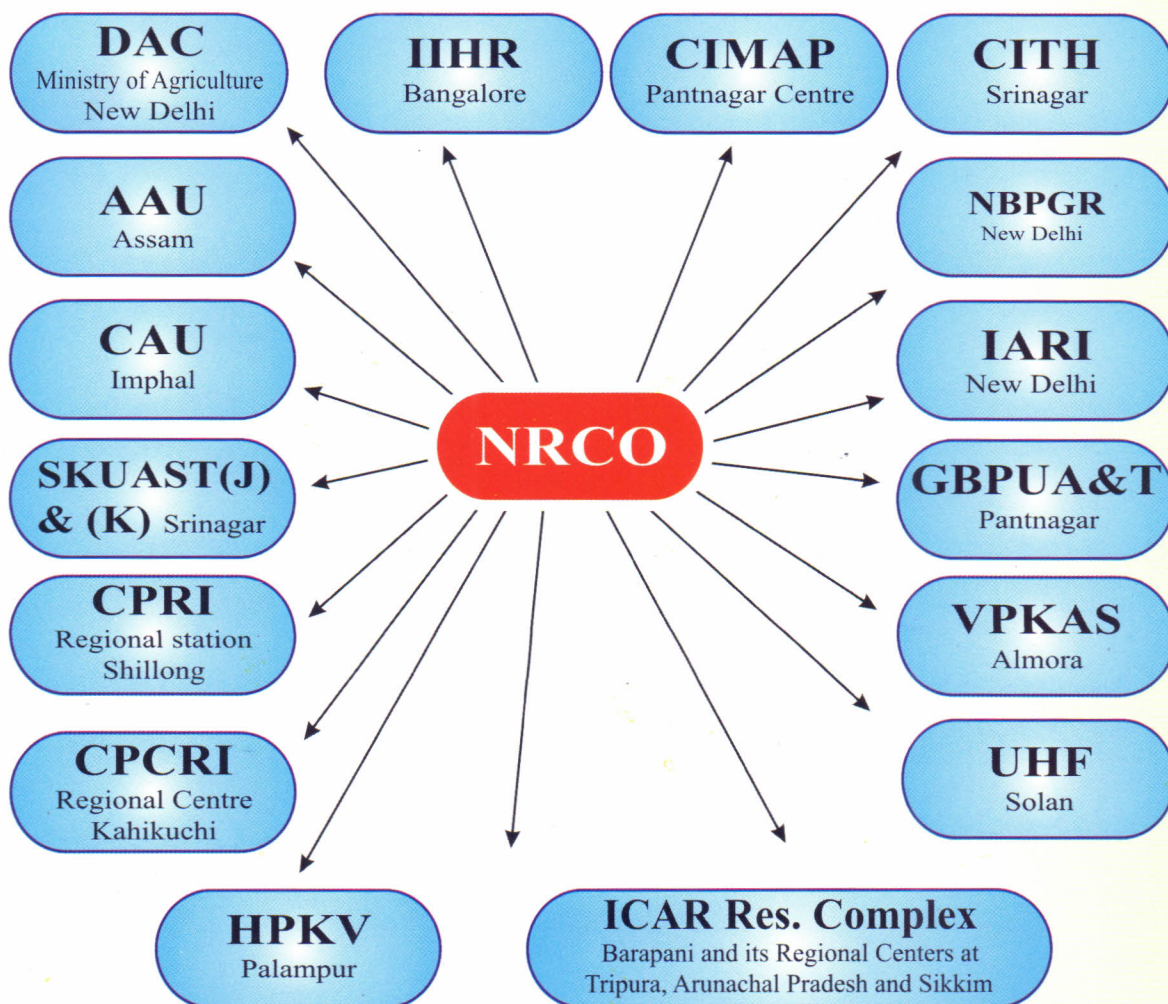
### Administration

Name	Topic	Duration	Institution
Rajat Kr. Das	Cash & Accounts	January 9-March 10, 2006	ISTM, New Delhi





## Linkages and collaboration







## List of publications

### Research Articles

Bag, T. K. (2006). A New Report on *Sclerotinia* White Rot of two Jewel Orchids from Darjeeling, India. *J Mycol Pl Pathol* 36(2): 304-05

Bag, T. K. (2006). Report of Orchid Wilt (*Sclerotium rolfsii*) on *Vanda* Group of Orchids. *Journal of Hill Research* . 19:44-45.

Barman, D. Rajni, K. Upadhyaya, R. C. and Singh, D. K. 2006 Effect of horticultural practices for sustainable production of rose in partially modified greenhouse. *Indian J. Hort.*, 63(4):415-418.

Barman, D. Upadhyaya, R. C. Rajni, K. and Naik, S.K. 2005 Effect of media and Planting system on growth and flowering of *Cymbidium tracyanum* L. Castle. *J. of The Orchid Society of India.*,19(1-2):73-76

Sherpa, A.R., Bag, T.K., Hallan, V. and Zaidi, A.A. (2007). Incidence of *Cymbidium mosaic virus* (CymMV) in Sikkim. *Indian Phytopathology*,60: 133-136.

Chakrabarti, S. and Sarkar, J. 2006. Estimation of foliar pigments and its relationship with leaf thickness in 16 species of the genus *Eria* of family Orchidaceae *Journal of Ornamental Horticulture*. 9(3):184-187.

Sarkar, J. Das, J. and Chakrabarti, S. 2006 Estimation of foliar pigments and phenol concentrations to assess red spider mite (*Tetranychus articae* Koch.) tolerance in *cymbidium* orchids *ENTOMON* 31(3):p159-164

Nagrare, V. S. 2006. Pest complex of orchid *Dendrobium nobile*. *Insect environment* 12(3): 101

### Popular articles

Nagaraju V., Nagrare V. S., Chakrabarti Syamali and Rampal 2006. *North- East: A heaven for orchids*, Souvenir, North-East Expo 2006, Dimapur, Nagaland. Published by Department of Agriculture and Cooperation, New Delhi pp. 55-66

### Paper presented in Seminar/Symposia

Bag, T. K. (2006). Documentation of Rust on Two Ground Orchids from India (Abst.). National Symposium on Plant Pathogens: Exploitation and

management” organized by Indian Phytopathological Society, held at Rani Durgabati University, Jabalpur 482 001 (MP) from 16 - 18<sup>th</sup> January, 2007.p 3

Barman, D., Rajni, K., and Upadhyay, R.C. (2006). Effect of VAM on flower Production and multiplication of gladiolus cv. Candyman. P. 64. In: National Symposium of Ornamental bulbous crops, 5-6 December, 2006, Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut-250110 (U.P.).

Barman, D., Rajni, K., Rampal and Upadhyay, R.C. (2006). Studies on corm and Cormel production of gladiolus cv. Jester. P.64. In: National symposium of Ornamental bulbous crops, 5-6 December, 2006, Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut-250110 (U.P.).

Chakrabarti, S. and Sarkar, J. Orchids as alternative medicine. National Symposium on Medicinal & Aromatic Plants for Economic Benefit of Rural People February 16-18,2007, Ramkrishna Vivekananda Mission Institute of Advanced Studies, Barrackpore,Kolkata.

Nagrare, V. S. and Upadhyaya R. C. 2006. Pest interception in Bulbous Ornamentals Under Mid Hill Conditions of Sikkim. National Symposium on Ornamental Bulbous Crops, 5-6 December, 2006, Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerat-250110 (UP)

### Technical publications

Bag, T. K. 2006. Orchid Diseases and their Management. Technical Bulletin No 3. National Research Centre for Orchids, Pakyong 737106, Sikkim. P1-18

Bag, T. K. 2006. Prevention of virus transmission in *Cymbidium*. (Folder), National Research Centre for Orchids, Pakyong 737106, Sikkim.

Barman, D., Nagrare, V.S., Rajni, K., Bag, T.K., Nayak, S.K and Upadhyay, R.C. (2006). *Cymbidium* cut flower production (Tech. Bulletin-IV). P.1-20. NRC for Orchids, Pakyong, Sikkim.

Nagrare, V. S. 2006. The Incredible Orchids, National Research Center for orchids, Pakyong, Sikkim

Ram pal and V. S. Nagrare 2006. Orchid diversity of India: its conservation and sustainable utilization. National Research Center for Orchids, Pakyong, Sikkim





## List of ongoing projects

### Institute projects

Project title	PI
<i>In vitro</i> propagation of orchid: <i>Cymbidium</i> and important rare and endangered species	R.P. Medhi
Cytogenetical research on orchids	S. Chakrabarti
Breeding for developing hybrids and improvement of Orchids	Ramgopal Devadas
Development of agro techniques for commercial scale production of orchids in open and protected condition.	D. Barman
Investigations on fungal diseases of orchids	T. K. Bag
Pest management in orchids and bulbous flowering plants	V. S. Nagrare
Collection, conservation, characterization, evaluation and maintenance of high altitude orchid germplasm	Ram Pal
Collection, conservation, evaluation and multiplication of bulbous ornamental crops	Ram Pal
Studies on bulb production of <i>Lilium</i>	Ram Pal

### Externally Funded Projects

Sl No	Project no	Project title	Name of the scientist
1.	TMOP(MM-1) Integrated Development of Horticulture in North Eastern States including Sikkim, Uttranchal, Himachal Pradesh and Jammu & Kashmir	Development of conventional and micro-propagation techniques  Production of planting material under low cost polyhouses. Standardisation of Production Technology  Refinement and transfer of production technologies for commercial production of ornamentals through training.	R.P Medhi & Ramgopal Devadas  D. Barman, T.K.Bag & V. S.Nagrare  R. P. Medhi, S.Chakrabarti, D.Barman, T. K.Bag, Ram Pal, V.S Nagrare Ramgopal Devdas
2.	DUS	Preparation for Plant Variety Protection and Conducting Test for Distinctness, Uniformity and Stability for Orchids.	Ramgopal Devadas
3.	Mega seed project	Seed Propduction in Agricultural crops and Fisheries	V. Nagaraju and D.Barman





## RAC & SRC meetings with recommendations

### RAC

The 7th Research Advisory Committee (RAC) meeting of this centre was held under the Chairmanship of Dr. H. P. Singh, Vice-Chancellor, Rajendra Agricultural University, Pusa, Bihar on 24th October 2006 at the conference hall of NRC for Orchids. The Director, Dr. R. C. Upadhyaya welcomed the Chairman, members of RAC, Scientists and other participants. The participants of RAC Committee as follows:

Dr. H. P. Singh, Vice - Chancellor Rajendra Agricultural University Pusa, Bihar	Chairman
Dr. Narendra Kumar, Director, DRDO, New Delhi	Member
Dr. R.C. Upadhyaya, Director, NRC for Orchids, Pakyong, East Sikkim	Member
Dr Ramgopal Devadas, Scientist (Plant Breeding) NRC for Orchids, Pakyong, East Sikkim	Member Secretary

Dr. P. Rajeevan, Professor, Kerala Agricultural University and Dr. S. K. Datta, Head, Floriculture Division, NBRI, Lucknow, UP could not attend the meeting due to some unavoidable circumstances





## Major recommendations

### A. Project / Work specific

Nationally and internationally passport data with description of collected orchids should be made with their location, accession number, collectors' name along with their photographs for future use.

Endangered orchid species should be conserved by *in-vitro* culture bottles for long-term usage. It is suggested for more research work on *in vitro* conservation in future.

Horticultural traits of commercial importance should be characterized, evaluated and documented instead of botanical characters, which are available in international descriptors and books.

'Improvement of Orchids' should be the main project under which the two sub-projects 'Utilization of Wild Species in Crop improvement' and 'Conservation of Orchids Germplasm' is to be included under breeding program.

Work on tissue culture multiplication should be concentrated on commercially important hybrids and species of orchids. The available protocols of tissue culture methods with the emphasis on cytokinins may be tested instead of coconut water and banana pulp. Commercially important orchid species and hybrids should be multiplied only through meristem culture using shoot and root tip.

Random crossing should not be done in breeding programs. The parents with commercially important and desirable floricultural characters should be selected for development of quality hybrids and register them in the name of NRCO series. The desirable parental characters like longer flowering duration, faster emergence, attractive flower colour, long inflorescence and compactness of flowers should be considered.

Cytogenetical characterization of Orchid germplasm based on pigments like chlorophyll, carotenoids, peroxidase isozyme and proline *etc* may be concluded as the data is not stable.

DNA fingerprinting and documentation of the orchid species available at NRCO may be done to make data bank with priority. Basic laboratory facilities for molecular works should be created immediately to do RAPD at present and identification of molecular markers from orchids may be taken up step by step.

The orchid species may be grouped on the basis of chromosomal study and necessary facilities may be created along with Flow-Cytometer to make a full-fledged Cytological Workstation.

The model floriculture project should be renamed as "Development of Integrated Floriculture Enterprise" with the addition of one objective as "To reduce the risk factor of farmers".

The break-even point for year on floriculture enterprise project should be calculated. Total expenditure should be given year wise with returns should be worked out.

In order to find out the standard dose of nitrogen and then to fix the P & K doses for bulblet production of Liliium, the evaluation of new hybrids should be done first, followed by testing the depth of planting on hybrids and then, finally test the NPK requirement of Lilly hybrids. Best two treatments obtained last year should be tested in next year along with control in larger plots.

Effect of standard dose of nitrogen should be tested first and then the effect of P & K may be tested on lily bulblets produced also through scale. Besides, three doses of NPK should be tested instead of testing many doses. During evaluation of new hybrids of



lilium, cost of market price should be included.

The new project 'Mites management in *Cymbidium*' should be done as a sub-project under the main project "Integrated Management of Pest of Orchids". The new experiment on 'Organic control of pest complex in *Dendrobium nobile*' may be included in main project. Emphasis may be given on Bio-control agents and bio-pesticide in the experiments.

The project "Management of Black rot of *Cymbidium* through fungicides" should be concluded with two years experimental results. The experiment may be continued with different copper fungicides as treatments. The effectiveness of drainage on the disease incidence should be studied.

A main project on "Integrated Management of Disease of Orchids" along with the sub-projects (1)

'Exploitation of Orchid Mycorrhiza (OM) in the Early Establishment (Hardening) and Growth Promotion of Tissue Cultured Plants of Important Orchids' with inclusion of bio-agents like Trichoderma, Bacteria *etc* (2) 'Monitoring and Management of Virus Diseases in Orchid' with the sub-sub-project on 'Diagnostics & Molecular characterization (ELISA, PCR *etc*) of virus' must be initiated.

### **B. General recommendations**

Develop linkages and collaboration with other institutes for collaborative work mainly in the field of molecular biology for training, if necessary.

Post harvest technology should be developed for long vase life and long distance transportation.

Limited watering should be done in orchids, once at fortnight, if possible by drip irrigation.

Farmer participatory trial should be initiated with a farming system approach.

New varieties and hybrids must be developed, which can be able to compete in the national and international market.

Scientist should publish in the reputed journals with high impact factor.

Some originality and practicality should be their in the research works of the scientists.

Plant varieties/cultivars of private sector should be included in the trials with the understanding of Private Public Partnership mode of works.

More number of farmers/private entrepreneurs should be motivated and encouraged for cultivation of important species and hybrids of orchids and technology would be supplied by NRCO.

All the scientists should work jointly to make NRCO a national repository for orchids with national and international recognition.

Nationally and internationally passport data with description of collected orchids should be made with their location, accession number, collectors' name along with photo.

### **Staff Research Council**

The Staff Research Council meeting was held under the chairmanship of Dr. R. C. Upadhyaya, Director, NRC for Orchids, Pakyong on 28.8.2006. The following members attended the meeting.

Mr. K. G. Bhutia, Principal Director (Horticulture), Govt. of Sikkim, Gangtok.

Dr. K.K. Singh, G.B.Pant Institute of Himalayan Environment and Development, Sikkim unit

Shri D K Bhandari, Floriculturist, Govt. of Sikkim, Gangtok.

Shri Gyen Ongrup Lepcha, Farmer Representative, Lower Dzengu, North Sikkim

Shri Nirmal Yonjon, Orchid grower, Dikling, Sikkim



Dr. S. Chakrabarti, Sr Scientist (Genetics), NRC for Orchids, Pakyong, Sikkim.

Dr. D. Barman, Sr. Scientist (Horticulture), NRC for Orchids, Pakyong, Sikkim.

Shri Ram Pal, Scientist (Horticulture) and Scientist in Charge, NRC for Orchids, Darjeeling Campus.

Dr. T. K. Bag, Scientist Sr. Scale (Plant pathology), NRC for Orchids, Pakyong, Sikkim.

Dr. V. S. Nagrare, Scientist (Entomology), NRC for Orchids, Pakyong, Sikkim.

Dr. R. Devadas, Scientist (Plant Breeding), NRC for Orchids, Pakyong, Sikkim.

### **Recommendations**

Protocol for mass propagation of Cymbidium hybrids should be developed for individual hybrids after making groups.

Proposals to initiate work on mutation and ploidy induction in breeding programme along with studies

on crossability behaviour was accepted.

Technology developed for Liliium bulb production may be provided to NGOs or private growers.

Breeding programme with wild Lilies may be initiated in the centre.

Project proposal on Mycorrhizal fungi was approved.







## Participation of Scientists in Conferences, Meetings, Workshops, Symposia, Seminar etc. in India and abroad

Meeting of PPV & FR Authority with ICAR/SAU Systems and Department of Agriculture & Co-operation" conducted by PPV & FRA at NAAS Complex, New Delhi on 4<sup>th</sup> May 2006.

### **R.Devadas**

Workshop under "Mega Seed Project" at NAAS Complex, New Delhi on 26-28<sup>th</sup> June, 2006.

### **D.Barman**

Meeting on Draft General Agreement between PPV & FRA and NBPGR and DUS testing sites on 13<sup>th</sup> July 2006 at NBPGR, New Delhi

### **R.Devadas**

Workshop under Technology Mission on Integrated Development of Horticulture in N E States, Sikkim, Uttranchal, H.P., J&K. (Mini-Mission 1) at NAAS Complex, New Delhi 5<sup>th</sup> August, 2006

### **R. C. Upadhyaya and D.Barman**

Second International flora expo, exhibition and conference at New Delhi 7-10<sup>th</sup> Sep. 2006

### **D.Barman**

Workshop on "Biodiversity-A Rajbhasha technical workshop" during Sept 18-19<sup>th</sup>, 2006 at hotel Pinewood, Shillong organized by Ministry of Forest and Environment regional office, Shillong. Presented paper on Orchid biodiversity of Northeast (Hindi).

### **V.S.Nagrare**

Brain Storming Session on "Plant Variety protection in Ornamental crops" organized by Floriculture Division, IARI, New Delhi on 9<sup>th</sup> November 2006.

### **R.Devadas**

2<sup>nd</sup> Annual Group Meeting of DUS project held at NBPGR, New Delhi on 10<sup>th</sup> November, 2006

### **R.Devadas**

18<sup>th</sup> Regional Committee Meeting (RCM-III) held at ICAR Research complex for NEH region, Umiam, Meghalaya on 22-24<sup>th</sup> December 2006

### **R.Devadas**

First Review meeting of Mega seed project held at NAAS complex, New Delhi on 1-2<sup>nd</sup> March 2007.

### **R.Devadas**





## Distinguished Visitors

- Dr. Rita Sharma, Add. Sec. & F. A., DARE, Ministry of Agriculture, Govt. of India 20.05.2006
- Dr. D. Prasad, Principal Scientist, Nematology Div., IARI, New Delhi-12 29.05.2006
- Shri Narendra Kumar Subba, Chairman, Denzang Agril. Cooperative Society (M.L.A.), Hee Bermick, Sikkim 05.07.2006
- Shri Som Nath Poudyal, Honorable Minister Food security and Agriculture and Horticulture and Cash Crops Development, Government of Sikkim 18.08.2006
- Shri. S.L. Bhat, Joint Secretary, Seed, DAC, Govt of India 31.08.2006
- Shri. A.G. Khongwir, Sr. G.M. (Tech) Meghalaya Industrial Development Corporation Ltd. Shillong. 27.09.2006
- Dr. M.L. Maurya, Dean, College Engi. & P.H.T, CAU, Ranipool, Gangtok, Sikkim 18.10.2006
- Dr. Narendra Kumar, Director, Directorate of Life Sciences, DRDO, New Delhi 24.10.2006
- Dr. H. P. Singh, Vice Chancellor, RAU, Pusa Samastipur, Bihar 24.10.2006
- *Dr. Mathura Raj, Director, Indian Institute of Vegetable Research, Varanasi* 28.10.2006
- Shri. K. C. Pradhan, Former Chief Secretary, Sikkim 26.03.2007



Dr. Rita Sharma, Add. Sec. & F. A., DARE, Ministry of Agriculture, Govt. of India visited the centre



Shri Som Nath Poudyal, Honorable Minister, Food security and Agriculture and Horticulture and Cash Crops Development, Government of Sikkim



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- Dr. H. P. Singh, Vice Chancellor, RAU, Pusa Samastipur, Bihar 24.10.2006
- Dr. Mathura Rai, Director, Indian Institute of Vegetable Research, Varanasi 28.10.2006
- Shri. K. C. Pradhan, Former Chief Secretary, Sikkim 26.03.2007



Dr. Rita Sharma, Add. Sec. & F. A., DARE, Ministry of Agriculture, Govt. of India visited the centre



Shri Som Nath Poudyal, Honorable Minister, Food security and Agriculture and Horticulture and Cash Crops Development, Government of Sikkim





## Personnel

### I. Scientific

V Nagaraju	Acting Director (up to. 31.05.2006)
R C Upadhyaya	Director (up to 11.12.2006)
R.P. Medhi	Director (11.12.2006 till date)
Syamali Chakrabarti	Sr. Scientist (Genetics)
D. Barman	Sr. Scientist (Horticulture)
T. K Bag	Scientist Sr. Scale (Plant Pathology)
Ram Pal	Scientist Sr. Scale (Horticulture)
V S Nagrare	Scientist Sr. Scale (Entomology)
S K Naik	Scientist (Soil Science) (on study leave w.e.f. 01.10.2005)
Ramgopal Devadas	Scientist (Plant Breeding)

### II. Administration

Shri. Sunil Kumar Das	Assistant Finance and Accounts Officer
Miss Lakit Lepcha	Assistant
Shri Rajat Kumar Das	Sr. Clerk
Mrs. Diki Bhutia	Jr. Clerk
Shri Phigu Tshering Bhutia	Jr. Clerk



### III. Technical

Shri Sunil Kumar	Sr. Tech. Asst. (T -4)
Shri G B Mukhiya	Farm Tech. (T-2)
Shri R C Gurung	Technical Asst., Driver (T-2)
Shri Janaki Mandi	Technical Asst (T-3)
Shri Manoj Adhikari	Technical Asst (T-1)
Shri Dipak Khatri	Technical Asst (T-1)
Ms. Meena Kumari Chettri	Technical Asst (T-1)

### IV. Supporting

Sri T.B. Singh	SSG IV
Sri Gopal Brahmin	SSG IV
Sri Dawa Bhutia	SSG II
Sri Tularam Dulal	SSG II
Sri Trilok Singh Balmiki	SSG II

#### Orbituary

Dr. V. Nagaraju, Principal Scientist (Hort) and acting Director was passed away on 6th August, 2006

#### Appointment

Dr. R.K.Avasthe, Senior Scientist (Soil Science), ICAR Research Complex for NEH Region, Sikkim Centre has joined as Acting Director w.e.f. 1.6.2006 to 17.7.2006

Dr. R. P. Medhi has joined as Director on selection by ASRB.on 11.12.2006

Shri Manoj Adhikari has joined as Field Assistant(T1) on 6.7.2006

Shri Deepak Khatri has joined as driver (T1) on 27.9.2006

#### Promotion

Miss Meena Kumari Chettri (SSG-II) was promoted as Laboratory assistant on 6.09.2006

Shri Phigu Tshering Bhutia (SSG-II) was promoted as Junior Clerk on 6.09.2006

#### Transfer

Dr R C Upadhyaya, Director was transferred to NBPGR, New Delhi as Principal Scientist (Hort.)

#### Retirement

Shri T.B.Singh (SSG-IV) retired from his service on 31.11.2006





## Other informations

### Kisan Mela

A kisan Mela was organized on 17-03-2007 under Technology Mission .180 Farmers and nurserymen from different northeastern states and Sikkim were participated in the mela with their exhibits. Shri M.T.Sherpa, Hon'ble Deputy speaker. Sikkim Legislative Assembly graced the occasion as special guest and Shri Somnath Poudyal, Hon'ble Minister for Food Security and Agriculture and Horticulture and Cash Crops development, Govt. of Sikkim graced the occasion as Chief Guest. Eight progressive growers two each from Meghalaya, Assam, Sikkim and West Bengal( Kalimpong) were felicitated with momento, shawl and certificates for their outstanding contribution in the field of Horticulture on this occasion.



### Hindi Diwas

To promote the use of Rajbhasha in the Centre the official language committee of NRCO organized Hindi Diwas on 14.9.2006. A series of events were performed like extempore, debates etc. on various topics to create awareness among the scientists and staff. Winners were awarded with prize and certificate.

### Raising day

Raising day of this centre was celebrated on 5.10.06. A series of sports and cultural programmes was organized which was attended by entire staff with their family members. The winners of various events were awarded with prize and certificates

### Institute Management Committee Meeting (IMC):

IMC meeting for the year 2006-07 was held on 12<sup>th</sup> March 2007 under the chairmanship of Dr. R. P. Medhi, Director, NRC for Orchids. Other members for the meeting were Sh. K.K. Singh, Director (Hort. & Cash Crops), Govt. of Sikkim, Dr. H. Rahman, Joint Director and Dr. Ashok Kumar, scientist (Horticulture) from ICAR Res. Complex for NEH Region, Sikkim Centre, Dr. V.S. Nagrare, Shri. Rampal and Dr. Ramgopal Devadas, scientists from NRC for Orchids also attended the meeting. The chairman dealt upon various activities and achievements of the centre. New agenda items including new and spill over civil works and priority equipments were approved by the committee.

### Library

Subscription of about 25 national journals was done during the reported year. At present there are about 1800 books on different subjects. During the year 270 books on different fields were purchased from Institute library funds. To promote the use of Hindi as official language near about 300 different kinds of Hindi books were purchased to enrich the library information facilities in the Centre.



## राजभाषा कार्यान्वयन रिपोर्ट

राजभाषा अधिनियम १९६३ धारा ३(३) एवं राजभाषा नियम १९७६ के अनुपालन पर राजभाषा विभाग गृह मंत्रालय एवं भारतीय कृषि अनुसंधान परिषद की ओर से जारी किए गए दिशा निर्देश एवं वार्षिक कार्यक्रमों के कार्यान्वयन हेतु इस संस्थान की राजभाषा कार्यान्वयन समिति का गठन निम्न सदस्यों से किया गया।

१. डा. द्विजेन्द्र बर्मन, वरिष्ठ वैज्ञानिक, सदस्य सचिव, हिन्दी समिति।
२. डा. विश्लेष शंकर नगरारे, वैज्ञानिक सीनियर स्केल, सदस्य, हिन्दी समिति।

राजभाषा अधिनियम के प्रावधान के अनुरूप राजभाषा कार्यान्वयन के लिए वर्ष २००६ की अवधि में निदेशक की अध्यक्षता में संस्थान की राजभाषा कार्यान्वयन समिति की बैठक नियमित रूप से बुलाई गई। बैठक में राजभाषा अधिनियम १९६३ धारा ३(३) एवं राजभाषा नियम १९७६ के अनुपालन की अनिवार्यता पर विशेष बल दिया गया।

### हिन्दी चेतना मास समारोह का आयोजन

राजभाषा विभाग के वार्षिक कार्यक्रम के अनुसार १४ सितम्बर २००६ से एक माह हिन्दी चेतना माह समारोह मनाया गया। समारोह में संस्थान के कर्मचारियों / अधिकारियों में राजभाषा के प्रति जागरूकता पैदा करने हेतु विभिन्न हिन्दी प्रतियोगिताओं जैसे श्रुतलेख, पत्र लेखन, अनुवाद टिप्पणी, प्रश्नोत्तरी, निबन्ध लेखन आदि आयोजित की गईं। इस अवसर पर संस्थान के अनेक कर्मचारियों /

अधिकारियों ने उपरोक्त लिखित प्रतियोगिताओं में भाग लिया एवं रुचि दिखाई। प्रतियोगिता के दौरान निदेशक महोदय ने समस्त प्रतियोगियों को संबोधित किया एवं शुभकामनाएं दी। साथ ही प्रतियोगिता में प्रथम, द्वितीय एवं तृतीय स्थान पाने वाले कर्मचारियों/अधिकारियों को उचित पुरस्कारों से सम्मानित किया गया।

### नगर राजभाषा समिति की आलेख एवं साक्ष्य समिति का विचार विमर्श कार्यक्रम

नगर राजभाषा समिति के आलेख एवं साक्ष्य उप समिति का विचार विमर्श कार्यक्रम इस संस्थान के सचिव एवं सदस्य हिन्दी समिति द्वारा नगर राजभाषा कार्यान्वयन समिति, गान्तोक में समय-समय पर भाग लिया।

### प्रशिक्षण कार्यक्रम

राजभाषा हिन्दी का कार्य साधक ज्ञान न रखने वाले कर्मचारियों / अधिकारियों के लिए संस्थान में ही हिन्दी प्रशिक्षण कार्यक्रम समय-समय पर आयोजित किए गए। इसके साथ ही संस्थान में हिन्दी भाषा से संबंधित कई बैठकें भी आयोजित की गईं।



# Orchids in natural habitat







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