

# ICAR-NRCO

## At a Glance

**A Premier Research Institute Working On  
Orchids since Two Decades**



ISO 9001-2008  
भा.कृ.अनु.प. - राष्ट्रीय आर्किड्स अनुसंधान केंद्र  
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**Correct Citation** ICAR-NRCO at a Glance,  
ICAR-National Research Centre for Orchids, Pakyong, Sikkim

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## Preface

India is one of the primary or secondary centres of orchid biodiversity and the major regions of diversity are NE Himalayas, NW Himalayas, Western Ghats and Andaman and Nicobar Islands. Orchids are the most evolved family of monocotyledonous plants and are represented by nearly 25,000-35,000 species belonging to 1000 genera. Nearly 1300 species of orchids are found in India distributed in different parts of the country. Indian orchids have also been used in various indigenous systems of medicines since time immemorial. Whereas the systemic collection and conservation of orchids for value addition through crossing and selection has started very recently in our country.

Today, more than 1,00,000 hybrids are known globally and cultivated for cut flowers and potted plants and more and more new ones are being registered every month. Orchid breeders evolved superior clones and tissue culturists cloned them in large numbers and horticulturists developed production technologies for growing them in to perfection. Today, orchids occupy the place among the top ten cut flowers and potted flowering plants sold in the world floriculture market. It is believed that both cut flower and potted flowering plant markets would be dominated by orchids during of 21 century. Realizing the strength of orchid genetic resource and diversity in climatic to grow large varieties of orchids for burgeoning national and international demands, a decade ago, Indian Council of Agricultural Research (ICAR) established National Research Centre for Orchids for providing research support to country's budding orchid industry. Since, its existence, the centre had made concerted efforts to develop strong linkages with the growers to understand the problems faced by them, many issues related to orchid production and protection were resolved based on existing knowledge, laboratory and field studies.

The centre has given due importance to the orchid breeding as well as production of quality planting materials which are considered as major bottlenecks in the development of orchid industry. Keeping the above strength and challenges in view, the perspective plan has been prepared with an approach to carry out research in the areas of ex-situ conservation of indigenous orchid germplasm, VISION 2050 diversity analysis using molecular markers, development of micro satellite markers for indigenous species identification, isolation, characterization of novel genes from native species, development of hybrids for commercial cultivation, development of user friendly virus detection kit for the farmers. The due attention has also been given to development of mass propagation protocols for production of disease free quality planting materials, development of production, post-harvest and plant protection technologies leading

to good agricultural practices. Unlike other flower crops, the private investment in orchid industry is very meager. Therefore, a provision for expansion of cultivation of orchids through popularization, farmer motivation, demonstrations and trainings has also been kept in this perspective plan.

I express my gratitude and extend my sincere thanks to Dr. T. Mohapatra, Secretary, DARE & DG, ICAR for his visionary approach in conceptualizing the 'ICAR-NRCO, At a Glance' document. I express my sincere thanks to Dr. A.K. Singh, DDG (Horticultural Science) and Dr. T. Janakiram, ADG (Horticulture-I), ICAR, New Delhi for their valuable guidance in this Endeavour. I acknowledge and appreciate the efforts of my colleague's scientists in developing and bringing out this document. I hope, this document 'ICAR-NRCO, At a Glance' would be useful to the researchers, teachers and students in floriculture besides planners and entrepreneurs in floriculture and related sector.

**Pakyong**

**(D. R. Singh)**



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## 1. Introduction

The ICAR-National Research Centre for Orchids, Sikkim was established by Indian Council of Agricultural Research, New Delhi on 5th October 1996 based on the recommendations of the Planning Commission during VIII<sup>th</sup> Five Year Plan. The basic objective for setting up this centre was to provide research support to upcoming orchid industry, conserve and use orchid genetic resources available in the country.

For this, Sikkim state authorities handed over about 22 acres of land with all other assets belonging to Regional Agricultural Centre to ICAR at Pakyong on lease basis for 99 years for establishing centre. After a year during October 1997, the centre also took over the CPRS, Darjeeling from CPRI and established a regional campus for taking research activities on temperate orchids. Latest, one sub centre established in Chettali, in the premises of IIHR, Regional station, Karnataka for research on tropical orchids.

In initial years of establishment, the major focus of research was on collection, characterisation, evaluation, conservation and utilization of genetic resources available in the country particularly in north-eastern region. 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 marketable varieties/hybrids, molecular characterisation, standardisation 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.

### The ICAR-National Research Centre for Orchids (Earlier)



**Administrative Building Conference hall**

### **The ICAR-National Research Centre for Orchids (Now)**



**ICAR-NRCO Head quarters, Pakyong campus**

### **ICAR-NRCO Darjeeling campus**

The Darjeeling centre was initiated research on orchids during October 1997, the centre also took over the CPRS, Darjeeling from CPRI and established a regional campus for taking research activities on temperate orchids.



**ICAR-NRCO Darjeeling regional campus, Darjeeling, West Bengal**

## Experimental farm

Darjeeling campus has altogether 1.23 acres of land with well-developed tissue culture laboratory and experimental farms including climate controlled polyhouse. The centre is mainly working on *Cymbidium*, *Coelogyne*, *Calanthe* and *Paphiopedilum* species.

## 2. Mandate & Objectives

### MANDATE

- ❖ Applied and strategic research on conservation, improvement and culture of orchids for enhancing productivity and utilisation.
- ❖ Transfer of technology and capacity building of stakeholders for enhancing and sustaining productivity of orchids.

### MISSION

- ❖ Science and Technology driven development of orchid industry in the country.

### VISION

- ❖ To act as premier centre for research and development activities related to orchid commercialization and sustainable utilization.

## Major Objectives

- ❖ To collect, conserve, characterize and evaluate germplasm and develop National repository of orchids.
- ❖ To evaluate locally adopted orchid species for their suitability as cut flower or potted plant for commercial purpose.
- ❖ To standardize micro propagation techniques for production of quality planting material at commercial scale.
- ❖ Molecular characterization to check bio-piracy and IPR protection of orchids.
- ❖ Development of protocols for mass multiplication.
- ❖ Production of quality planting materials for large scale cultivation.
- ❖ To develop hybrids/ varieties suitable for domestic and export markets.



- ❖ To develop production, protection and post-harvest technologies for orchids.
- ❖ To act as a national repository of scientific information on mandate crops.
- ❖ To develop export-worthy orchid lines through a systematic breeding programme
- ❖ To carry out systematic work on disease and pest management of Orchids.
- ❖ To standardize post-harvest management practices of orchid cut flowers for domestic and International markets
- ❖ To coordinate research with other scientific organizations and act as a nodal organisation for orchids.

### 3. Thrust Area

- ❖ Collection, maintenance, documentation and conservation of germplasm.
- ❖ Morphological and molecular characterization of important germplasm to safeguard valuable indigenous generic resources.
- ❖ Strategic development of new improved varieties with genetic potential.
- ❖ Development of potential hybrids with high yield, quality and tolerant to biotic and abiotic stresses.
- ❖ Development of protocol for mass multiplication of improved varieties/hybrids of orchids and bulbous flowering plants.
- ❖ Development of production technology for increasing productivity of new hybrids/varieties of commercial orchids.
- ❖ Standardization of pre and post-harvest techniques for reducing the storage and transport losses and development of value added products.
- ❖ Promotion of integrated disease and pest management programme.
- ❖ Disseminate technologies through vibrant training programme, demonstration, publication and mass media.
- ❖ To prepare the data base and compilation of data by providing micro processing facilities.
- ❖ Promoting the human resource development on relevant discipline.
- ❖ Strengthening the floricultural research information system with special reference to orchids.

## 4. Major Research Programmes

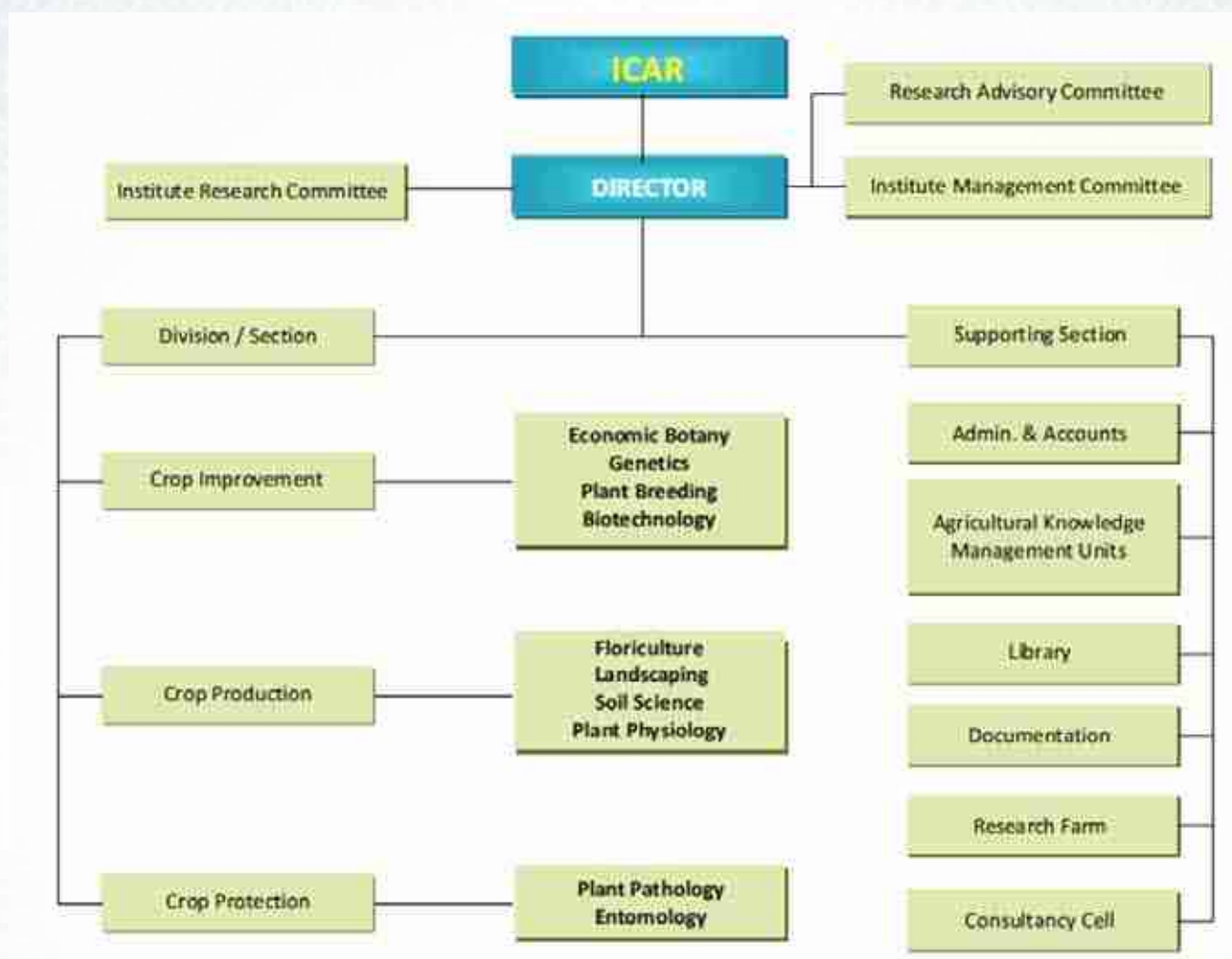
- ❖ Conservation, characterization and sustainable use of diversity in orchids - **DNA Bar Coding**
- ❖ Genetic improvement of orchids for yield, quality and resistance to biotic and abiotic stresses - **Variety Development, MAS and Apomixis**
- ❖ Development and refinement of production and protection technologies for improved of productivity, marketing and utilization of orchids - **Organic farming, Aeroponics and Hydroponics**
- ❖ Improvement of knowledge and skill of stakeholders for improving production of orchids

### External funded Projects

- ❖ DUS Testing on Orchids (PPV&FRA).
- ❖ Assessment of chemical and genetic divergence of some fragrant orchids of north-east India for sustainable improvement of community livelihood (DBT-TWIN Project-IIT, Kharagpur).
- ❖ National Mission on Himalayan Studies (NMHS, MoEF & CC, GOI) – **Conservation, longterm ecological monitoring, GIS, DBMS, natural resources accounting methods and chemical profiling.**
- ❖ Inventorization of gama irradiation technology for **orchid varietal improvement** (DAE, BARC, GOI).

## 5. Organogram

### Institute structure/ Organisational setup



Organogram of ICAR-NRCO

## 6. Facilities (Infrastructure)

### Facilities

#### 1. Infrastructure

The laboratory cum administrative building, two fibre houses, 18 medium cost polyhouses with micro-irrigation system, four net houses and four low cost polyhouses have been constructed on sloppy land for different experimental and conservation purpose. The centre is also equipped with automatic

weather station to assist in carrying out research in different disciplines. Orchid sanctuary has been created on 4 acres of farmland covered with different species of trees for ex-situ conservation.

The institute having well established tissue culture, genetics, molecular biology, horticulture, physiology & pathology laboratories. The centre has advance equipment's for basic and applied research. Beyond this, the institute having good conference hall and training hall (90 seater).



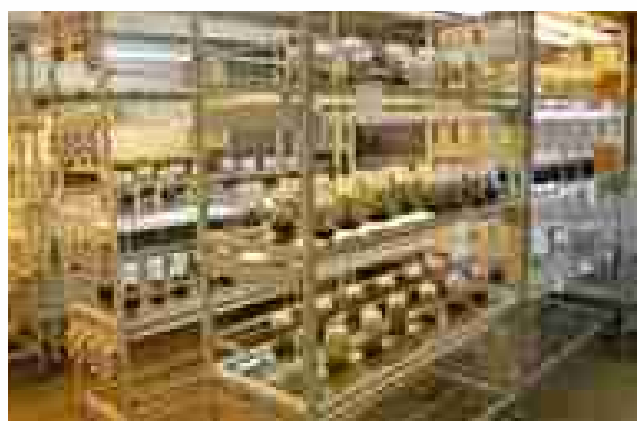
**Genetics Lab**



**Molecular Lab**



**Laminar air flow chamber**



**Tissue culture lab**



**Pathology lab**



**Physiology Lab**



**Horticulture Lab****Automatic Weather station****Laminar air flow chamber****Growth Chambers- Inside view****Conference Hall****Training Hall**

## **2. A.K.M.U.:**

The Agricultural Knowledge Management Unit (AKMU) earlier known to be ARIS Cell of the Institute is well established featuring 19 computers interlinked with LAN, photocopier machine, printers, scanner etc. To back up the orchid research in addition to facilities application software packages like SAS 9.3, SPSS, Gen Stat, word processing, database management system are also available.

### 3. Library:

The library information system has been enriched with the subscription of several national and international journals, magazines and reports of horticultural importance. The library of the centre has a collection of about 1582 books, 36 Indian journals & 05 international journals. The centre has published 3 books, 20 book chapters, 52 technical bulletins. More than 100 scientific research papers and popular articles were also published by the centre.



Library view



Journal section

### 4. Water harvesting structures (system):

The Institute arranged a perfect water harvesting system for sustainable procurement of rain harvested water to avoid the water crisis problems in unseasonal periods.



Water harvesting structures

### 5. ICAR- Residential complex:

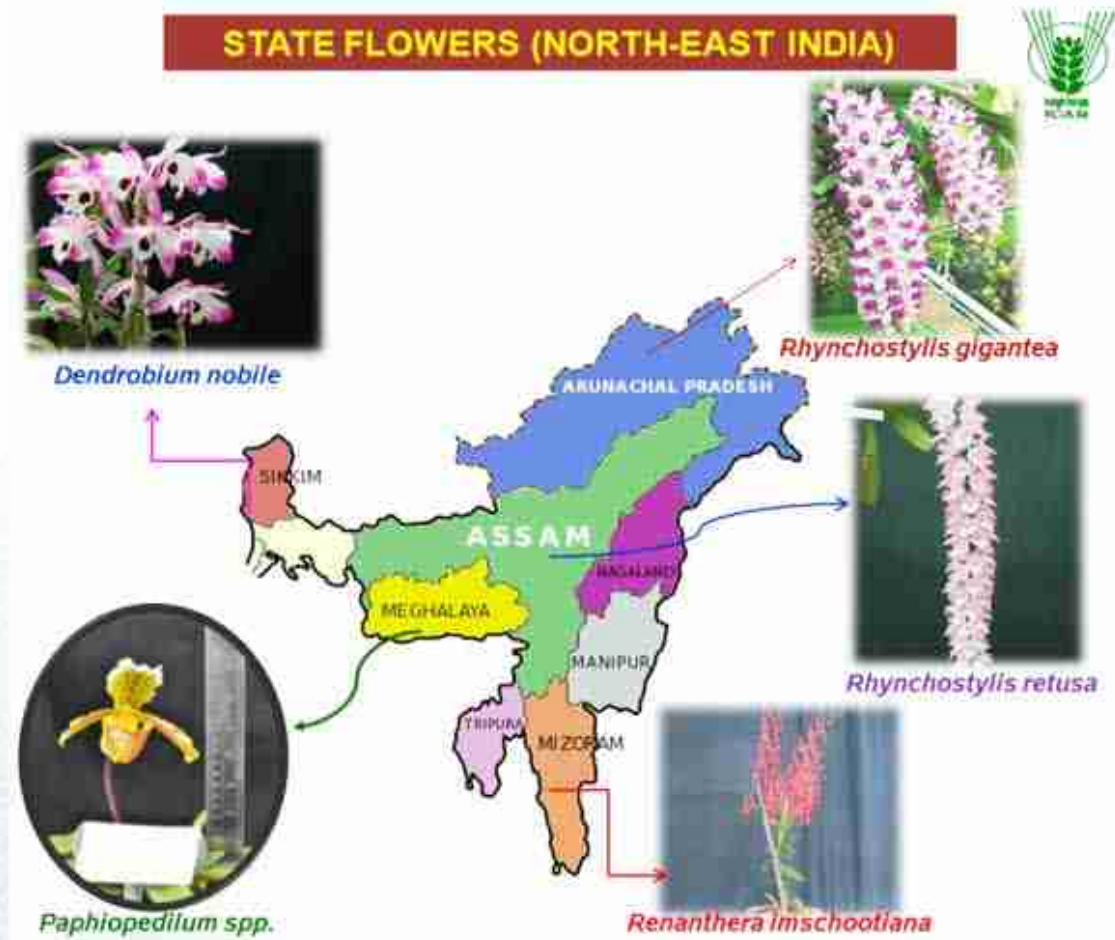
The Institute having a type-1, type-2, type-3 and type-4 quarters. Latestly one new type-4 quarter was inaugurated for staff.

### Why orchids are so important...

- ❖ Most wide spread/spatial/temporal species
- ❖ **Orchids evolution:** 40-80 m year (mid-cretaceous) (Crane et al., 1995, Nature, 374-27-33)



- ❖ **2nd largest family** (flowering plants)
- ❖ **1/10<sup>th</sup>** of flowering plants
- ❖ **Orchids Diversity:**
  - Genera:** 800
  - Species:** > 25,000
  - Modern hybrids:** > 2, 00,000
- ❖ Trade: **Market oriented/cut flowers/potted plants.**
- ❖ Global Floriculture Exports: **Euro 5.1 billion** (9 billion by 2025)
- ❖ Netherlands (58%), Colombia (14%)
- ❖ India is the harbour - nearly **1350 species** of orchids.
- ❖ In India, **5 states (Assam, Arunachal Pradesh, Meghalaya, Mizoram and Sikkim)** having orchids as **State Flowers**.



## 7. Importance

### Important Orchids which are conserving in ICAR-NRCO



*Rhynchostylis retusa*



*Paphiopedilum fairrieanum*



*Diplomeris hirsuta*



*Renanthera imschootiana*



*Paphiopedilum spicereanum*



*Vanda coerulea*



*Dendrobium nobile*



*Cymbidium elegans*



*Dendrobium falconeri*



*Satyrium nepalense**Dendrobium parishii**Paphiopedilum venustum*

## 8. Achievements

### Salient achievements

#### Orchid Conservation

Developed ex-vitro orchid conservatory (339 species from 87 genera, 3130 accessions)

#### NAGS poly house-1 (Sub- tropical)



NAGS collections (Sub-tropical)



Poly house overview

#### NAGS poly houses-2 (Tropical)



NAGS collections (Tropical)



Poly house overview

### Conservation Polyhouses



Meghalaya house



Assam house



Sikkim house



Conservation house



Vertical conservation



Conservation at low  
cost polyhouse

### Conservation under simulated natural habitat



In this method, orchid plants were tied on the trees or planted under the shades of trees as that of nature. Thus the collections were duplicated and in the event of loss of the germplasm at one place helped to recover from the other.



## Rehabilitation of Orchid species of Sikkim in the natural habitat



**Plants of Different Species Fallen in the forest Area**



**Rehabilitation through participation of forest dwellers**

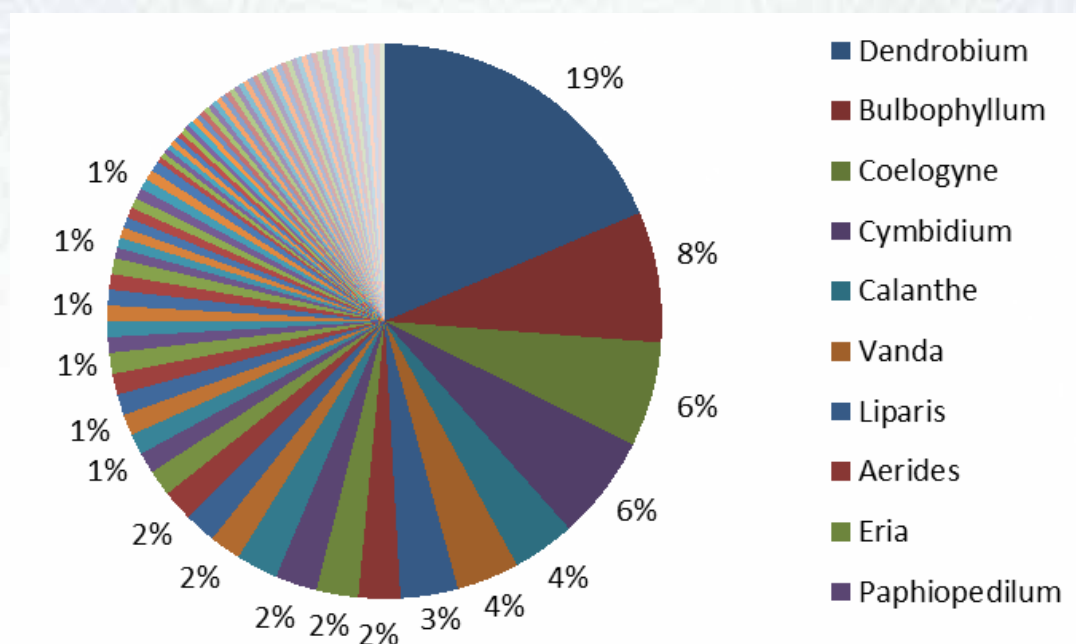


**Rahabilitation of Plants to different host trees**

## Complied the final Species list of the institute

The institute is having 339 species which belongs to 87 genus. Beyond this, institute is having more than 100 hybrids. Pakyong centre conserving tropical and sub-tropical germplasm whereas Darjeeling centre conserving temperate germplasm.

Ratio of genus wise



### Herbarium and Digital herbarium

Conventional herbarium has the disadvantage of getting spoiled overtime. Thus the concept of digital herbarium has been introduced by the centre and till date around 39 species has been digitalized for future reference.



*Phaiustankervilleae*



*Pholidotaimbricata*



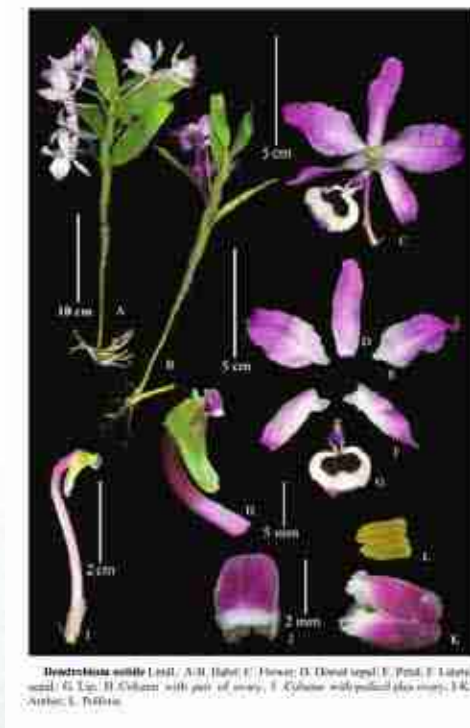
*Renanthera imschootiana*



*Rhyncostylis retusa**Thunia marshalliana**Vanda coerulescens*

### Compiled the species photo plates (70 no)

The orchid species were dissected properly and compilation of species photo plates by using digital photography rapidly with the technology. Currently, there is 70 species were completed.

*Dendrobium nobile**Thunia alba* var. *alba*

Several promising/new genotypes in species *Pleione humilis*, *Coelogyne punctulata*, *Coelogyne nitida*, *Pleione praecox*, *Dendrobium amoenum*, *Cymbidium lowianum*, *Paphiopedilum villosum* and *Liparis bootanensis* have been identified.

4 New species namely *Cymbidium cyperifolium*, *Calanthe mannii*, *Calanthe yucksomnensis*, *Calanthe davidii* were recorded for the first time in West Bengal. Hence, these are new addition to the orchid flora of West Bengal.

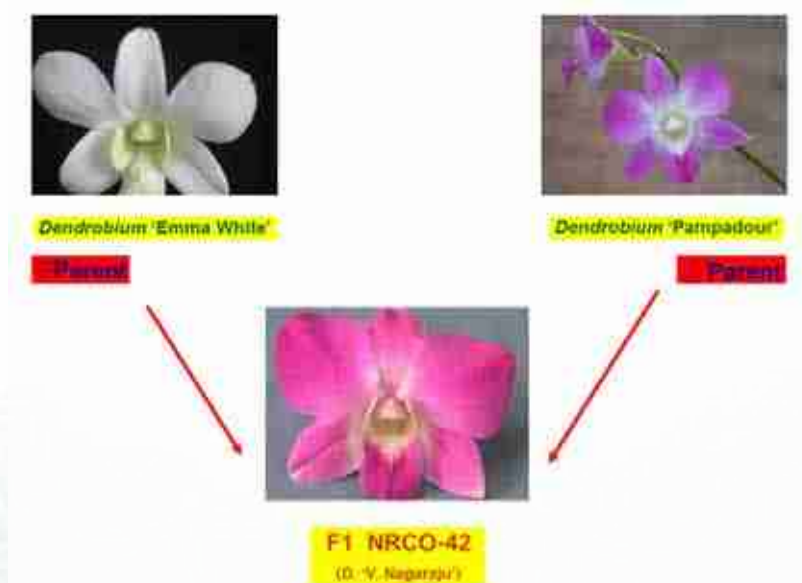
**Varieties :** Three (03) varieties were released and 12 new varieties were identified for release.

**Cymbidium 'B. S. Basnett' :** 1<sup>st</sup> native hybrid species, It is developed from *C. lowianum* x *C. tigrinum* (Re-invention of historical cross developed in 1903, very late flowering in summer season, Breeding Value)



**Cymbidium 'B. S. Basnett'**

**Dendrobium 'V. Nagaraju' :** 5 -6 flowers/spike, flowers in off season (Nov- Feb), single gene control of colour



**Aranda 'Kung Gyatso'** :It is developed from *Arachnis clarkei* and *Vanda coerulea*.1st in India, height > 90 cm, more keikis, helps to assess gene flow, flowering Feb – March, AICRP Trial (2013-15)/PPB.



**Aranda 'Kung Gyatso'**

**PL x PW 10:** Flowering mid to late season, Season: Dec – Feb, peduncle length-21 cm, flower size: 11 x 11.6 cm (mod), vase life: 111 days, potted variety, flat D/Sepal.



**PL x PW 10**

**PL x PW 19 :** Flowering period is Nov – Mid Feb, Flower size - 13.2 x 13.8 cm, peduncle length - 11.30 cm, peduncle girth: 5.71 mm, potted vase life is > 3 1/2 months.



**PL x PW 19**



**SHEETAL 1 (IC 614753):** Plant height – 18.5 cm, Deep green leaves & vigorous growth, Flower size (9.6 x 11.3 cm), Semi deep half funnel shaped dorsal sepal, (Oct-Mar)



**SHEETAL 1 (IC 614753) Plant, flower & floral parts**

**SHEETAL 2 (IC 614750):** Grand, Spectacular Size, Dominating length & Prominent nose, Flowering: Oct/Nov - Mar, Flower size: 14.2 x 13.2 cm, Peduncle length: 19.75 cm, Peduncle girth: 0.54 cm, Potted Vase life: > 4 months.



**SHEETAL 2 (IC 614750) Plant, flower & floral parts**



**(PBX-05-29/2012-3 & 4):** It is developed from *Cymbidium* 'Red Beauty' x C. 'Golden Elf'. Potted variety with attractive flowers, suitable for early season (Sept to Dec), commercial value.



**The F- 1 clones developed from parents having commercial value**

**PBX-05-751/2013-14 :** It is developed from *Cymbidium* 'Nonina Paleface' X *C. iridiodes*. Early flowering (4th wk, Sept), Spike length (> 70 cm), florets (12-13), medium to standard type, Alternate flowering and scented cymbidiums.



**PBX-05-751/2013-14**

**PBX-05-29/2014/31:** It is developed from *Cymbidium* 'Red Beauty' x C. 'Golden Elf' and Early Flowering (Oct – Nov' 2014)



**PBX-05-29/2014/31**

**PBX-05-751/2013:** It is developed from Cym. 'Nonina Paleface' x *Cymbidium iridioides*. Early flowering (4th wk, Sept), Spike length (> 70 cm), florets (12-13), medium to standard type, Alternate flowering.



**PBX-05-751/2013**



**Darjeeling Nymph (NRCODC/CMYH/1/6):** It has been developed by crossing a between a hybrids (Cym. Sleeping Nymph) and a native species (*Cymbidium lowianum*). This is first hybrid developed and registered with *International Orchid Registration Authority*, RHS, London from the Institute.

### Salient Features

Nine (09) clones from this cross have been selected for cut-flower production and remaining are suitable pot plant production. The characteristics of the selected clones are given as below:

**NRCODC/CMYH/1/6/21:** Medium sized plants with sturdy long flower spike measuring 58.6 cm bearing 6-7 flowers during first flowering. Flowers are large (12.93 cm across), green in colour (RHS N144A) and lip marked with red orange (RHS N46A). This clone flowers during March a very good plant for cut flower production.



NRCODC/CMYH/1/6/21

**NRCODC-CMYH/1/6/23:** Medium height plants (55.6cm) with dark green (RHS 146A) leaves. Inflorescence about 65 cm long having 6-7 yellow green (RHS 144A), large (12.36 cm across) flowers. Lip is marked orange red (RHS N34A). the clone is suitable for cut flower production.



NRCODC-CMYH/1/6/23

**NRCODC-CMYH/1/6/29:** Medium height plants with light green (RHS135A) leaves. Inflorescence about 80 long bearing 11 medium sized (11.2 cm), yellow green (RHS 153D) flowers. The clone is suitable for cut flower production.



**NRCODC-CMYH/1/6/29**

**NRCODC-CMYH/1/6/11:** Medium height plants (47.95 cm), light green leaves bear 5-6 flowers on nearly 46 cm long flower spike. Flowers are large yellow green (RHS 153C) marked with darker lines. Lip marked with orange (RHS 153D). The clone is suitable for pot plant.



**NRCODC-CMYH/1/6/11**

**NRCODC/CMYH/1/6/262:** Medium sized plants with straight and sturdy flower spikes, front facing flowers, flower spikes with very good flower balance, flowers intermediate in size, yellow green and lip marked with red purple. The clone is suitable for pot plant production.



**NRCODC/CMYH/1/6/262**

**NRCODC/CMYH/1/6/298:** Medium sized plants, yellow green flowers (RHS 10B) on straight flower spike (27.5cm), flowers are front facing with beautifully red purple banded lip.

**NRCODC/CMYH/1/6/298**

**NRCODC/CMYH/1/6/91:** Medium sized plants with straight flower spikes bearing 8 numbers of flowers at first flowering, spike needs support, front facing flowers yellow green in colour, sepals and petals are lightly tinged with brown at apex, apical lobe of the lip is marked with red purple. The clone is suitable for cut flower as well as potted plant.



**NRCODC/CMYH/1/6/91**

**NRCODC/CMYH/1/6/204:** Medium sized plant with straight flower spikes bearing eight numbers of flowers, but flowers spikes need staking/support. The clone has good flower balance, yellow green flowers with the lip banded with red purple. The clone suitable for cut flower as well as potted plant.



**NRCODC/CMYH/1/6/204**

**NRCODC/CMYH/1/6/154:** Medium sized plants, with apple green beautiful flowers (RHS 144 A) , 10.5 cm across. The flower spikes need training, lip apex marked with red purple.





NRCODC/CMYH/1/6/154

**Darjeeling's Delight (NRCODC/CMYH/2/6/1):** It is a cross between a native species (*Cymbidium lowianum*) and an intermediate *Cymbidium* hybrid (Cym Showgirl 'Cocksbridge'). This is a second cross registered with the *International Registration Authority, Royal Horticultural Society*, London as Darjeeling's Delight. (Ref Page No. 2 & 7-8)

### Salient Features

Two clones from this cross have been selected that are suitable potted flowering plants. The salient features of these two clones are given as below:

**NRCODC/CMYH/2/6/1:** Low height plants (38.4 cm), inflorescence 33.5 cm long bearing 5 flowers of 8.6 cm across. The flowers are RHS 46 A in colour on a lighter background (RHS 150D). The clone needs further improvement through induction of ploidy level.



NRCODC/CMYH/2/6/1



**NRCODC/CMYH/2/6/2:** It is medium in size (height 74.6 cm). It bears about 56 cm long flower spike having 8 numbers of flowers less 9.36 cm across. Medium sized flowers well presented on flower spikes. The flower spike has very good flower balance. The clone can be further improved by doubling the chromosomes



NRCODC/CMYH/2/6/2

**Germplasm Registration:** PGRC registration (IC 566525) of 'Red Vanda' (State flower of Nagaland) and molecular profiling of *Vanda* (18 no.), *Cymbidium* (17 no.), *Aerides* (8 no.) & *Dendrobium* (37 no.) species.

PPVFRA & DUS Guidelines: Developed Breeder & Farmers Rights on *Dendrobium*, *Cymbidium*, *Vanda*, *Oncidium*, *Phalaenopsis* and *Cattleya* etc.



*Cymbidium*



*Dendrobium*



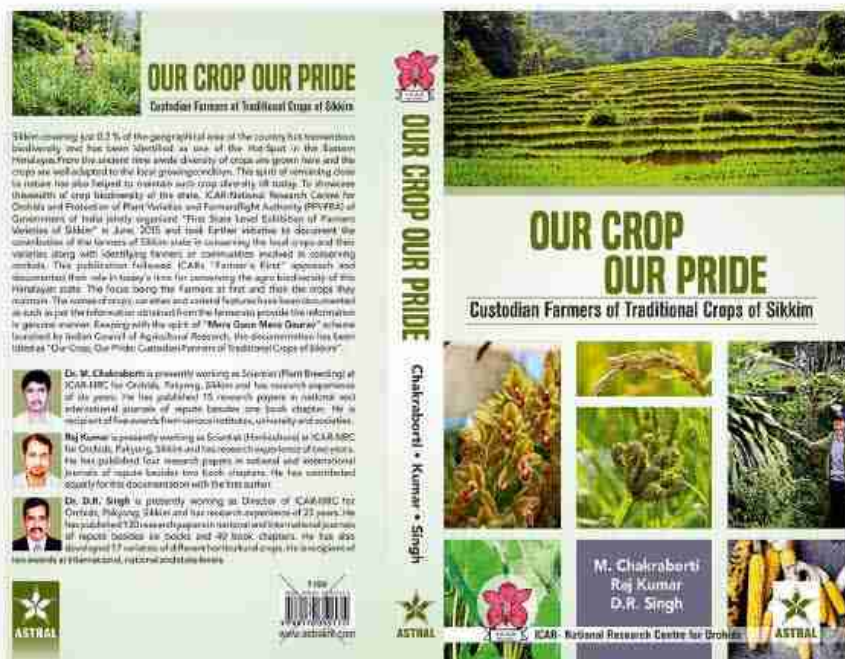
*Vanda*

## Documentation of traditional crop diversity of Sikkim

# Custodian Farmers

## “Documentation of traditional crop diversity”

### Farmers First Approach



- 24 villages from the four districts of Sikkim
- 70 Farms visited
- 44 farmers were identified and documented
- Identified eligible communities and farmers facilitated for filling awards application from PPVFRA

### Our Crop Our Pride- Compiled documentation of custodian farmers for traditional crops of Sikkim

**DNA Bank & NCBI Deposits:** DNA isolated from 260 species. 65 DNA barcode sequences (ITS, matK, rbcL, trnH-psbA) were submitted to NCBI.

**DNA repository of orchids:** The DNA of native orchids are being preserved under  $-80^{\circ}\text{C}$ . Nearly 250 species samples are preserved carefully.

DNA  
Repository



DNA are stored  
under  $-800\text{ C}$



**Patent Filed** on “Efficient Method DNA Extraction Protocol For Orchids (No. 826/KOL/2013)”  
an improved method and efficient method for DNA isolation extraction from Orchids plants.

### Patent Filed

Efficient Method DNA Extraction Protocol For Orchids (No. 826/KOL/2013).

### METHOD OF CHLOROPLAST DNA ISOLATION – ORCHIDS Protocol

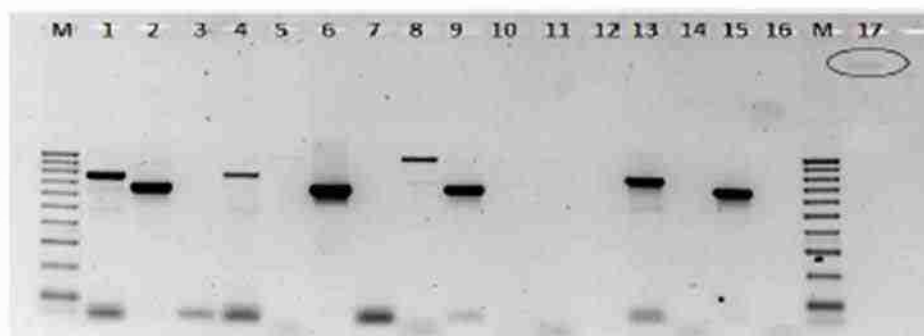
**Process:** An improved method for Chloroplast DNA isolation from Orchids

**Product:** cpDNA isolation Kit for orchids

**Background:** Chloroplast genome sequences helps to provide important source of molecular markers to understand evolutionary and ecological processes. High throughput sequencing (HTS) is a new application which drastically reduced the cost of large scale sequencing in a short time. Extraction of pure chloroplast DNA is required for efficient sequencing of chloroplast genomes. Unfortunately, most of the existing protocols for isolation of chloroplast DNA were not suitable for orchids having high secondary metabolites and do not produce sufficiently pure yields for High throughput sequencing from Orchids.

**Methodology:** Genetics section developed a simple and inexpensive method to obtain chloroplast DNA from orchid species by modifying the existing protocols. Many protocols for extracting chloroplast DNA require an ultracentrifugation step to efficiently separate chloroplast DNA from nuclear DNA. The developed method does not require an ultracentrifuge.

**Significance:** The developed method produced chloroplast DNA of very high quality from orchid species.



Agarose gel showing PCR amplified cpDNA using ITS, rbcL and mat k primers (1 -16), M denotes 100 bp step ladder and lane 17 showing intact cpDNA.



## Crop production

### Mass multiplication of tissue cultured plants:

For production of quality planting material the tissue culture laboratories were strengthened at main Centre and Darjeeling Campus. The protocols for mass multiplication of six *Cymbidium* hybrids have been standardized. Presently, 25,000 - 30,000 tissue cultured orchid plants are produced annually.

#### Standardization of growing media:

Studies on different media and nutrition have helped to standardized different growing mediums in appropriate ratio and evolve optimum dose of fertilizers required to realize potential yield of selected orchids.

***Cymbidium*:** Leaf mould, coco chips and brick pieces (4:2:1)

***Dendrobium*:** Brick pieces and coconut husk (1:1)

***Eria*:** Brick piece, Cocopeat, coco husk and sphagnum moss (1:1:1:1)

***Coelogyne*:** Coco chips, tree bark, chopped sphagnum or green moss and brick/stone chips (1:1:1:1).

***Cattleya*:** Cocochips, tree bark, cocopeat and brick pieces (4:2:2:2)

***Zygopetalum*:** Leaf mould, charcoal, coconut husk, rotten logs (2:1:1:1).

### Optimization of nutrient requirement

#### *Cymbidium*

- ❖ A solution of 30:10:10 NPK at 0.1% at 15 days interval (1 year old plants).
- ❖ 20:20:20 NPK at 0.1% at 15 days interval (2 year old plants).
- ❖ 15:25:25 NPK at 0.1% at 15 days interval (Reproductive stage).

#### Production management of tropical and sub-tropical orchids:

- ❖ Orchid hybrids of *Cymbidium*, *Dendrobium*, *Vanda*, *Phalaenopsis*, *Cattleya*, *Mokara*, *Oncidium* and *Aranda* suitable for different altitudes identified.
- ❖ Standardization of growing media for commercial cultivation of potted orchids like *Cymbidium* (Cocochips + Cocopeat + Brickpieces + Slow release fertilizer (3:3:1:1g), *Dendrobium* (Cocochips + brick pieces + tree bark (1:1:1) and *Cattleya* (Cocochips + brick piece + leaf mould/ leaf fern (1:1:1).

- ❖ Techniques for round the year cultivation of *Dendrobium* developed by selecting different hybrids developed

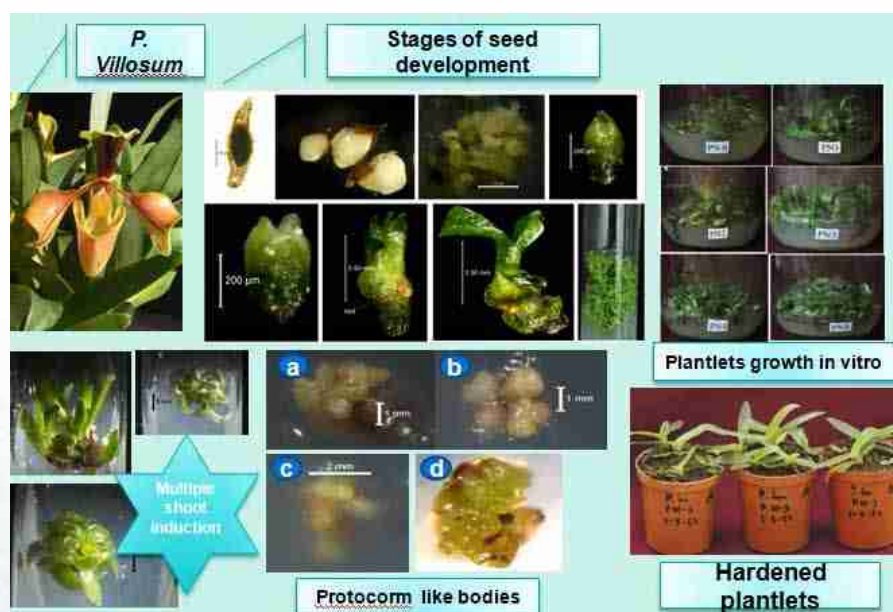
**Success story:** > 1, 00,000 Quality planting material distributed in NEH region (under DBT project).

**Propagation techniques:** In-vitro, plantlets from back bulbs (*Cymbidium*) & *Lillium* propagation and in-vitro flowering developed.



**Propagation of Cymbidium through backbulbs**

Standardization *in vitro* propagation protocol (*Paphiopedilum*)



***Paphiopedilum* – invitro propagation protocol**

### Standardization *in vitro* propagation protocol (*Zygopetalum*)



*Zygopetalum maculatum* – invitro propagation protocol

**Model Floriculture:** Cymbidium based orchid cropping system developed was adopted by Govt of Sikkim.

**Integrated Pest Management:** Pest control measures in *Cymbidium*, *Dendrobium*, *Vanda*, *Phalaenopsis* & *Paphiopedilum* etc and bio-control measures developed for mites and aphids.

**Organic Farming:** Organic methods were developed using local materials (ex: organic fertilizer)

### Post Harvesting Technology

- ❖ Post-harvest studies on vase life, standardization of harvesting stages, pulsing & impregnation, holding solutions, and effect of chemicals on bud opening for a number of orchid species and hybrids have been evaluated.
- ❖ Pulsing with 5% sucrose increases the vase life of Cym. 'PCMV' (56 days).
- ❖ 3. 2% cane sugar as holding solution had maximum longevity of first floret (54 days), zero per cent of flower dropping, maximum solution uptake (24ml) and highest vase life (61.2 days) followed by 4 % cane sugar.
- ❖ In opening of tight bud of Cymbidium hybrid, treatment with 4% sugar + 200 ppm salicylic acid gave highest per cent (75%) of fully opened flowers with maximum vase life (45 days).



## Packaging of spikes

ICAR-NRCO developed different packaging and drying techniques for making other economic products. The spikes can be utilized as loose flowers and can be made into single flower packages or small arrangement packages as souvenirs and gifts.



Spikes after 20 days



Spikes after 30 days

## Single flower packing and drying



Dried Single flowers after Different period of drying techniques

### Single flower clear box packing



Single flower clear box packing

### Single flower and single spike packing



Single spike packing

### Single flower and single spike packing



Single spike packing

**Programmes/Schemes:** Tribal Sub-Plan (TSP) and Revolving Fund Scheme (RFS) of Mega Seed Project.



## **Tribal Sub Plan**

### **Objectives**

- ❖ To create basic infrastructural facilities for promotion of orchid cultivation as an integrated approach with floriculture.
- ❖ To supply quality planting material / seeds, manures and pesticides keeping in view of organic cultivation
- ❖ To train and demonstration on orchid production and pest management under IPM at both off-site and on-site.

### **Action Plan**

- ❖ Earmark of funds under TSP/SCSP for 12<sup>th</sup> plan
- ❖ **Consultation with state institutions and departments**
- ✓ Survey and assessment for selection of different locations
- ❖ Awareness programmes
- ✓ Polyhouses for demonstration
- ❖ On-site and off campus training on orchid cultivation & floriculture
- ✓ Asset transfer to SHGs/ Farmers
- ❖ **Monitoring and evaluation**
- ❖ Feedback and re-orientation
- ❖ **Expansion to other North-Eastern states/ other locations**

## TSP - Meghalaya



**A Report on the CRI Capacity Training & Demonstration, Tribal Sub-Plan Scheme (TSP)  
Orchid Cultivation, Production & Management  
Bakhat, TSP, June 2016**

The National Research Centre (NRC), Pakyong under the guidance of Dr. Jyotsna & Model Officer (TSP), ICAR-NRCO, Shimla, Dr. R. Devdas conducted a one day intensive off-campus training in collaboration with NDC West Khasi Hills District on Orchid Cultivation for the members of the Meghalan Orchid Conservation Society and other orchid growers at Tongleng in West Khasi Hills.

The Meghalan Orchid Conservation Society was formed with an aim to identify and preserve selected indigenous orchid species.

The training started at 10:00 AM with a welcome speech from Dr. Jyotsna, Director, the Director of the society followed by a short speech from Dr. L. Maiti, IAC and Model Officer of TSP, who highlighted the journey and the efforts of the founder of the Meghalan Orchid Conservation Society, in promoting the conservation of the indigenous varieties of orchid. Then Dr. R. Devdas spoke about the richness of the indigenous varieties of orchid within Meghalan and its value for medicinal purposes. He also encouraged the various agencies to work together and to protect the richness of the species.

Dr. R. Devdas and his team also demonstrated the technique for orchid propagation.

After the training, the members of the society and others were also provided with supply of inputs and materials for scientific propagation under the Tribal Project Scheme.

**Appreciation letter from DC,  
West Khasi Hills**

  
Dr. R. Devdas  
Deputy Commissioner  
West Khasi Hills District  
Meghalan



**Documented for 'Plant Genome Savior Community Award' for PPV & FRA, New Delhi**



## TSP - Sikkim



FLD under TSP programme



Training to TSP beneficiary farmers under TSP programme



Distribution of Kits to farmers under TSP programme



### TSP - KarbiAnglong, Assam



Interaction with Director, IACR-NRCO



Training on Media preparation and planting



Field exposure Visit (Sikkim)



Lab visiting at ICAR-NRCO



Off Campus Demo, Marlelangso, Assam



## 9. Other Programmes

### Other programmes/activities



## 10. Extension Services / HRD

### Extension Services/ HRD

**ICAR-NRCO** have played a great role in extension activities since long time about TOT, FLD, Awareness programmes, training programmes in various aspects of orchid conservation, crop production, crop protection in orchid growing areas.

Two National level conference “**National Conference for Production and Utilization of Orchids**”, Feb 19-21, 2011 and **National Dialogue on Orchid Conservation and Sustainable development for Community Livelihood** from, Mar 8-9, 2013.



MTC on “**Recent Trends in Floriculture Improvement**” from 11-18<sup>th</sup> January, 2010 & “**Conservation of Orchids**” from 19<sup>th</sup>- 26<sup>th</sup> Sept. 2012 & “**IPM in floriculture**” from 26<sup>th</sup> Nov- 3<sup>rd</sup> Dec 2012.



Short Course on “**Current Trends in Commercial Floriculture**” from 20-29<sup>th</sup> July, 2011 and “**Short training course in floriculture**” from 27<sup>th</sup> Feb 2012.







Training on Production technology of Cymbidium, Dendrobium & Phalaenopsis at Dimapur, Nagaland



Demonstration units at different locations in Sikkim



Field demonstration for media preparation, disease & pest management of orchids to farmers



Distribution of DBT planting materials at different demonstration units in Sikkim

4th Stakeholders Meeting held on 19/04/2016 for promote and TOT of orchids in ICAR-NRCO(Hon'ble Governor Shri. SrinivasPatil, Sikkim as Chief guest)



Awareness programme on Conservation of Orchid biodiversity along with Swatch Bharat Pakwada by the fellows of NMHS at Yakten village (East Sikkim) on 19-10-16.



World Soil day celebrated on 05-12-16 in adopted & MGMG village Kartoke, East Sikkim, Sikkim which created the awareness of conservation of soil and promotion of organic farming.



Orchid Technology Week 2016-17, held in three different orchid growing area of the district i.e. Mirik, Pokhariabong and Kurseong from 5th to 10th January, 2017 in Darjeeling District of West Bengal, to bring an insight on every aspect of orchid cultivation, technologies and business in Darjeeling area.





## Jai Kisan Jai Vigyan



The prestigious National programme “Jai Kisan Jai Vigyan”

## Swatch Bharat:



National Programme “Swatch Bharat Abhiyan”

## Mera Gaon Mera Gaurav

### Initiatives

- ❖ Baseline survey conducted
- ❖ Telephonic advice and email communications – 51
- ❖ Total no. of farm visits – 46
- ❖ Gosthis / meetings conducted – 03 ( Total 142 farmers interacted )
- ❖ Total general awareness programme arranged – 06 ( Total 77 farmers interacted )
- ❖ No. of farmers benefitted by creating linkage with state department officials – 70.





## Memorandum of Understanding (MOU)



### CAU-NRCO sign MOU for collaborative orchid research

#### MEMORANDUM OF UNDERSTANDING

between

**ICAR-National Research Centre on Orchids, (Ministry of Agril.), Pakyong, Sikkim**

and

**Jawaharlal Nehru Tropical Botanical Garden Research Institute, Government of Kerala, Palode, Thiruvananthapuram-695562, Kerala**

This MEMORANDUM OF UNDERSTANDING is made on this \_\_\_\_\_ day of Two thousand and \_\_\_\_\_, **ICAR-NRC on Orchids, Pakyong-737106, Sikkim** a research institute under 'Indian Council of Agricultural Research' which is an autonomous research organization under Department of Agricultural Research and Education, Ministry of Agriculture, Government of India, hereinafter referred to as **NRCO** (which expression unless excluded by (or) repugnant to the subject shall mean and include its successor-in-office and assigns) of the ONE PART;

AND

**Jawaharlal Nehru Tropical Botanical Garden Research Institute, (Government of Kerala), Palode, Thiruvananthapuram-695562, Kerala** hereafter referred to as the 'JNTBGRI' (which expression shall where the context so admits include its successors and permitted assigns) of the ANOTHER PART;

NRCO from Sikkim and JNTBGRI, Kerala in view of their common objective of contributing to orchid research in India, mutually desire to promote and develop collaborative linkages to share their expertise and knowledge through this MOU.

### ICAR-NRCO sign MOU with JNTBGRI, Trivandrum, Kerala for orchid research to promote and develop collaborative linkages to share their technologies

## 11. Awards / Honour

### Awards & Honour

#### **Fakhruddin Ali Ahmad Award 2002-03**



**Best stall winner  
'International Flower Show' (IFS)  
2008**

**Best stall winner  
'International Flower Show' (IFS)  
2013**



Teamwork in Tribal Farming System

#### **'Jewel Of Sikkim'**

to

Dr. R. C. Upadhyaya, Ex-Director,  
ICAR-NRCO in 2006

Best stall winner  
under Germplasm category in  
'International Flower Show' (IFS - 2008)  
Best stall winner  
under Germplasm category in  
'International Flower Show' (IFS - 2013)

#### **'Indira Gandhi Rajbhasha Award'**

to

**Dr. N. K. Meena in 2014**

Prestigious 'Indira Gandhi Rajbhasha Award' (2012) received from the President of India at Rashtrapathi Bhavan original book titled, 'Orchids - Overview and Production Technology' authored by N. K. Meena, R. P. Medhi and Rampal

**National Level Award 2015**

to

**Shri. Trilok Singh Balmiki**

87th Foundation Day celebrations at Patna,  
Bihar  
(25th July, 2015)





**Pandit Deen Dayal Upadhyay Antyoday  
Krishi Puraskar**

**[Zonal Level Award, 2016 (Zone VI)]**

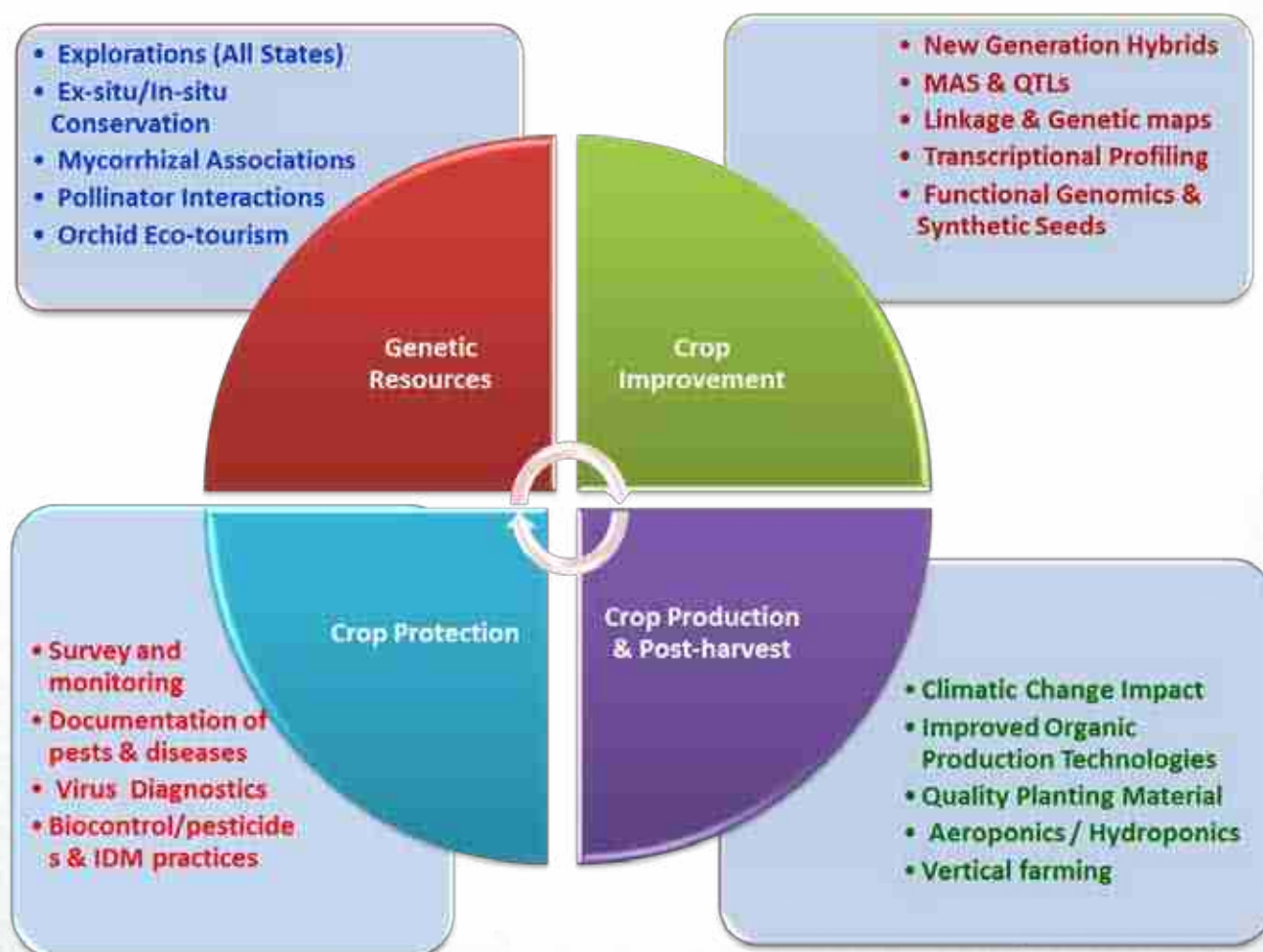
to

**Smt. Anuradha Chettri**

25th Sept, 2016 at CAE & PHT, CAU, Rani Pool,  
Sikkim

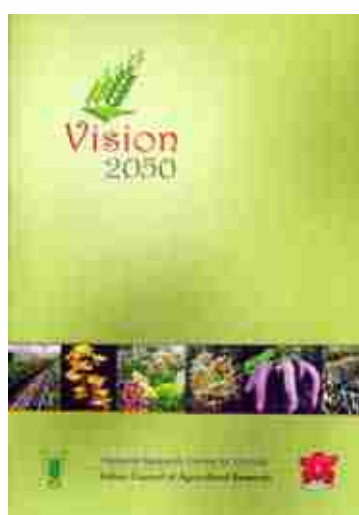
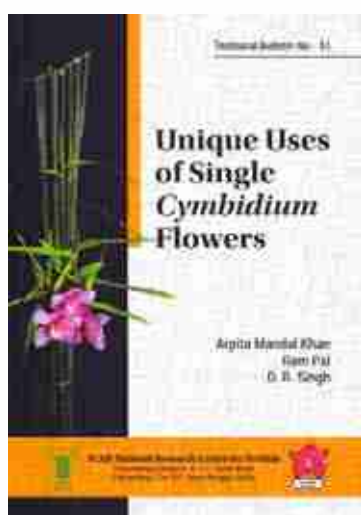
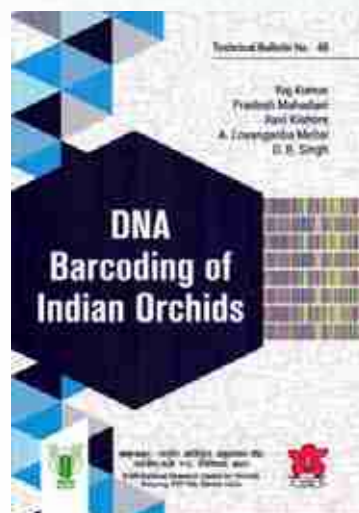
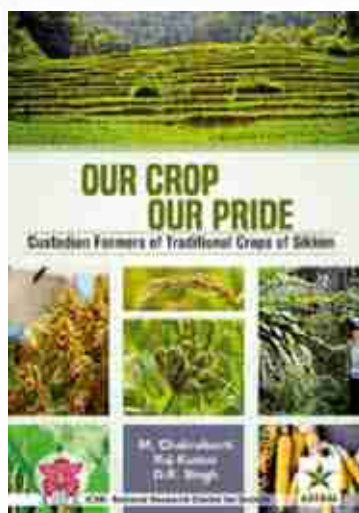
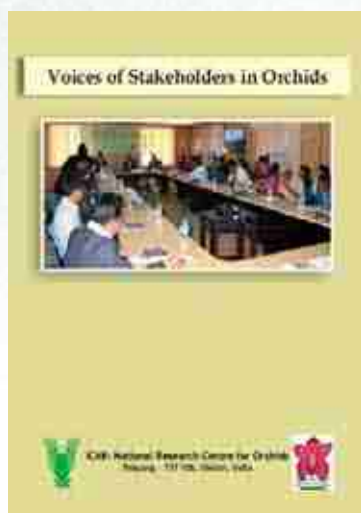
## 12. Future Plan

### Future plan

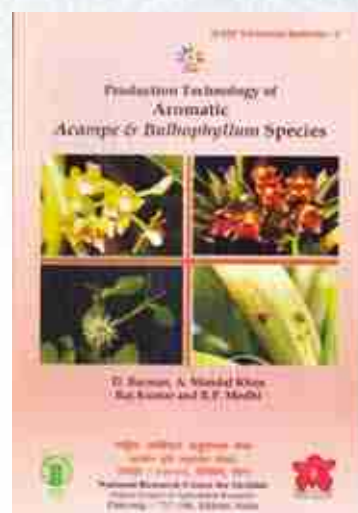
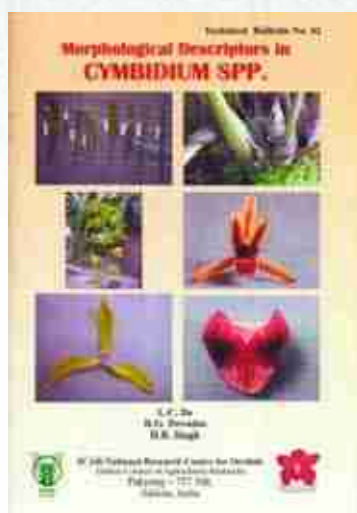
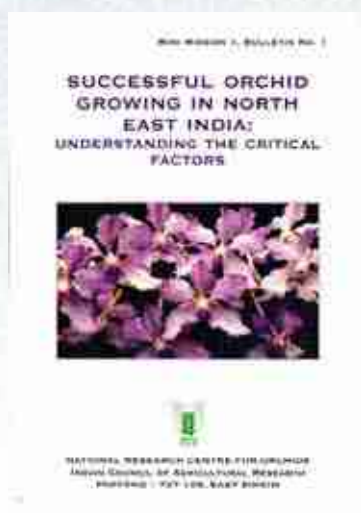


## 13. Publications

## Publications







## Publications (Hindi)

