# Orchids
## Newsletter

राष्ट्रीय आर्किड् अनुसंधान केन्द्र
(भारतीय कृषि अनुसंधान परिषद्)
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**(Indian Council of Agricultural Research)**
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भाकृअनुप ICAR

NRC Orchids

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## Contents



# RESEARCH HIGHLIGHTS

### Genetic diversity analysis of native *Vanda* species using RAPD markers

12 species of genus *Vanda*, collected from different locations of India were analysed using RAPD markers. The *Vanda* species used in this study were *Vanda alpina, V. amesiana, V. coerulea, V. coerulescens, V. cristata, V. parishii, V. pumila, V. stangeana, V. teres, V. tessellata, Vanda spathulata and Vanda wightti*. Leaf materials of these species were used for DNA extraction and fingerprinting. Out of the 110 RAPD primers screened, 84 primers were identified as polymorphic and could distinguish the *Vanda* genotypes (Fig.1). These 84 markers were subsequently selected for genetic diversity analysis and DNA fingerprinting of *Vanda* genotypes.

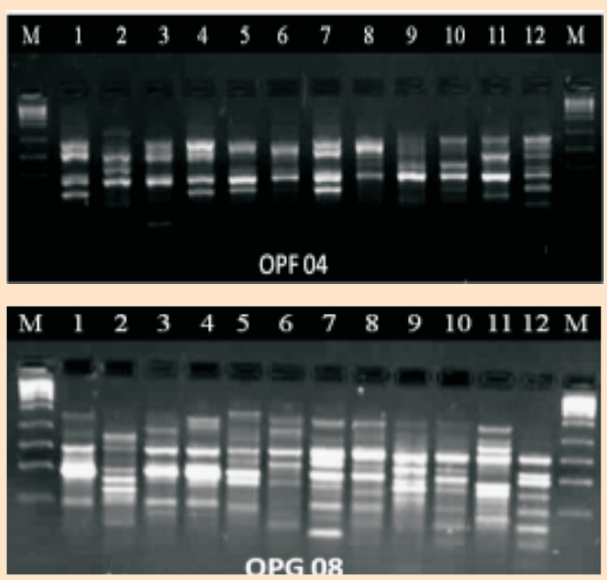


**Fig. 1.** RAPD Banding pattern of *Vanda* species using primer OPF04 and OPG08

### Molecular variation of species of genus *Vanda* using ISSR markers

The same set of 12 *Vanda* species were also evaluated using Inter Simple Sequence Repeat (ISSR) markers. PCR amplifications using 22 selected UBC ISSR primers showed multiple

banding patterns (Fig.2).

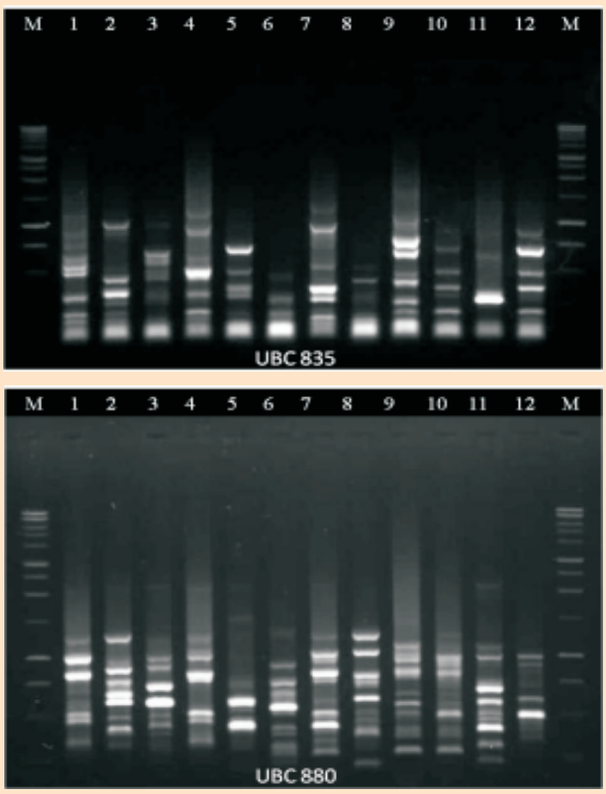


**Fig. 2.** ISSR Banding pattern of *Vanda* species using primer UBC 835 and 880

## Genotyping of native *Vanda* orchids using nuclear (ITS) and ten plastid loci (microsatellite markers)

Genotyping of the 12 native species of *Vanda* was also carried out using three nuclear (ITS) and ten plastid loci (microsatellite) markers. Significant variability was observed in the species under study. The samples were stored for sequencing for development of molecular data base

## Morphological characterization and evaluation of orchid species

The orchids collected at Darjeeling Campus of NRC (O) were characterized and evaluated for their horticultural traits. The plants were photographed for preparation of digital herbarium. The species viz. *Cremastra appendiculata*, *Epigenium amplum, Epigenium rotundatum, Coelogyne nitida, C. occultata, C. ovalis, C. barbata, Cymbidium elegans, C. cyperifolium, C. erythreum, C. gammieanum, Spiranthes sinensis, Otochilus albus, Calanthe biloba, C. plantaginea, C. puberula.*

## Promising genotypes identified

Two variants of *Pleione humilis* and one each of *Coelogyne nitida*, *Coelogyne punctulata* and *Dendrobium amoeneum* were collected from Darjeeling district of West Bengal.

## Effect of culture media on germination of selfed and crossed seeds of different species and hybrids.

Seeds from 2 selfed *Vanda coerulea, Dendrobium chrysotoxum* and 3 crosses of *Vanda cristata* var. *multiflora X Aerides odoratum, Vanda stangeana X Aerides odoratum, Vanda cristata X Aerides odoratum* were harvested after 6-7 months of pollination. The harvested capsules were cultured in different media, viz. MS (Murashige and Skoog), Gamborg (B5) and Nitsch (NC) supplemented with activated charcoal and sucrose. The observations on different parameters like time taken for greening, globule formation and germination were recorded. Germinated seeds were further sub-cultured on different media for their proliferation and differentiation. *Dendrobium chrysotoxum* responded to Nitsch media while others responded to Gamborg B5 media.

**Fig. 3.** Germinated seeds of *Vanda coerulea* and *Vanda stangeana* X *Aerides odoratum* in Gamborg B5 media

## Effect of different media and BAP on germination of *Cymbidium dayanum*.

Selfed seeds of *Cymbidium dayanum* were sterilized and cultured in different media, viz. MS (Murashige and Skoog), Gamborg (G5) and Nistch (Na) supplemented with activated charcoal (1.5g/l), 0.8 % sucrose and BAP (0.0, 0.2, 0.5mg/l). Among the three basal media tested for the seed germination Gamborg's B5 supplemented with 0.2mg/l BAP was found to be the best, which took least number of days for globule formation (29days) and first seed germination (38days) compared to MS and Nistch.

**Fig. 4.** Seed germination of *Cymbidium dayanum* in Gamborg (0.0,0.2,0.5mg/l) media

## Optimization of nutrient requirement for *Cymbidium* plants under hardening

The effect of different concentrations (i.e., 0.1%, 0.2% and 0.3%) of NPK (19:19:19) solution besides control (0.0%) was studied in two spray intervals [07 Days (A) and 15 Days (B)] in *Cymbidium* hybrid 'Sleeping Nymph'. Nutrient solution was applied as foliar applications. It was recorded that foliar application of 0.2% at 15 days interval produces maximum number of spikes (2/pot), flower size (86.92 cm), internodal length (3.1 cm), and flower stalk length (5 cm); whereas spike girth (0.70 cm) and number of flowers (8.25) were recorded maximum in the 0.3% at 7 days interval as compared to other treatments in both the cases.

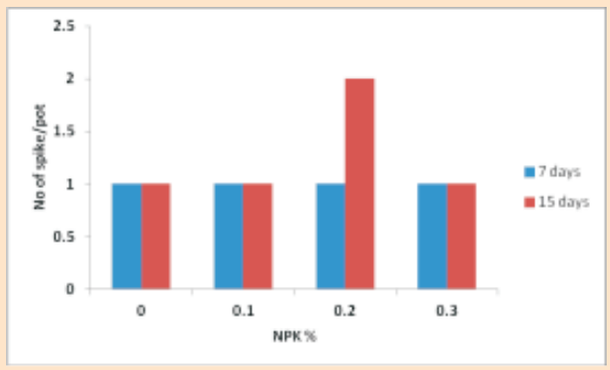


**Fig. 5.** Flower production at different NPK concentration and interval of spraying

## Effect of inorganic nutrients and growth regulators on reducing pre-blooming in *Cymbidium* hybrid 'Black Magic'

N:P:K 10:10:10, 20:10:10 and 30:10:10 at 0.1% and 0.2% concentrations besides two growth regulators Benzyl Adenine (BA) and $GA_3$ at concentrations of 100 ppm & 200 ppm each as well as their combinations ($GA_3$ @ 100 ppm + BA @ 100 ppm and $GA_3$ 100 ppm + BA 200 ppm) were applied as foliar spray. The nutrients were sprayed at weekly interval whereas the growth regulators were given at monthly intervals. The result revealed that foliar application of 0.2% of 10:10:10 NPK and $GA_3$ 100 ppm + BA 100 ppm produces maximum number of flower spikes (2.33) but the application of 0.2% of 20:10:10 NPK along with $GA_3$ 100 ppm + BA 100 ppm increased spike length (78cm), rachis length (34cm), spike girth (1.12cm), flower stalk length (5.5 cm). Again numbers of flower per spike (14) were found maximum in the plants sprayed with 0.1% of 30:10:10 NPK and $GA_3$ 100 ppm + BA 100 ppm.

## Influence of drenching and spraying of inorganic nutrients in *Cymbidium* hybrid 'Levis Duke Bella Vista'

Experiment on drenching and spraying of inorganic nutrients in *Cymbidium* hybrid has been carried out with three inorganic nutrients like 30:10:10,

20:20:20 and 15:30:30 NPK at two different concentrations viz., 0.05% and 0.1% of two mode of application, drenching with 0.1% of 30:10:10 NPK increased the number of leaves (7.33), plant height (48.65 cm), leaf length (45.53 cm) and number of shoots (6.91) as compared to other treatments and spraying mode.

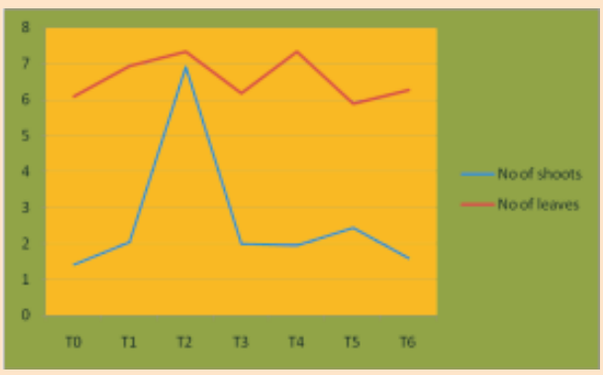


**Fig. 6.** Influence of drenching of nutrient on production of vegetative characters

## Evaluation of tropical and subtropical hybrids of commercially grown orchids

In *Aranda,* 'Propine Spot', 'Sayan A.B. Gold', 'Majula Ren. Storier', 'AKV Fuch's Delight', 'Propine White', 'Thailand Sunspot', in *Mokara*, 'Happy Beauty', 'Walter Ouame White', 'Khan Piak Swan Rasri Gold', 'Chark Kuan Orange', 'Madame Pani', and in *Oncidium*, Colm. 'Wildcat Bobcat', 'Wildcat Carmera', 'Pixie Ruth', Onc. 'Sweet Sugar', Onc. 'Sharry Baby Sweet Fragrance', 'Taka Yellow', 'Popki Red', 'J.R. Pink Spot', 'J.R. Orange Red' and 'J.R. Yellow Brown' were found promising for commercial cultivation.

## Effect of chemical preservatives on vase life of *Cymbidium* 'Pine Clash 'Moon Venus'

In *Cymbidium* hyb. 'PCMV', out of five different stages of harvest maturity, two buds opened stage had maximum vase life (66.8 days) and floret opening followed by 3-4 buds opened stage (64.8 days). Out of four treatments (0%, 2% cane sugar, 4% cane sugar and 8% cane sugar), 2% cane sugar 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. Increasing sugar concentration to 8% reduced the longevity of first floret (27.2 days) and vase life (36.2 days). A combination of 2% sucrose + 200 ppm 8-HQS showed maximum vase life (77.6 days) followed by 2% sucrose + 100 ppm $Al_2(SO_4)_3$ (77.4 days) over control in tap water (65 days).

## Detection of orchid viruses by RT-PCR and ELISA

### 1. By RT-PCR

21 *Cymbidium* hybrids and one weed sample (*Crassocephalum crepidiodes)* were tested in RT-PCR for the detection of CymMV and ORSV. RT-PCR results showed that 6 samples were found positive with CymMV and 20 samples including weed were found positive with ORSV.

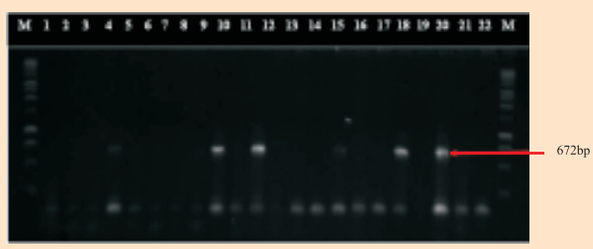


**Fig. 7.** M= marker, lane no.4, 9, 11, 5, 1 8 and 20 are showing CymMV positive bands

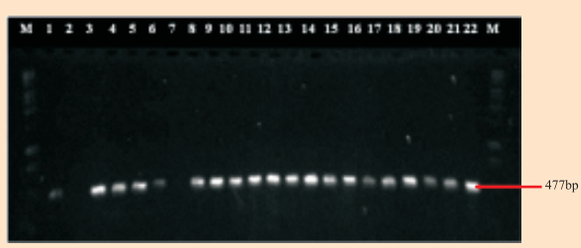


**Fig. 8.** M= marker lane no.1, 3-6 and 8-22 are showing ORSV positive bands

**2. By ELISA**

### (i) Virus indexing of orchid samples from Shillong, Meghalaya

Seventeen orchid species under seven genera namely *Cattleya, Cymbidium cyperifolium, Paphiopedilum fairrieanum, Cymbidium devonianum, C. eburneum, C. lancifolium, Renanthera, Esmeralda cathcartii, Oncidium* from Shillong, Meghalaya were collected from local farmers and tested against CymMV, ORSV and CyRSV in DAS-ELISA test. It was found that most of the samples were virus free except *Oncidium* species which was found positive with CymMV.

### (ii) Virus indexing of orchid samples from TBGRI, Trivandrum

Twenty samples of *Dendrobium, Acampe, Coelogyne, Paphiopedilum, Vanda, Cymbidium* etc. were collected from Tropical Botanical Garden and Research Institute, Trivandrum checked for CymMV, ORSV and CyRSV in ELISA test. ELISA test revealed that all the samples were free from these viruses.

### (iii) Virus indexing of *Aranda, Mokara, Oncidium, Paphiopedilum* and *Renanthera*

50 samples including 15 *Aranda* hybrids, 12 *Mokara* hybrids, 13 *Oncidium* hybrids, 9 *Paphiopedilum* hybrids and one *Renanthera* hybrid imported from Thailand were screened against CymMV, ORSV and CyRSV. ELISA results revealed that one hybrid of *Aranda* Salaya Red, three hybrids of *Mokara* Char Juan Pink, *Mokara* Khan Pink Suan V Kultana Gold and *Mokara* Happy Beauty (B), 8 hybrids of *Oncidium* namely *Oncidium* Colm Pixie Ruth, *Oncidium* Taka, *Oncidium* Janik Rainbow Orange Red, *Oncidium* Taka Yellow, *Oncidium* Sherry Baby Sweet Fragrance (B), *Oncidium* Gower Ramsey, *Oncidium* Sweet Sugar and *Oncidium* Jairak Rainbow, Orange Spot and two species of *Paphiopedilum* namely *P. hirsutisimum* and *P. villosum* were infected with CymMV while 2 hybrids of *Oncidium* namely *Oncidium* Colm wild Cat Carmera and *Oncidium* Sherry Baby Sweet Fragrance (B) were also found positive with ORSV. CyRSV was not found in any of the samples.

### (iv) Virus indexing orchid samples from Kalimpong, West Bengal

16 samples of *Aerides, Arachnanthe, Ascocentrum, Cymbidium, Dendrobium* and *Vanda* species were collected from Hulumba Nursery, Kalimpong and checked for CymMV, CyRSV and ORSV. Only one species of *Cymbidium sikkimensis* was found infected with ORSV. Rest of the samples was free from the viruses.

### (v) Virus indexing of *Cymbidium* hybrids from Pakyong

17 samples randomly selected from polyhouse in Pakyong were checked for CymMV and ORSV from 9 samples from Vivacious Super White, 7 samples of Levis Duke Bella Vista and one sample of Burgundian Sydney were checked for ORSV and CymMV. ELISA results revealed that 6 samples of Vivacious Super White and two samples of Levis Duke Bella Vista were infected with CymMV while 6 samples of Levis Duke Bella Vista and 2 samples of Vivacious Super White were found infected with ORSV.

### (vi) Virus indexing of *Cymbidium* hybrids from Yangang

30 samples of *Cymbidium* hybrids Margret Thatcher and Levis Duke Bella Vista were checked for CymMV and ORSV in DAS ELISA test from

Yangang South Sikkim. It was found that 24 samples were detected positive with ORSV and 19 samples were positive with CymMV.

### Survey on pests associated with orchids- host range

The qualitative and quantitative surveys for pest infestation along with its host range on orchids have been made at Pakyong, Kartok, Raigoan, Dikling, Assamlinzey, Rumtek (HCCD Department), Somaria, Jorethang (West Sikkim), Mirik, Darjeeling and Kalimpong (WB). Three species of scale insects (ti-scale, *Pinnaspis buxi*; soft brown scale, *Chrysomphalus aonidum* and boisduval scale, *Diaspis boisduvali*) were reported to infest on *Cymbidium aloifolium, Cymbidium pendulum, Cymbidium devonianum, Cymbidium lancifolium* and many *Cymbidium* hybrids.

### Relative efficacy of seven IPM Modules against mite infesting *Cymbidium* 'H C Aurora'

Seven IPM modules were tested against two spotted spider mite, *Tatranychus urticae* under polyhouse condition. The seven IPM modules (M1-Sanitation + econeem 3000ppm 2 ml/lit. + propargite 57 EC 0.25%, M2- Garlic extract 5% + ethion 50 EC 0.05% +sanitation, M3- Chilaune leaf extract 10% + neem guard 2.5ml/lit. + profenophos 50EC 1.5ml/lit, M4- Dhatura leaf extract 10% + NSKE (achook) 1500ppm 5ml/lit. + mycomite 3 g/lit, M5- Tobacco extract 5% + neem oil 0.03EC 5ml/lit. + bifenthrin 10 EC 0.25%, M6- Titapat extract 10% + forced water treatment + imidacloprid 17.8 SL 0.003% and M7- control) were applied at ten days interval from the emergence of pest. Results showed that all the modules were found significantly superior over control. The maximum percent reduction (100%) in mite population was recorded in M5 followed by M1 and M6 reduced 98.00% and 95.22% respectively.

### Evaluation of IPM modules against aphid infesting *Cymbidium*

Seven IPM modules were tested against aphid, *Macrosiphum luteum* in *Cymbidium* under polyhouse condition. The seven IPM modules (M1-Sanitation + neem guard 2.5ml/lit. + propargite 57 EC 0.25%, M2- sanitation + Garlic extract 5% + ethion 50 EC 0.05%, M3- Tobacco extract 5% + econeem 3000ppm 2 ml/lit. + imidacloprid 17.8 SL 0.003%, M4- Dhatura leaf extract 10% + NSKE (achook) 1500ppm 5ml/lit. + profenophos 50EC 1.5ml/lit, M5- Chilaune leaf extract 10% + neem oil 0.03EC 5ml/lit. + cow urine 50%, M6- Titapat extract 10% + forced water treatment + bifenthrin 10 EC 0.25%, and M7- control) were applied at ten days interval from the emergence of aphid. The results showed that all the modules were found significantly superior over control. Among seven IPM modules, M-3 (Tobacco extract 5% + econeem 3000ppm 2 ml/lit. + imidacloprid 17.8 SL 0.003%) was most effective in reducing aphid population (94.33 %).

## INSTITUTIONAL ACTIVITIES

Independence Day Celebration

Celebration of Hindi Saptah
(14 – 20th September, 2011)

12th RAC meeting of the Institute

The 12th RAC (Research Advisory Committee) Meeting of NRC Orchids convened on 14th and 15th October 2011 at the Conference Hall under the Chairmanship of Prof. D.P. Ray, Vice Chancellor, OUAT, Bhubaneswar. Other members present were Dr. Umesh Srivastava, Member, ADG (Hort. II), ICAR, New Delhi; Prof. S. P. Vij, Member, Ex Head Deptt. of Botany, Punjab University, Chandigarh; Dr. S. N. Sinha, Member, Ex Head, IARI Regional Station, Karnal; Prof. S. K. Mitra, Member, Faculty of Horticulture, BCKV, Mohanpur; Dr. R. C. Srivastava, Member, Joint Director, BSI, Kolkata; Dr. R. P. Medhi, Member, Director, NRCO, Pakyong; Dr. J.G. Varshney, Member IMC, Joint Director ICAR Res. Complex for NEH region, Sikkim Centre; Mr. P.T. Bhutia, Representative, IMC Nominee, State Dept. of Horticulture and Cash Crops, Govt. of Sikkim and Mr. Nirmal Yonzon, Progressive Orchid Grower, Pakyong, E. Sikkim. Dr. D. Barman, Pr. Scientist (Hort.) and member secretary of the meeting invited all the esteemed members of the RAC. The Director, NRC for Orchids formally welcomed the Chairman and other members of of RAC. All the Scientists of the Institute also made their presentation of research activities in the meeting.


Vigilance Week
(31st Oct. – 5th November, 2011)

National Integration Week Celebration
(19 – 25th November, 2011)

The 10th Institute Research Committee meeting of NRC for orchids, Pakyong, Sikkim-737 106 was held on 30th December, 2011 under the Chairmanship

of Director, Dr. R. P. Medhi at the Conference Hall of the Institute. Other members present at the meeting were Prof. S.P. Vij, FNASc., FPAS, FLS, Scientist Emeritus, Punjab University, Chandigarh; Prof. G.S. Yanzon, Chairman & Director, Darjeeling Society of Education Research and Development, Darjeeling; Dr. Saroj Toppo, Representative, ICAR Research Complex for NEH Region, Tadong, Sikkim and Shri. Deo kumar Rai as farmer's representative. Dr. L. C. De, Principal Scientist (Hort.) was the Member Secretary, for the meeting. In addition to the above, all the scientists of the Institute made their presentation of research activities during the meeting.

## Participation of Scientists in Conference, Meetings, Workshop, Symposia, Seminar etc in India and Abroad

NBPGR- NAGs workshop at NBPGR, New Delhi from 29 - 30th July, 2011.

S. Chakrabarti

Agribusiness Campaign at NIRJAFT, Kolkata from 11-12th August, 2011.

S. Chakrabarti

Scientific Advisory Committee (SAC) meeting of Krishi Vigyan Kendra (ICAR) at Ranipool, East Sikkim on 19th August, 2011.

R. P. Medhi

Final Seating of Orchid Task Force for DUS Testing on Orchids for Finalization of Test Guide lines in *Cymbidium*, *Dendrobium* and *Vanda* orchids at PPV&FRA, NASC Complex, New Delhi 110012 from 29 - 30th August, 2011.

L.C. De

Joint Research Co-ordination Committee meeting for NEH Region at ICAR, RC for NEH Region, Barapani, Meghalaya on 7th October, 2011.

R. P. Medhi

64th Annual Meeting of Indian Phytopathological Society and National Symposium on Biology of Infection, immunity and disease control in pathogen – plant interaction, held at Department of Plant Sciences, School of Life Sciences, University of Hyderabad from 2 - 4th December, 2011.

R. P. Pant

Two day work shop under International Union of Microbiological Societies (IUMS) National committee, Indian National Science Academy (INSA) and Indian Agricultural Research Institute at INSA office at Bahadurshah Jafar Marg, New Delhi from 7-8th December, 2011.

R. P. Pant

Borer meet at Bangalore on 9th December, 2011.

R. P. Medhi

Review meeting of progress at NIRJAFT, Kolkata from 16-17th December, 2011.

S. Chakrabarti

National Conference on 'Orchids in India: Diversity, Characterization and Resource Development for Community Livelihood & Orchid Show'. Organized by TOSI at NASI, Allahabad from 21- 23rd December, 2011. Production of orchids under captivity. (*Invited Lecture*).

R. P. Medhi, D. Barman, L. C. De and R. P. Pant

## Education and Training

Twenty One days winter school on "Molecular Mechanisms Involved in Conferring Abiotic Stress Tolerance to the Biological Control agents *Chrysoperla, Trichogramma, Trichoderma* and Pseudomonas" at NBAII, Bangalore form 01-21st December, 2011.

N. K. Meena

International training course on *In-vitro* and cryopreservation techniques for conservation of plant genetic resources organized by NBPGR (ICAR) – Biodiversity international Centre of Excellence at NBPGR, New Delhi from 14-26th Nov., 2011

Rampal

## Publications

### Book Chapters

1. Meena., N. K., and R. P. Medhi. 2011. Non-Chemical Pest Management in Cultivation of Important Flowers in Himalayan Sikkim. *Eco-Safe Management of Diversified Pest Problems*. Aavishkar Publishers, Distributers, Jaipur. pp. 29 – 47.

2. Pant., R. P., Smita, Gupta and R. P. Medhi. 2011. Important Diseases of Orchids and their Management. In: *Plant Health Management.* P.1-15. (Eds). P. C. Trivedi, *Agrobios* (India), Jodhpur, India.

### Research Papers:

1. Barman., D., R.P. Medhi, Utpala Parthasarathy, K.Jayarajan and V.A. Parthasarathy. 2011. Geospatial approach to Diversity of *Cymbidium* Swartz in Sikkim. *The MIOS Journal* 12 (10): 8-16.

2. Meena., N.K., V.S. Nagrare and R.P. Medhi 2011. Thrips, *Dichromothrips nakahari* Mound (Thysanoptera: Thripidae) infesting the orchids in India- A new report. *Indian J. of Horticulture,* **68(4)**: 587-588.

3. Meena., N. K. and R. P. Medhi. 2011. Bioefficacy of botanicals and biopesticides in management of shoot borer, *Peridaedala* sp. (Lepidoptera: Tortricidae) on *Epidendrum* sp. under polyhouse conditions. *Pestology*, **Vol. 35 (5)**: 47-51.

4. Naik, S.K.,R. Devdas,, T. Usha Bharathi D. Barman and R.P. Medhi. 2011. Changes in nutrient content and iron deficiency in growing media of *Cymbidium* hybrid' Pine Clash Moon Venus'. *Indian J. Agric. Sci.* **81(8)**: 764-6.

5. Ram Pal, M. Dayamma and R. P.Medhi. 2011. A new variety of *Pleione humilis* (Orchidaceae) from Darjeeling district of West Bengal India. *J. Orchid Soc. India.* **25(1-2)**: 73-75

6. Ram Pal and R. P. Medhi. 2011. Variability in the germplasm of *Cymbidium elegans* Lindl. Orchid collected from Darjeeling district of West Bengal, *Indian Journal of Forest.* **34**: 177-180

7. Ram Pal, R. P. Medhi and N. K Meena. 2011. Bottlenecks in commercializing *Cymbidium* orchids in Darjeeling. *Indian Res. J. Ext. Edu*. **11(3)**: 49-53

## Popular articles

1. Chakrabarti., Syamali. 2011. Trade and Marketing of *Cymbidium* Orchids - Present Status and Future Prospects. *Farmer's Digest*. **44(7)**: 30-32.

2. Chakrabarti., Syamali. 2011. Edible Orchids. *Farmer's Digest.* October .**44(10)**: 7-9.

3. Chakrabarti., Syamali. 2011. Indoor Culture of Zygopetalum Orchids. *Farmer's Digest.*November.**44(11)** : 38-40.

4. Chakrabarti, Syamali. and R. P. Medhi. 2011. Orchids as source of medicine. *Indian Biologist*. Special Volume.: 142-147.

5. De., L.C., and R.P. Medhi. 2011. Orchid-Nature's Gift for Value Addition. *Indian Farmer's Digest.* **44(10)**: 24-26.

## Bulletin

1. Rao. A.N., P.K. Rajeevan, S.K. Sood, L.C. De, and G.S. Rawat. 2011. *Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability on Orchid Cymbidium spp.* Protection of Plant Varieties and Farmers Rights Authority, NASC Complex, New Delhi.

2. Rao. A.N., P.K. Rajeevan, S.K. Sood, L.C. De, and G.S. Rawat. 2011. *Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability on Orchid Dendrobium spp.* Protection of Plant Varieties and Farmers Rights Authority, NASC Complex, New Delhi.

3. Rao. A.N., P.K. Rajeevan, S.K. Sood, L.C. De, and G.S. Rawat. 2011. *Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability on Orchid Vanda spp.* Protection of Plant Varieties and Farmers Rights Authority, NASC Complex, New Delhi.

## Paper presented in Seminars/Symposia

1. De., L. C., A.N. Rao, P.K. Rajeevan, G.S. Rawat, S.K. Sood. Geetamani Chhetri and Manoj Srivastava. 2011. Characterization of commercial orchid species using DUS test guide lines. In: *Proceeding of National Conference on Orchids in India: Diversity, characterization and resource development for community livelihood & orchid show* from 21-23rd December, 2011 at NASI, Allahabad.

2. De., L.C., Geetamani Chhetri and R.P. Medhi. 2011. Orchid- an wonderful crop for diversification. In: *Proceeding of National Conference on Orchids in India: Diversity, characterization and resource development for community livelihood & orchid show* from 21-23rd December, 2011 at NASI, Allahabad.

3. Medhi., R. P., and Ram Pal 2011. Development of orchid-based micro enterprises for conservation and income generation. In: *National Conference on Orchids in India: diversity, characterization, and resource development for community livelihood & orchid show* from 21-23rd Dec. 2011 at NASI, Allahabad.

4. Meena., N. K., R. P. Medhi and S. P. Vij. 2011. Pests associated with *Cymbidium* orchids and their management. In: *National Seminar on Orchids in India: Diversity, Characterization and Resource Development for Community*

*Livelihood & Orchid Show* from 21-23rd December, 2011 at NASI, Allahabad.

5. Pant., R. P., Smita Gupta and R. P. Medhi, 2011. Orchid diseases and management under captivity. In: *National Conference on Orchids in India: Diversity, Characterization and Resource Development for Community Livelihood, and orchid Show* from 18-21st December, 2011 at NASI, Allahabad.

6. Pant., R. P., Anupam, Varma and R .P. Medhi, 2011. Status of orchid viruses and their management strategies. In: *INSA-IARI Meeting* from 7-8th December, 2011 at Indian National Science Academy, New Delhi.

7. Ram Pal and R. P. Medhi 2011. Need for adopting complementary conservation strategies for orchid germplasm management in India In: *National Conference on Orchids in India: diversity, characterization, and resource development for community livelihood & orchid show* from 21-23rd December, 2011 at NASI, Allahabad.

### Awards/Rewards/Recognition/Bodies acquired during the year

1. Paper entitled *Occurrence of Cymbidium mosaic and Odontoglossum ringspot viruses in orchid germplasm of Sikkim and Darjeeling hills, their identification and diagnosis* authored by Pant., R. P., Mrinal Das, K. B. Pun, P. Ramachandran and R. P. Medhi. In: *Indian Phytopathology Vol. 63 (3): 2010, 326-332 pp.* awarded Prof. M. J. Narashimhan Medal Award Certificate for best paper published in Indian Phytopathology on 4th December, 2011 at University of Hyderabad during 64th Annual Conference of the Indian Phytopathological society.

2. Paper entitled *Commercialization of Cymbidiums: NRCO turning dreams into reality* authored by Dayamma., M., Ram Pal and R. P. Medhi 2011. Awarded best poster presentation In: *National Conference on Orchids in India: diversity, characterization, and resource development for community livelihood & orchid show* from 21-23rd December, 2011 at NASI, Allahabad.

## Appointments

### Scientific

- Shri. N. Sailo joined as Scientist (Plant Physiology) on 5th September, 2011
- Dr. M. Chakraborti transferred from IGFRI, Jhansi and joined this Centre as Scientist (Plant Breeding) on 21st November, 2011.

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