

NAL hands over two *HANSA-3* Aircraft to Madras Flying Club, Chennai

Two *HANSA-3* aircraft (Reg. Nos. VT-HOC and VT-HNZ) were handed over to DGCA by Dr A. R. Upadhya, Director, National Aerospace Laboratories (NAL), Bangalore, for allotment to the Madras Flying Club, on 6 February 2008.

Capt. Sebastian T. Joseph, Honorary Secretary of the Madras Flying Club, received the aircraft on behalf of the Club, from Shri D.N. Lahon, Director, AED, DGCA, at a function held at C-CADD.



HANSA-3 VT-HOC

The event began with a welcome address by Head, C-CADD, followed by Director's remarks and subsequently handing over the aircraft documents and keys to DGCA. Following this, the Director (AED), DGCA, Bangalore, formally handed over the two aircrafts to Madras Flying Club.

Capt. Joseph expressed his happiness to receive these airplanes and mentioned that around 200 students are eagerly waiting in the flying school to fly this machine.

Dr H.N.V. Dutt, Jt. Head, C-CADD; AVM (Retd.) A.S. Lamba, Test Pilot *HANSA*; Capt. Santhosh Babu, Jet Airways; Shri Rajashekar, Dy. Director, DGCA (AED); Dr Ranjan Moodhithaya, Head, KTMD; Shri E. Nagarajan, COFA; Dr K. Yegna Narayan, Scientists and Engineers from NAL and ADES were also present on the occasion.



Agreement signed between NAL and Coral Digital Technologies Pvt. Ltd, Bangalore

The National Aerospace Laboratories (NAL), Bangalore, signed an agreement with Coral Digital Technologies Pvt. Ltd, Bangalore, for collaborative development of Un-inhabited Aerial Vehicle (UAV) Autopilot System on 30 January 2008. Collaborative development of UAV autopilot requires CORAL to integrate Microelectromechanical system (MEMS) based accelerometers, rate gyros, global positioning sensor and air data sensors including angle of attack sensor with a processor board capable of hosting the UAV control laws and embed the onboard software developed jointly by NAL and CORAL. CORAL will manufacture and provide the UAV autopilot with onboard navigation software in India and abroad with support from NAL.

New Projects undertaken by CLRI

New projects undertaken by the Central Leather Research Institute (CLRI), Chennai, during October-December 2007 include:

CONSULTANCY PROJECTS

S.No.	Title	Sponsor
1	Developing Computer Aided Designs for the manufacture of footwear	M/s Phoenix International Ltd, Chennai
2.	Eco Screening of Leathers used for shoe manufacturing	M/s Sara Leather Industries, Chennai M/s Multivista Global Ltd, Chennai
3.	Preparation of DPR for establishing a Common Effluent Treatment Plant (CETP) at Muzaffarpur industrial area	Bihar Industrial Area Development Authority, Patna, Bihar
4.	Study on Bio-compatibility toxicity of silk proteins	M/s Sericare Divn. Of Health Line Pvt. Ltd, Bangalore

GRANT-IN-AID PROJECTS

S.No.	Title	Sponsor
1.	Identification and characterization of anti-angiogenic principle from amphibian skin and its implication in pathological conditions	Department of Science & Technology, New Delhi
2.	Chondrocyte culture on 3D collagen scaffold and their characterization	Department of Biotechnology, New Delhi
3.	Synthesis & physicochemical characteristics of surfactants from biosources	Department of Science & Technology, New Delhi
4.	Delivery of growth factors through a novel wound dressing for chronic wounds	Department of Biotechnology, New Delhi
5	Identification and Characterization of proteoglycans in frog skin and their implications in wound healing	Department of Biotechnology, New Delhi

National Botanical Research Institute, Lucknow

R&D Highlights: 2006-07

Pursuing R&D in the field of biodiversity, biotechnology, bioprospecting, genetic engineering, environmental botany, phytochemistry, agricultural and economic botany and bioinformatics, the National Botanical Research Institute (NBRI), Lucknow, during the year 2006-07, was engaged in 138 multi-disciplinary networked, technology leadership, in-house, sponsored, grant-in-aid and collaborative research projects and consultancy assignments. The scientists of the institute published 145 research papers in various refereed national and international journals and filed 56 patents. Eleven patents filed earlier were granted this year. Two technologies, namely, 'Trichoderma consortium technology package' and 'Commercial production of Bt cotton' were transferred for commercialization, while four MoUs were signed with various parties. The institute maintained consistent improvement in external cash flow which increased from Rs 4.79 crore in the previous year to Rs 5.67 crore in 2006-07.

NBRI is recognized in the country as pioneer in the development of indigenous technology of transgenic Bt cotton engineered for resistance to insect pests and its transfer to the seed industry. Major progress was made in crop improvement through the development of improved varieties of opium poppy, ornamentals,

refinement of protocols for tissue culture, bioprospecting and molecular taxonomy, biopesticides and biofertilizers. A high yielding multiple disease resistant/tolerant variety of opium poppy, named 'Madakini' was evolved. Two varieties of chrysanthemum christened as 'Mini queen' and 'Rangoli' were developed.

Towards bioresource conservation and utilization, significant progress was made in exploring plant diversity for valuable molecules, conservation of RET species and investigating plant and microbial resources as alternatives to chemical pesticides and fertilizers. In the area of environmental botany, a range of strategies to reduce the heavy metals from leather industry effluent were developed through screening of plant species. Fly ash tolerant bacteria were isolated from rhizospheric zone of *Typha latifolia* for developing approaches for vegetating fly ash landfills.

A brief account of area-wise R&D activities/accomplishments during 2006-07:

Plant Biodiversity & Conservation Biology

Three new species of *Astragalus*, namely *A. lachungensis* Chaudhary, *A. uttaranchalensis* Chaudhary & Khan, *A. himachalensis* Chaudhary & Rana

were described. Besides, a detailed taxonomic study on 12 endemic species of *Astragalus* of India was carried out. Critical examination of type materials established that *Astragalus zemuensis* W.W. Smith belongs to *Oxytropis* and therefore a new combination *Oxytropis zemuensis* (W.W. Smith) Chaudhary has been proposed.

Molecular diversity evaluation of 53 wild/semi-wild accessions of *Citrus indica* Tanaka (Indian Wild Orange), *C. medica* L. (Citron), *C. latipes* (Swingle) Tanaka (Khasi Papeda), including an indeterminate variant of *C. indica* (locally known as 'Memang Athur' among the Garo tribes of Meghalaya) Pathali Pahar Village in Assam and Along Valley and Tipi forests in Arunachal Pradesh revealed a low level of genetic variability in *C. indica*. *C. indica* showed maximum genetic similarity with Memang Arthur followed by *C. latipes* and *C. medica*. ISSR analysis supports that 'Memang Athur' and *C. indica* formed two closely related sister groups with very low genetic distance and sympatric distribution, whereas *C. medica* and *C. latipes* formed distinct groups diverging from *C. indica*. Molecular analysis and genetic diversity studies were carried out in *Punica granatum* L.

Palynology: Detailed pollen morphological study was pursued in 30 important indigenous medicinal plants for preparing a pollen



handbook, which will be useful for pharmacognosy and pharmaceutical industries. Comprehensive palynological study of more than 80 *Bougainvillea* cultivars has provided sufficient clues for tracing the origin of various cultivars as well as their interrelationships.

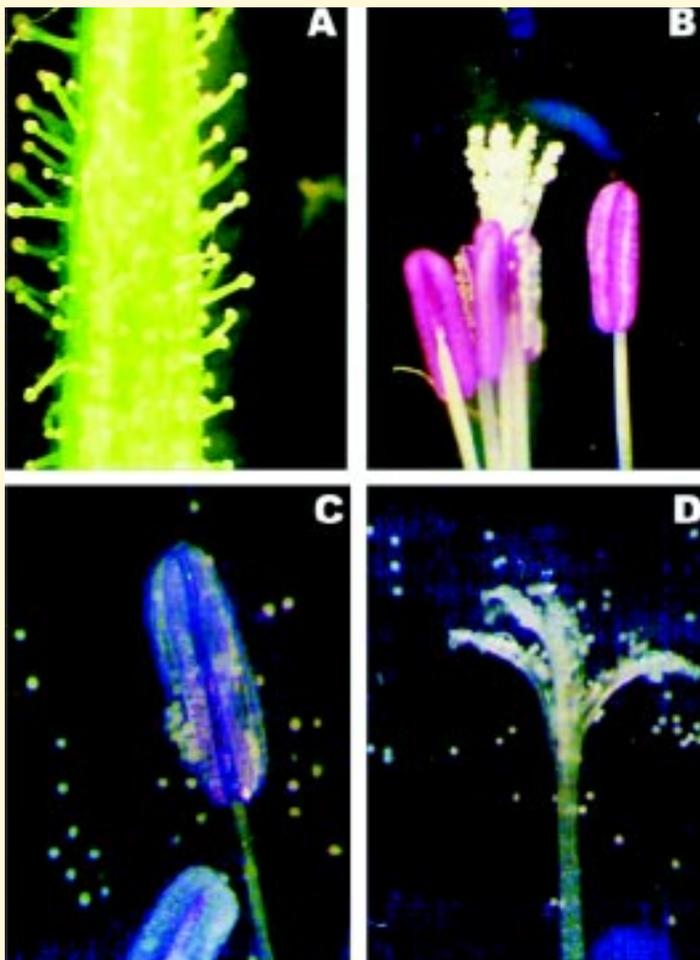
A detailed pollen calendar of Lucknow has been prepared which shows significant variability in pollen incidence and distribution as encountered in different months.

Seed Biology: Detailed studies on pollen-stigma interaction in relation to reproductive success and seed viability in *Rauvolfia serpentina* and *Plumbago zeylanica* revealed that inadequate pollen load on stigma surface results in only 10-20% pollen germination in

R. serpentina, which is one of the vital causes of empty seed set.

In *Plumbago zeylanica*, prolonged stigma receptivity resulted in adequate pollen load with 50-60% pollen germination on its surface. This is one of the significant reasons for the reproductive success of *P. zeylanica* in its natural habitat.

Lichenology: Seven new species of lichens were described and nine species were recorded as new additions to the Indian lichen flora. Lichen herbarium was



Flowering parts of *Plumbago zeylanica* L. (a rare species).
A. Glandular calyx, B. Stamens along with receptive stigma.
C. Dehiscence of anther, D. Receptive stigma with pollen load

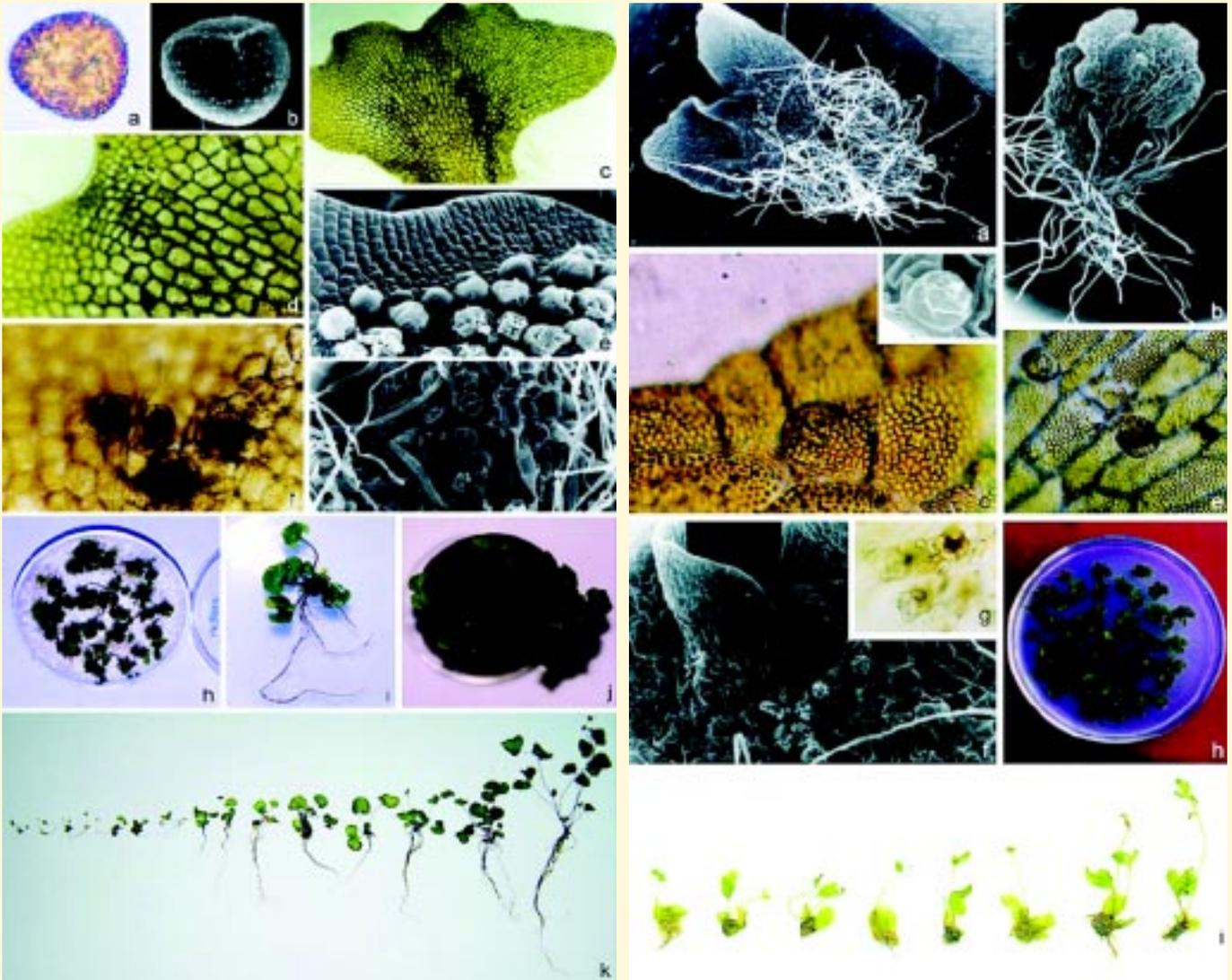
enriched with more than 1000 specimens collected from Uttarakhand, Jammu and Kashmir and Central India.

Bryology: Bryodiversity and conservation studies resulted in the identification of *Frullania udarii* Nath et Singh as a new species from Meghalaya, India. *Anthoceros angustus* Steph, *A. erectus* Kash, and *Phaeoceros laevis* spp. *laevis* Prosk were recorded as new additions from Khasi and Jaintia hills of Meghalaya. *Hyophila involuta* (Hook.) Jaeg. was recorded

as a new addition to the bryoflora of Pachmarhi Biosphere Reserve (PBR), while *Hypnum subimponen* Lesq spp. *ulophyllion* as new addition to west Himalayan bryoflora. *In vitro* propagation of *Marchantia paleacea* Bertol and *Funaria hygrometrica* Hedw was successfully carried out. The cultured plants were transferred to pots.

Pteridology: Reproductive biology of two threatened homosporous ferns, *Pellaea falcata* (R.Br) Fee and *Dicksonia antarctica* Labill was studied. Genetic diversity studies in *Pteris vittata* L, an economically important fern complex, revealed that cytological abnormalities and reproductive failures coupled with other factors were probably responsible

for the extinction of the cytotypes in their natural habitats. It was concluded that in India, only the tetraploid cytotype is abundant while diploid and hexaploid cytotypes were probably extinct. In order to study diversity within and among the cytotypes of *P. vittata*, PCR methods were employed on 23 accessions. Two pteridophytes, namely, *Selaginella bryopteris* (Sanjeevani Booti) and *Cheilanthes farinosa* (Silver fern) were introduced in the fern house of the institute.



Different development stages of *Pellaea falcata* **a-b**. A single spore under compound and scanning electron microscopes. **c**. Cordate thalloid gametophyte, **d**. A portion of the gametophyte showing notch, **e**. SEM view of gametophyte side showing archegonia at (200x) 100 mm, **f**. A portion of the gametophyte showing archegonia, **g**. SEM view of antheridia (250x) 100 mm, **h**. Sporophytes in composite culture, **i**. Single sporophyte in isolate culture, **j**. Sporophytes transferred in earthen pot, **k**. Successive developmental stages of sporophyte

Different development stages of *Dicksonia antarctica* **a**. SEM view of gametophyte showing archegonia below notch at (24x) mm, **b**. SEM view of gametophyte with frilled wings at (50x) 500 mm, **c**. Single antheridium, **d**. SEM view of an antheridium. **e**. Bursted antheridium (A= antherozoids), **f**. Gametophyte showing archegonia, **g**. A portion of gametophyte showing archegonia, **h**. Composite culture **i**. Successive developmental stages of sporophyte

Algology: Sixty eight fresh water algal taxa were enumerated from Gangtok, Sikkim (India). Twenty-nine species of genus *Cosmarium* were recorded from different localities of Sikkim Himalayas. All localities exhibited poor to scarce

growth of *Cosmarium* taxa on submerged vegetation, water splashed rocks and other substrates. *Cosmarium crenatum* Ralfs, *C. retusiformae* Z (Will) Gutz var. *elevatum* Krieg., *C. venustum* (Breb.) Arch. *C. laeve* Rab., *C.*

caelatum Ralfs var. *caelatum*, *C. furcatospermum* West & West var. *maius*, *C. pseudopyramidatum* Lund. var. *cornicolinum* Lutken, *C. raeticum* messik var. *raeticum*, *C. quadratum* Ralfs., *C. quadrifarum* Lund f. *hexastrichum* (Lund)



Nordst were the first reports from India. Ten species of *Nostoc* were recorded from Pakyong, Sikkim.

Biomass Biology, Environmental Sciences and NBRI Field Stations

Ecotoxicology and Bioremediation: The remediation strategy based on plants and Cr tolerant bacteria in combination with addition of cow dung manure and sand for microbial proliferation led to natural attenuation of Cr toxicity of tannery sludge. Thirty plant species were identified for plantation sludge dumps. Approximately 16% of the total sludge dump was vegetatively covered, following *in situ* planting techniques. Many rhizosphere colonizing bacteria, including *Azotobacter*, *Azospirillum*, *Bacillus* and *Pseudomonas*; fungi including *Penicillium*, *Sclerotinia*, *Helminthosporium*, *Aspergillus* and a few species of actinomycetes were isolated from the rhizosphere of these plants.

Cassia fistula, *Chenopodium album*, *Citronella citrates*, *Sida acuta* and *Vetiveria zizanioides* were found effective in removing heavy metals from tannery waste contaminated soil. Vegetables such as spinach (*Spinacea oleracea*) and Bathua (*Chenopodium album*), grown on tannery waste contaminated soil accumulated toxic metals above the prescribed levels and therefore, are unfit for human consumption. On the other hand aquatic plants like *Bacopa monnieri*, *Ceratophyllum demersum* and *Hydrilla verticillata* were found

suitable for phytoremediation of aquatic bodies, as significant accumulation of metals and metalloid (arsenic, cadmium and lead) was observed in them upon exposure to these metals without any significant effect on the plant growth. The gene for phytochelating synthase, responsible for the synthesis of phytochelatin, was characterized and cloned from *C. demersum* (*CdPCS1*).

Investigations were carried out to assess the impact of augmentation of fly ash tolerant bacterial strains, isolated from *Typha latifolia* growing naturally on fly ash dumps, on metal extractability. Out of the 11 bacterial strains isolated from the rhizospheric zone of *T. latifolia* and later purified in the laboratory, NBRFT2, NBRFT4, NBRFT5, NBRFT9 and NBRFT10 were found to have induced bioavailability of Fe, Zn, and Ni and immobility of Cr, Cu, Pb and Cd simulatenously. A consortium of these strains is being tested to enhance the phytoextraction of metals (Fe, Zn and Ni) by *Brassica juncea* — a metal hyperaccumulator plant.

Study on identifying lower group of plants for use as bioindicators and biomonitors of toxic metals, metal accumulation studies were undertaken on algae, lichens, bryophytes and pteridophytes in various parts of the country. The metal accumulation in various algal species vis-à-vis their seasonal occurrence showed a contrasting trend. Maximum amount of Fe was found accumulated in *Oedogonium* sp. and *Spirogyra* sp. while *Oedogonium nigra* and *Phormidium*

bohneri accumulated maximum amounts of Cr, Ni and Cu accumulation in different algae was found negligible. *Ulothrix* spp. accumulated significant amount of Ni, although its accumulation in other forms was negligible. All the major algal taxa showed appreciable amount of Zn accumulation. The results thus suggest the possibility of utilizing some promising Cr accumulator forms like, *O. nigra* and *P. bohneri* in developing pollutant specific bioindicators. Survey and collection of ferns and fern-allies growing in fly-ash contaminated areas of Thermal Power Stations at Amarkantak, Chachai, district Sahadol (MP) was carried out. Spore germination and subsequent cellular and organ level differentiation in *Pteris vittata* in the presence of various concentrations of sodium arsenate showed 100% lethality in spore germination at 250 mg/ml concentration. In lower dose (50 mg/ml) the gametophyte development was comparable to the control. Increase in the arsenic dose resulted in retarding the growth and differentiation of gametophyte.

Biomass Biology & Eco-Auditing: Investigations were carried out on metabolic profiling of different morphotypes of guggul (*Commiphora wightii*). Significant variability was observed in morphological features and chemical constituents of guggul. An improved extraction procedure was developed for optimum extraction of major metabolites. High guggulsterones yielding individuals were multiplied through macropropagation and planted for multilocational field trials. The

group also isolated and purified two new marker compounds from guggul gum resin. A protocol was standardized for supercritical fluid extraction of guggul metabolites.

Germplasm collections of *Jatropha curcas* were made from Andaman Islands, Rajasthan, Uttarakhand, Karnataka and U.P.

Genetics & Plant Breeding and Agrotechnology

Germplasm lines of opium poppy, vegetable amaranth, linseed and *Cuphea* emanating from different ecogeographical origins as well as those generated by the institute were evaluated. In opium poppy, a number of promising lines and some stable genotypes were identified for high thebaine, codeine and papaverine contents. A new high yielding multiple disease resistant/tolerant stable variety of opium poppy, named 'Madakini'

with distinct morpho-physiological traits was developed from the existing varieties. The variety characterized by significantly high opium and seed yield, also exhibits high content of morphine and other alkaloids in comparison to the existing varieties/lines. In Amarnath, a genotype AV190 showed better performance for foliage yield in comparison to other genotypes. The genotype also showed higher amount of desirable nutrients. In linseed, 72 F₁s were made through line × tester analysis and a genotype with 3% omega 3 fatty acid ($\alpha C_{18=3}$) was isolated as a donor parent for use in evolving a low linolenic acid variety. A new combined selection parameter based on score for component was made for component breeding in linseed.

Detailed karyotypic studies were carried out on 20 wild and cultivated taxa of *Chenopodium*, which belonged to three ploidy levels 2x, 4x and 6x.

Plant Microbial Interactions

Microbiology: A novel rhizosphere competent high temperature/drought tolerant *Pseudomonas putida* MTCC 5279, was isolated having very good potential for commercialization due to its ability to survive at high temperature. A synergistic mixture of a novel plant growth promoting bacteria, developed from hot desert (*Pseudomonas fluorescens* MTCC 5304) and cold desert *Pseudomonas* sp.) will be applied as seed inoculant for promoting plant growth in a wide range of agriculture, horticulture and floriculture plants. Seven bacterial strains effective against fungal isolates were identified. CHM12 strain was most potent against fast growing fungal pathogens. B5.2 though effective against fast growing fungal pathogens was not so against slow growing fungal pathogens. A formulation consisting of B5.2



Papaver somniferum variety Madakini developed by NBRI, Left: Field view of 'Madakini', Right: A single plant



showed promising results when tested on field grown rice plants under various stages of sheath blight infection caused by *Rhizoctonia solani*. Plant growth promoting *Paenibacillus lentimorbus* B-30488 (B-30488R) isolated from milk was observed as a good competitor to native microbes. It has the ability to promote the growth of monocots, dicots, C3, C4 and legume plants. The results showed that B-30488R survives well in rhizosphere of plants and has good potential as an inoculant for plant growth promotion and biologic control. *Serratia marcescens* NBRI1213 significantly induced plant-defense enzymes both locally and systemically in betelvine and is a potential useful plant growth promoting bacteria (PGPR) and biocontrol agent against *Phytophthora nicotianae*.

Molecular Biology and Genetic Engineering

Plant Molecular Biology: The Plant Molecular Biology group cloned and sequenced the gene family of sterol glucosyltransferases (SGT) in *Withania somnifera*. One of the genes from the family was expressed in *E. coli*. Functional characterization of this gene suggested its role in biotic and abiotic stresses. Isoenzymes of SGT were purified from membrane and cytosolic fraction of *W. somnifera* leaves. Characterization of these enzymes revealed their roles in various biotic, abiotic stresses and secondary transformation of sterols.

Transgenic tobacco plants expressing rabies glycoprotein

(RGP) were analyzed by southern blotting. Partial purification of RGP and glycoprotein analysis was performed in transgenic tobacco plants. Pentamerized cholera toxin B subunit (CTxB) was affinity purified from transgenic tobacco plants and glycosylation analysis was done. Groundnut plants were transformed with CTxB-RGP fusion gene. The full length RGP and Ctx-RGP genes were cloned in PVX-virus vector.

Gene Expression: In an effort to understand the role of ethylene responsive transcription factors in tomato fruit ripening and stress responses, transgenic tobacco and *Arabidopsis* plants over expressing one of the drought and cold responsive Ethylene Response Factors (ERFs) were developed. A new ERF designated as NTf16 was identified. It encodes a protein of 314 amino acids. An increment of almost ten days in the shelf life of transgenic tomato carrying an antisense gene of ACC oxidase from banana has been confirmed with second generation of the transgenic tomato variety. Same construct has been introduced in banana in order to achieve transgenics with longer shelf life.

Molecular Virology: Molecular characterization of *Tomato Aspermy Virus* strain infecting chrysanthemum cultivars and three strains of *Cucumber Mosaic Virus* infecting chrysanthemum, tomato and banana was done. ELISA based diagnostics of these virus strains were developed for indexing the cultivars of chrysanthemum, tomato and banana. Utilizing coat protein gene of *Cucumber Mosaic Virus*

transgenic tomato plants were developed and evaluated for the presence and expression of transgene.

For molecular identification of *Banana Bunchy Top Virus* affecting banana cultivation in India, cloning and sequencing of complete DNA-1 component, coat protein and movement protein genes were carried out. Two new CMV strains (from *Rauvolfia serpentina* and *Cymbopogon citrate*); five new begomovirus isolates (from soybean, chilli, Bemli jute and *Dimorphotheca*) and five new phytoplasma isolate (from chilli, pigeon pea, desert rose, sesame and chrysanthemum) were recorded for the first time from India. The *Bean Yellow Mosaic Virus* (BYMV) which causes disease in Gladiolus was characterized at molecular level.

Pharmacognosy and Ethnopharmacology

Pharmacognosy and Ethnopharmacology: Detailed pharmacognostic evaluation of *Curcuma aeruginosa* Roxb, rhizome was carried out. A rapid, accurate and robust method was developed for the separation and identification of fifteen phenols belonging to six different types of phenolics, which could be used in the quality control and standardization of herbal drugs including compound herbal formulations. Antimicrobial activity of some Indian medicinal plants was carried out against some gastrointestinal (GI) pathogens. *Emblica officinalis* extract was found most active against all tested GI pathogens as compared to other

plant extracts. *Enterobacter aerogenes* was most sensitive among all the strains tested against all selected plant extracts.

Under the scheme for validation of traditional Ayurvedic drugs and development of new drugs, 37 crude samples were authenticated on the basis of macro and microscopic characters. Pharmacognostic studies of dried rhizome/ roots have been performed to develop quality control parameters for Kava. The "Laghu Panchmool" of 'Dashmoola'-an important Ayurvedic formulation, has been chemically investigated and some chemical markers have been isolated and standardized using HPTLC. Some therapeutically important chemical markers have been identified and isolated from *Aegle marmelos*, *Premna integrifolia*, *Stereospermum suaveolens*, *Gmelina arborea* and *Oroxylum indicum*. These markers have been used for the standardization of the root drugs.

Phytochemistry

Further improvement was achieved in the development of black hair dye in terms of its texture and luster by the use of natural binder for consumer feasibility and acceptability. The dye is a blend of natural herbs (as colourants), natural minerals (as mordants) and natural gum (as binders). In order to reduce application and effective time to 1 h, a pretreatment formulation was developed. Some natural dyes, rich in tannins and naphthaquinones, were isolated from *Punica granatum*, *Wendlandia tinctoria* and many other common

natural dyes, which possess promising anti-microbial activity.

Plant Biotechnology and Plant Physiology

Plant Tissue Culture: To develop a protocol for rapid multiplication of plants of desirable clones of *Jatropha curcas* through plant tissue culture, bud-break was induced in nodal stem segments of field grown plants of 18 important accessions. However, severe problem of contamination in the explants was encountered. Initial use of a broad-spectrum biocide/fungicide in the nutrient medium was found useful in raising infection-free cultures to some extent in 12 accessions, but the regenerated shoots on subculture again showed infection, which was detrimental for their survival.

An *in vitro* process of germplasm preservation of *Azadirachta indica* through regenerative excised root culture was developed.

Ex vitro hardening of *in vitro*-raised plantlets of *Mangifera indica* var. Romani was facilitated with the application of three strains (R4, Fx & 796) of *Trichoderma* sp. *In vitro* processes for rapid multiplication of two important RET plants namely, *Uraria picta* (a rare and endemic leguminous herb) and *Clerodendrum serratum* (an endangered shrub) were developed for germplasm preservation.

Plant Metabolism and Biochemistry: Oxidative stress *in vitro* studies on *Phaseolus mungo* and *Triticum aestivum* seedlings revealed that H₂O₂ acts as a signaling molecule only at lower concentrations. However, H₂O₂

treatment in combination with heavy metal, like Cd⁺⁺ resulted in complete inhibition of growth and germination.

Lower concentrations of weed extracts when combined with sugar industry waste, such as press mud and biocompost, enhanced the growth and yield of crop plants.

Plant Physiology: In order to develop protocols for screening *Jatropha curcas* accessions for drought tolerance, *J. curcas* germplasm garden was developed. A total of 140 accessions were available for physiological and silvicultural studies. Photosynthetic rate and water use efficiency measured in various accessions of *J. curcas*, indicates considerable variation in both the parameters.

Betelvine Biotechnology: The group studied the differential response of *Piper betle* landraces to Abscisic acid (ABA). Chlorophyllase transcript accumulation in response to ABA was quicker in Kapoori Vellaikodi than Khasi Shillong. *Piper betle* showed immunomodulatory activity.

Floriculture Botanic Garden And Eco-education

Floriculture: Two new varieties of chrysanthemum, i.e. 'Mini Queen' and 'Rangoli' were developed from open pollinated seedling selections on the basis of their performance.

Botanic Garden: A species namely, *Clerodendrum speciosissimum* Van Geert from Wilhelma Botanic Garden, Stuttgart, Germany was introduced in the Botanic Garden. This species is native to the mountains of Java



New introduction: *Clerodendrum speciosissimum* Van Geert



and Sri Lanka. The most striking feature of this taxon is that it remains in bloom during most part of the year except winters. Plant wealth of botanic garden was further enriched with the introduction of *Heliconia* sp., *Crinum* sp., *Narcissus* sp. (Yellow Flowered), insectivorous plants (*Nypenthes khasiana*, *N. ventricosa*, *Drosera burmanni*), *Beaumontia grandiflora* and *Bougainvillea* cv 'B.T Red'.

New chrysanthemum varieties developed by NBRI
(Left top: Rangoli & Left: Mini queen)

Science in Music

Nayudamma Memorial Lecture by Dr T. Ramasami

Prof. Y. Nayudamma was Director, Central Leather Research Institute (CLRI), Chennai, during 1958-71 and later Director General, CSIR, till 1977. In recognition of his valuable contributions to the all round development of CLRI, the institute has been organizing Nayudamma Science Foundation (NSF) Lecture every year. After his demise in 1985, the NSF Lecture was named as 'Nayudamma Memorial Lecture'. This lecture in 2007 was organized

by CLRI in association with Nayudamma Memorial Science Foundation, Chennai and Nayudamma Science Foundation on 23 December 2007. The lecture was delivered by Dr T. Ramasami, former Director of CLRI and presently Secretary, Department of Science & Technology, New Delhi on the topic 'Science in Music'.

During his lecture Dr Ramasami analyzed systematically the Science in manufacturing the musical instruments like violin and

mirudangam. While talking about violin, he highlighted the role played by the quality of wood in determining the timbre and tonal quality of the instrument. The superior quality of violins of yester years and the inability to reproduce such quality in recent times was mostly attributed to the changing climatic conditions and their impact on quality of available wood.

He talked about a collaborative project undertaken by CLRI with the *mirudangam* Maestro Shri

Umayalpuram K. Sivaraman. The use of specific parchment leathers for specific purposes in the manufacturing of *mirudangam* was highlighted on the basis of their structure and physical properties. The role played by the cow and the goat parchments as annular rings on the *mirudangam* in enhancing the tonal qualities of the instrument was explained. The chemical composition of the minerals used for the black patch and the source of such minerals from the Ganges or Cauvery river banks was analyzed. He also spoke on standardization of the *mirudangam* to reflect the mood of the artist and the ambience of the hall. The possibility of designing a travel-friendly *mirudangam* that can be dismantled and re-assembled also formed part of this research project. Speaking about Prof. Nayudamma who was his mentor and a teacher, Dr Ramasami said "He had the ability to make extraordinary personalities emerge from ordinary people".

Dr V.L. Dutt, Chairman, KCP Ltd, Chennai and also the Chairman, Nayudamma Memorial Science Foundation, Chennai, presided over the function and spoke about the various activities of NMS Foundation. Dr A.B. Mandal, Acting Director, CLRI, welcomed the participants and briefly spoke about the contributions of Prof. Nayudamma during his tenure as Director, CLRI. Shri D. Chandramouli, Scientist G, proposed a vote of thanks.

CSIR Programme on Youth for Leadership in Science at CECRI, IITR, NCL, and NEERI

Launched in 1999, the CSIR Programme on Youth for Leadership in Science (CPYLS) aims at encouraging the meritorious students of class X from CBSE, ICSE and other Boards to pursue science as a career. The programme is intended to help build a scientific temper at an early stage.

Presented here are highlights of the CPYLS held at Central Electrochemical Research Institute (CECRI), Karaikudi, Indian Institute of Toxicology Research IITR. [erstwhile Industrial Toxicology Research Centre (ITRC)], and National Environmental Engineering Research Institute (NEERI), Nagpur; and National Chemical Laboratory (NCL), Pune.

Central Electrochemical Research Institute (CECRI), Karaikudi

Held on 26-28 December 2007, the CPYLS at CECRI was inaugurated by Dr P. Ramasamy, Vice-Chancellor, Alagappa University. Dr Ramasamy delivered the keynote address in which he stressed the need and advised the participants for choosing science as a career. He presented educational kit consisting of science books, viz., *Learning Science* (4 volumes), *Understanding Chemistry*, by Dr C. N. R. Rao and *Chemistry of Candle* by Michael Faraday to all the students as a token of appreciation for securing top positions in SSLC examinations. Prof. A. K. Shukla, Director, CECRI, presided over the function. Shri S. John, Deputy Director, welcomed the participants. Shri C. Sri Vidya Rajagopalan, Deputy Director, spoke about CPYLS. The inaugural function was followed by a video presentation on "Renewable Energy and the Power of the Sun". by the CECRI Director.

A workshop on "Quality Leadership for Academic Excellence" was conducted by Prof. N. Janaki Raman and a Science Quiz was conducted by Prof. M.A. Durai. A series of popular science lectures and video films on "Fuel Cells" highlighting fuel cell research in India and CECRI, demonstration and practicals on the various sophisticated analytical instruments formed other important components of the two-day programme. A magic show on "Science/Truth behind Magics" was also arranged on the occasion. Also conducted was a programme "Students Meet Scientists".

All the students actively participated in the group discussions. In the feedback session, the students and teachers pointed out that the programme was very useful for them and all the lectures were thought provoking. Parents, teachers and students expressed their whole-hearted thanks and appreciated this CPYLS Programme.

In the valedictory function, Professor A.K. Shukla distributed certificates to the students and delivered the valedictory address.



Indian Institute of Toxicology Research (IITR) [[erstwhile Industrial Toxicology Research Centre (ITRC)]]

Eighteen meritorious students from different parts of Uttar Pradesh attended the programme at IITR held on 29-30 January 2008. Several scientific programmes were organized during the two-day event. Dr Rishi Shankar, Scientist, IITR, delivered a talk on “Microbes: Friends or Foes”.

Prof. Sushil Kumar from Indian Institute of Management, Lucknow, delivered an invited talk. Dr Ashwani Kumar, Director, IITR, welcomed the guests and also gave a brief introduction of the speaker. Prof. Sushil Kumar during his lecture interacted freely with students. First he talked of management. Stating that “Management is nothing but application of common sense”, he discussed, “How principles of management are applied in life?” During his interactive session, he discussed: What is science and technology? What is the difference between science and arts? He said there is a need of creative thinking



Dr Ashwani Kumar, Director, IITR, with participants

in its holistic approach. He advised students to keep their curiosity alive. With the help of examples he described that there is a scientific theory behind religious beliefs. He said that at present students are lucky that they get an opportunity to take an informed decision. They should develop a scientific

temperament and always select a profession that matches with their interest. He asked a question: Why India is still a developing country? And opined “the reasons behind this are that we do not know the proper utilization of technology and are poor human resource manager.”

National Environmental Engineering Research Institute (NEERI), Nagpur

The CPYLS at NEERI was held on 3-4 January 2008. Fifty-five meritorious students of Vidharba and its nearby region attended. Dr Sukumar Devotta, the then Director, NEERI, welcomed the students and their parents. He spoke about the importance of CSIR and its 38 laboratories spread all over the country. He also talked about NEERI and explained how its

activities in the field of air environment, water environment, land and biological environment are vital for the nation and society. Dr Devotta explained that CSIR is conducting research right from space to deep oceans. He pointed out that India has the largest young population in the world and urged the students to adopt science as a passion. NEERI and CSIR will

provide the best possible facility for facilitating inventions and innovations, he added.

A series of popular science lectures on Environmental Biotechnology, Water Pollution, Air Pollution, Materials for Environment Protection, Environmental Genomics, Solid Waste Management, Analytical Instrumentation, Green House



Clockwise from top left: Dr C.V.C. Rao delivering the lecture on Air Pollution, CPYLS students at a NEERI Laboratory and watching a practical demonstration

Gases and Global Warming, Mathematical Modeling and Wastewater Treatment were delivered by the scientists during the two-day programme. Students were taken round the Permanent Exhibition of the institute and also

significant activities related to environmental science and engineering. During the programme, students expressed their curiosity by interacting and asking many scientific questions. Audio-visuals on science were also arranged.

the various laboratories of NEERI. They were shown practical demonstrations on various

At the concluding function, Dr S.R. Wate, Deputy Director and Head, EIRA Division, NEERI, spoke on the importance of this programme. The students expressed satisfaction and were grateful for the opportunity given to them by NEERI and CSIR for attending this programme. Dr Wate gave away certificates to the students. Dr S.P. Pande, Scientist and Head, R&D Planning Unit, coordinated the programme.

National Chemical Laboratory (NCL), Pune

The CPYLS at NCL was attended by 160 students along with their parents/teachers. Shri S. B. Katte, event coordinator, welcomed the audience and gave examples of eminent scientists from NCL and elsewhere that excelled in their fields.

Dr Ganesh Pandey, Head of Organic Chemistry Division, welcomed the audience and introduced Prof. K. N. Ganesh,

Director, Indian Institute of Science Education and Research (IISER).

Prof. Ganesh delivered the inaugural address titled 'Science is Important'. He discussed as to 'why science is exciting' and 'why one should pursue a career in science'. The most important element that nucleates the society is the role of teachers and education. The past was without technology. The future holds challenges to attain energy,

water, food and environment security, removal of poverty, terrorism and diseases, and ushering in knowledge. Therefore, education needs to be focused. Giving statistics on population, diseases and income, Prof. Ganesh highlighted the condition in India. He stated that none of the Indian universities is listed in the first 500 globally. American, British and other western universities attract a large



number of students from India because of their reputation and quality of education.

Prof. Ganesh further said that approximately 50% of our children go to school, 30% reach standard X and of these 40% pass X. Only 6% of these go into higher education. The challenge lies in providing greater opportunities to our children to attend colleges and universities. Out of the 200,000 students who enter college, approximately 60,000 are trained in science and technology. About 3,50,000 standard XII students appear in various aptitude tests and about 4,000 are absorbed in IITs. India produces around 5,000 Ph.Ds in comparison to 16,000 Ph.Ds produced in China and 25,000 in United States. Ph.D degree holders in our country are unutilized or underutilized owing to lack of job opportunities. Many of the universities have become mere examination conducting centers. Modernisation and revision of courses is the need of the hour.

Prof. Ganesh, stated that a divide exists between teachers who are responsible to educating students at the university level and

the scientists who perform research either in universities or institutions. Those who teach are generally less involved in research and those who do research are not involved in teaching. He elaborated on how IISER has initiated the process where students learn while experimenting and experiment while learning. The challenge lies in motivating committed people to enter science. Education system in India is also getting competitive. Educational institutions must, therefore, learn to excel in a competitive environment.

Describing the objectives of creating IISER, Prof. Ganesh pointed to the importance of problem solving, workshop practices, experimental work and good communication skills. Areas like earth, planetary and atmospheric sciences, etc. have to be taught along with compulsory science subjects and vocational projects. Prof. Ganesh opined that students should be evaluated based on their practical and problem solving stages rather than merely excelling in examinations. Flexible system for evaluation of the students

Corrigendum

The research work '**Identifying mechanism of antifoulant for best use**', published in *CSIR News* 57(2007) 376-77, was carried out at National Institute of Oceanography (NIO), Goa, and *not* at the Indian Institute of Chemical Technology (IICT), Hyderabad. This inadvertent error is very much regretted.

must be developed. This would help mould the students to gain a strong foundation and a deep understanding of science. Prof. Ganesh concluded by stating that IISER spells the seven E's namely, Education, Excitement, Explore, Examine, Explain, Extend and Expand, and eliminates the eighth E, which stands for Examination.

Lectures were arranged for the students in the area of chemical, physical and material sciences, biotechnology, tissue culture and career opportunities. The students interacted with scientists and also visited the laboratory facilities.



Prof. K. N. Ganesh delivering the CPYLS lecture



Students with parents and teachers attending the programme



Calendar of Training Courses at CIMAP during 2008

The Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow, will be organizing the following training/event/activities during 2008:

S.No	Training/Event/Activity	Date/Duration	Contact Person(s)
1	Hundred Days' Certificate Course on Medicinal and Aromatic Plants (100dCCC-2008)	28 Feb- 6 June	Drs A. K. Kukreja A. K. Singh (TBD)
2	Entrepreneurial Training on Essential Oil & Processing Technology (EOPT-2008)	21- 30 April	Er. Sudeep Tandon/ Dr A K Singh (Q)
3	Plant Tissue Culture and Transformation Techniques (PTCT-2008)	1-14 May	Drs A. K. Kukreja/ S. Banerjee
4	School Science Teacher Training on Integrative Scientific Approaches in Education (SSTT-2008)	19-20 May	Drs Ashok Sharma/ Rakesh Tiwari
5	CIMAP Training School on Advanced Instrumentation and Analytical Techniques for Natural Products (AIAT)	9-22 June	Ers. Anil Kumar / P. V. Ajai Kumar
6	CIMAP Summer Training on Techniques and Tools of Biotechnology and Bioinformatics (CST-2008)	23 June- 22 July	Drs Ashok Sharma / A. K. Mathur
7	CIMAP Summer School Molecular Techniques in Bioprospection and Biodiversity Analysis (CSS-2008)	23 June-08 August	Drs M. P. Darokar / Shoab Luqman
8	Organic Farming: Techniques and Tools (OFTT-2008)	11-20 August	Drs Alok Kalra/ D. D. Patra
9	IT Techniques for Research & Management (ITRM-2008)	17-23 September	Shri Rakesh Tiwari/ Manoj Semwal
10	Biotechnology and Bioinformatics Workshop (BBW-2008)	17-22 October	Drs Ashok Sharma/ A. K. Shasany
11	CSIR Program for Youth for Leadership in Science (CPYLS-2008)	14-15 November	Drs Ashok Sharma/ Feroz Khan
12	"CIMAP Winter School" Recent Techniques in Structural and Functional Genomics (CWS-2008)	1-10 December	Drs Vikrant Gupta/ Ashutosh Shukla
13	Industrial Plants Extraction Techniques (IPET-2008)	15-24 December	Drs S. K. Chattopadhyay/ Sudeep Tandon



Visitors at NAL from DLR, Germany, BELL, Canada and DDR&E, USA

A high level DLR Delegation, Germany, visited the National Aerospace Laboratories (NAL), Bangalore, on 7 February 2008. Dr A. R. Upadhya, Director, NAL welcomed the delegates and made a presentation about 'NAL activities'. Prof. Szodruch, Member of the Executive Board, DLR, Germany, made a presentation on 'DLR activities'.

A top level executive team from BELL, Helicopter, Canada also visited NAL on 7 February 2008.

A three member delegation from US Director of Defense Research Engineering (DDR&E) visited NAL on 18 February 2008.

FORM IV (See Rule 8)

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I, S. K. Rastogi, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Sd/- S. K. Rastogi
Signature of Publisher

Dated 15 March 2008