NATIONAL ACADEMY OF BIOLOGICAL SCIENCES
NABS
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NABS News Letter

National Academy of Biological Sciences

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Contents

From the Desk of the President...

Dear NABSians,

NABS Greetings

I am delighted to inform you that the first award, "Prof. S. Kannaiyan Memorial Award" was conferred on Padma Bhusahan Dr. R. S. Paroda, Chairman, Trust for Advancement of Agricultural Sciences & Former DG, ICAR, New Delhi during the 5th Interactive Workshop- 'Prospects of Medicinal Plants in Promoting Wellness' held on 14 May, 2012 at University of Madras, Chennai. The award was conferred by the senior most member of NABS, Dr. Kirti Singh, Chairperson, World Noni Research Foundation. He was instrumental in helping us to organize the workshop in collaboration with World Noni Research Foundation. I take this opportunity to place on record our gratitude and thanks to Prof. P. I. Peter, Chairman, Noni BioTech Pvt. Ltd., who is also the Corporate Fellow of NABS for his gesture of partial financial support.

Our vision is also to celebrate the tenth year of birth of the Academy by organizing a National level seminar which falls due in 2014. I would urge our beloved members to propose a theme so that we can start working on this. May I take this opportunity to request you to contribute more and more towards the Corpus Fund of Prof. S. Kannaiyan Memorial Award in the years to come. I also appeal to all our members to persuade your colleagues to enroll themselves as a member of NABS and be a part of NABS.

(V. A. Parthasarathy)

2. From the Editor's Desk

The 5th Interactive Workshop on "Prospects of Medicinal Plants in Promoting Wellness" organized in collaboration with World Noni Research Foundation was an unprecedented success. It was also a matter of great pride in conferring "Prof. S. Kannaiyan Memorial Award" on Padma Bhushan Dr. R. S. Paroda. The organizers did put that extra step forward to ensure that the workshop did not waver from its prime objectives. The presence of visionaries like Padma Bhushan Dr. R. S. Paroda; Dr. Kirti Singh, Chairperson, World Noni Research Foundation; Prof. P.I. Peter, Chairman, Noni BioTech, Chennai & Founder of World Wellness Organization and Dr. H.P. Singh, DDG (Hort.), ICAR goes on to show the respect these prominent personalities have on NABS. Besides, it also strongly indicates that NABS has changed from a fledgling academy to more stronger and powerful platform to express and exchange ideas among the scientific community. Thanks to everyone at the academy, the dedicated secretary and of course the amazing members. Our founder President Prof. S. Kannaiyan's vision of creating a platform to foster and nourish young scientists to exchange ideas and discuss on issues critical to our country's development seems to be setting fruit. Scientific exchanges can be made sitting across a table but unfortunately this does not usually work. This is where NABS can serve as a not-for-profit umbrella organization by providing a structural link between scientists, researchers and policy makers. Apparently, meeting a challenge requires drawing on all available scientific expertise in order to generate multidisciplinary solutions. So welcome aboard the academy and let us know what you have thought, conceived and would like to implement.

M. Anandaraj
Editor-in-Chief

3. About the 5th Interactive Workshop

The Academy organized the 5th Interactive Workshop on "Prospects of Medicinal Plants in Promoting Wellness" at Chemical Sciences Auditorium, Maraimalai Campus, University of Madras, Guindy, Chennai in collaboration with World Noni Research Foundation, Chennai on 14 & 15 May, 2012. The Inaugural Function was presided over by Dr. V.A. Parthasarathy, President, NABS. Dr. Kirti Singh, Chairperson, World Noni Research Foundation inaugurated the Workshop. The interactive workshop was held for two days. Out of the 20 papers received, 16 were presented and discussed. The following recommendations emanated from two-day deliberations.

- There were many presentations on various aspects of Medicinal Plants. It is time, a monograph on 'Medicinal Plants' can be brought out with all the knowledge gained so far.
- Many ITKs are available with tribal from whom obtaining the information is difficult. A good beginning has been made in University of Madras which must be a model for others to document these ITKs.
- ITKs from tribal have indicated the availability of safer anti-venom plants. This knowledge must be validated.
- Medicinal plants are used for their secondary metabolites. *In vitro* techniques may be refined and commercialized for production of secondary metabolites.
- It is difficult to propagate the medicinal plants in view of highphenol / tannin contents. The micropropagation protocols must be perfected for many of these plants.
- *In vitro* techniques for evaluating the antioxidant and other medicinal properties must be carried out for those crops for which such studies have not been carried out.
- Some of the well validated medicinal plants may be carried forward for clinical trials.
- Sustainable eco-friendly and non chemical methods of management of inset and non-insect pests, diseases and nematodes affecting medicinal plants need to be developed and made available to cultivators.

3.1. Salient features of two-day workshop and annual meeting

A. Special addresses and lectures delivered

- **Prof. S. Kannaiyan Memorial Oration**
  Meeting the Current Challenges for Food, Nutrition and Environment Security -
  Dr. R. S. Paroda
- **Keynote address**
  Wellness- Prof. P. I. Peter

B. Awards and Fellowships

- **Prof. S. Kannaiyan Memorial Award for 2012**
  Padma Bhushan Dr. R. S. Paroda
  Chairman, Trust for Advancement of Agricultural Sciences and Former DG, ICAR was conferred with Prof. S. Kannaiyan Memorial Award
- **Honorary Fellow of NABS**
  Dr. S. Ayyappan
  DG, ICAR, New Delhi was conferred with Honorary Fellow of NABS (*in absentia*)

  Dr. H. P. Singh
  DDG (Horticulture), ICAR, New Delhi was conferred with Honorary Fellow of NABS in person
- **Fellow of NABS**
  Dr. K. Nirmal Babu
  Project Coordinator (All India Coordinated Research Project on Spices) IISR, Kozhikode, Kerala

  Dr Prakash Babu
  University of Hyderabad, Andhra Pradesh

  Dr. K. Sahayaraj
  St. Xavier's College, Palayamkottai, Tamil Nadu

  Dr. K. Samiayyan
  Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu

  Dr. J. Venkateswara Rao
  Indian Institute of Chemical Technology, Hyderabad, Andhra Pradesh

  Dr. Sanjay Arora
  Central Soil Salinity Research Institute, Gujarat (*in absentia*)

  Dr. Utpala Parthasarathy
  Indian Institute of Spices Research, Kozhikode, Kerala (*in absentia*)

C. NABS-Best Woman Scientist Award

Dr. Latha Rangan
Indian Institute of Technology, Guwahati, Assam

Dr. B. Meena
Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu

D. Corporate Fellow

Prof. P. I. Peter
Chairman, Noni BioTech, Chennai was admitted as Corporate Fellow of NABS

4. Awards and Recognitions received by members

Congratulations to the recipients !

Sl. No.	Name of Member	Awards / Recognitions Received
1.	Dr. D. P. Ray -Fellow of NABS E-mail: ouat_dproy@yahoo.co.in	▪ HSI- Shiv Sakthi Award-2011 by Horticultural Society of India
2.	Dr. U. S. N. Murty - Fellow of NABS E-mail: usnmurty@iict.res.in murty_usn@yahoo.com	▪ Fellow of Andhra Pradesh Akademi of Sciences -2011 ▪ e-North East Award-2011
3.	Dr. S. Nakkeeran -Fellow of NABS E-mail: nakkeeransingai@yahoo.com	▪ Fellow of Indian Society of Mycology and Plant Pathology ▪ Outstanding Research Scientist on Noni Award - 2011 by World Noni Research Foundation, Chennai

4.	Dr. P. Nallathambi - Life Member of NABS E-mail : scientist_thambi@yahoo.co.in	■ Fellow of Indian Society of Mycology and Plant Pathology
5.	Dr. P. Selvam - Life Member of NABS E-mail: periyasamy_selvam@yahoo.co.in	■ Outstanding Research Scientist on Noni Award-2011 by World Noni Research Foundation, Chennai
6.	Dr. S. T. Kajjidoni - Fellow of NABS E-mail: stkajjidoni@yahoo.co.in	■ Fellow of Indian Society of Genetics and Plant Breeding (ISGPB), New Delhi
7.	Dr. V. Prakasam - Member of NABS E-mail: prakasamv@gmail.com	■ Dr.B.B. Mundkur Memorial Lecture Award by Indian Phytopathological Society
8.	Dr. K. Samiayyan -Fellows of NABS & EC Member	■ Bharat Ratna Dr. C. Subramaniam Award for Outstanding Teachers in Agriculture and Allied Sciences 2011 by Indian Council of Agricultural Research, New Delhi

5. Research notes and communications

a. A novel protease with industrial potential from brine samples of Tuticorin Coastal Region of Tamil Nadu, India

Brine is the hub of all saline tolerant forms. The present study focused on the screening of novel microbes from the salt pans of Tuticorin (Tamil Nadu, India) where the sea water is evaporated to produce salt. The brine samples were collected and screened for halophilic forms employing modified nutrient agar medium

The isolates obtained from the brine of Tuticorin coastal region, Tamil Nadu, India are named as strain as MVBDU-1 to 7. These isolates required 15-20% salinity for in vitro growth employing modified nutrient broth medium. All the isolates required a neutral pH (7.0) for optimal growth. The optimal temperature for growth of the isolates was 35-40°C. Majority of the isolates belong to halophilic eubacteria and they responded to universal bacterial primers, whereas MVBDU-1, 2 and 7 responded to halobacterial specific primers confirming that they belong to haloarchaea. Based on colony morphology, cell shape, biochemical characteristics, 16S rDNA technology and FAME analysis, they were identified as follows: 1.*Halobacterium* sp. MVBDU-1; 2.*Halobacterium* sp. MVBDU-2; 3.*Halobacillus* sp. MVBDU-3; 4.*Bacillus* sp. MVBDU-4; 5.*Staphylococcus epidermidis* MVBDU-5; 6.*Virgibacillus* sp. MVBDU-6 and 7.*Haloferax* sp. MVBDU-7.

The red coloration in the salt pan as well as in culture is caused by Halobacterium sp. MVBDU-1, and the pigment has been identified as bacterioruberin carotenoid which finds lot of applications in medicine and food supplements. Its property as an antoxidant is well illustrated as that of higher plant carotenoids. Of the various isolates, only MVBDU-1 and 4 produced protease activity. For several advantages that the Halobacterium sp. MVBDU-1 is endowed with, the strain was selected for further detailed studies on growth and protease characterization. The strain MVBDU-1 produced protease in the mid log phase. The protease production is possibly extracellular as higher activity was observed in 12,000 rpm supernatant.

The crude enzyme in the 12,000 rpm supernatant was thermostable (40-60°C) and required high salinity (15-20% NaCl) and a pH of 7.0 for maximal activity. Among the divalent cations ZnCl2 (1.0mM) decreased the activity by 50%. EDTA at 2.0mM totally abolished protease activity. EDTA is a well known chelator. Its total inhibition of protease activity indicates that the protease of Halobacterium sp. MVBDU-1 is a neutral metalloprotease. The enzyme does not require any reductant for its activity. The following components such as peptone (1%), casein (1%), CaCl2 (1.0mM), MgSO4 (1.0mM) and MnSO4 (1.0mM) enhanced the activity quite significantly. The enzyme could be purified 100-fold

employing ammonium sulfate precipitation, DEAE-sepharose anion exchanger and sephadex G-100 column. Four-fold activity was obtained upon purification .The purified enzyme as observed with the intact cells or cell free supernatant required high concentration of salt (15-20%) with specific requirement of NaCl rather than KCl. With NaCl (Na+) much higher protease activity was obtained. The highly purified protease had a molecular weight of 26 kDa. Since the protease is neutral, halophilic and thermostable, it may find wider applications in industries. Dehairing and stain removal assays were quite successful. Quite often it is suggested that application of Haloarchaeal isolates in the industrial effluent will detoxify the effluents as they are capable of producing extracellular proteases and lipases which are known to function under extremely harsh conditions.

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b.Effect of *Bacillus* spp. and *Pseudomonas aeruginosa* for the management of carnation wilt incited by *Fusarium oxysporum* f.sp. *dianthi* under protected cultivation

The detailed survey was undertaken to assess the incidence of *Fusarium* wilt of carnation in Nilgiris district of Tamil Nadu, India. Ten varieties of white, red, yellow, 9 light pink, 7 dark pink and 9 bicoloured carnation varieties were surveyed for the occurrence of *Fusarium* wilt in Nilgiris, Coonoor and Kothagiri of Nilgiris district in Tamil Nadu. The wilt incidence ranged between 38.0% to 49.8%. in carnation varieties like, Baltico (White), Gaudina (Red), Harvey (Yellow), Navona (Light pink) and Farida (Dark pink). In vitro screening of *Bacillus*, BSC 7 (*B. amyloliquefaciens*) and *P. aeruginosa* (P1) showed highest inhibition of *F. oxysporum* f.sp.*dianthi* to an extent of 55.95 and 55.29 per cent over control respectively. Crude antibiotics from Bacillus spp., (BSC7, BSC11, BS2) extracted using ethyl acetate showed increased antagonism against *F. oxysporum* f.sp. dianthi and *P. solanacearum* and was thermo stable even at 120ºC. Thin layer chromatography confirmed the presence of surfactin and iturin with Rf value of 0.3 and 0.7 in the *Bacillus* isolates BS2, BSC7 and BSC11. BS2 was characterized with the presence of iturin, bacillomycin, fengycin and surfactin genes. The isolates BSC7 and BSC11 were characterized with the presence of iturin and surfactin genes. Similarly, assay for the presence of 2, 4-diacetyl phloroglucinol (DAPG) through TLC confirmed the production of 2, 4-DAPG with Rf value of 0.8 for P. aeruginosa (P1). GCMS studies with crude antibiotics revealed the presence of approximately 24 different antimicrobial compounds pertaining to aliphatic hydrocarbons, fatty acid, and lipopeptide, diterpene and plasticizer compounds with antifungal and antibacterial activity. Dipping of rooted cuttings and soil drenching with consortia of *B. subtilis* BS2+ *B. amyloliquefaciens* BSC7+ *B. cereus* BSC11@ 0.05% recorded 1.0% wilt and the flower yield was 262.80 numbers. Besides, the plant height, length of flower stalk was also increased. The disease incidence and flower yield in untreated control was 30.50% and 125.03 flowers/m2 respectively. The flower yield in plants applied with consortia of antagonists increased up to 109.6% over control.

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c. Characterization of ruminant fungal cellulases for improved digestion of feed by herbivores

Anaerobic rumen fungi commonly survive in the gastrointestinal tract of herbivores. They are indispensable for the digestion of crop residues in ruminants and play a major role in plant cell-wall decomposition. Faeces collected from domesticated small and large and wild ruminants were used for the isolation of anaerobic fungi. The fungi were identified by integrating the data obtained on the morphology of the colony, hyphal growth characteristics and the sequence analysis of the ITS1 region. Fungal strains of genera *Neocallimastix, Piromyces, Caecomyces, Anaeromyces, Orpinomyces* and *Cyllamyces* were identified.

The digestibility of paddy straw in specific culture broth (M10 broth) was studied to assess the potential of the isolated fungi as cell wall degraders. The fungi were tested in in vitro media for fermentative degradation of paddy straw which served as the sole source of cellulose. The cellulose degradation was studied using the parameters such as total gas production, true digestibility, apparent digestibility and NDF digestibility and the assay of cellulolytic enzymes using crude extracts of the culture medium. In the axenic cultures, three fungal strains showed maximal gas production, NDF digestibility and fibrolytic enzyme activity. They were BTrP1 (Piromyces from nilgai), CDN1 (Neocallimastix from camel) and EMP1 (Piromyces from Indian elephant). A positive correlation was observed between the gas production and the activity of avicelase, filter paper cellulase, ß, 1-4 endoglucanse and xylanase.

A stimulatory study, wherein rumen fluid was treated as a mixed culture along with pure cultures of fungi, indicated further effect of the fungi on digestion of paddy straw. The parameters employed to study the digestibility included gas production and the activities of fibre degrading enzymes. Among the eighteen fungal strains from large ruminants, none of the isolates were able to bring about a significant increase in the digestibility parameters of paddy straw. Most of the fungal strains from wild (BTrP1, BTrP2, BTrN1) and pseudo (CDN1, ZEP1, ZEN1) ruminants, and large herbivores (EMP1, LCN1, LAN2) were able to exert a positive effect on the aforesaid parameters.

The final objective was to identify the cellulase gene and characterize it biochemically employing different kinds of substrates and work out the structural and functional aspect applying bioinformatics tools. The cDNA encoding cellulase from the best fibrolytic fungi Piromyces (BTrP1) designated as cel(bt) contained 1610 bp in length, Piromyces (EMP1) designated as cel(em) contained 1737 bp and Neocallimastix (CDN1) designated as cel(cd) contained 1889 bp. All the three genes encoded an enzyme from glycosyl hydrolases family 6. Carboxy methyl cellulose, Avicel, barley beta glucan, lichenan and oat spelt xylan were used to determine the substrate specificity of cloned enzymes. Cellulase from Piromyces (Nilgai) and Neocallimastix (Camel) was found to contain ß - 1, 4 endoglucanase belonging to family 6 GH, while cellulase from Piromyces (Elephant) was an exoglucanase.

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d. Genetic diversity of *Alternaria* isolates causing leaf blight of cotton and management of leaf blight with bacterial endophytes

In recent days, *Alternaria* leaf blight becomes as a major problem in the cultivation of Bt cotton. Severe infection leads to complete defoliation and death of the plants. Hence, based on the severity, we assessed the genetic diversity of 20 isolates of pathogenic *Alternaria* of cotton obtained from the states of Tamil Nadu, Karnataka and Andhra Pradesh by using 15 primers through RAPD-PCR. Each isolates produced a distinct pattern of DNA fragments which were used as a measure for the degree of relatedness between the isolates. Polymorphism of DNA fragments was observed among all the isolates. But maximum polymorphism was observed in the primer OPA5 and OPA6. Based on cluster analysis on similarities computed from RAPD markers, it showed eleven different clusters at 51 per cent similarity co-efficient level. Eight isolates were not clustered and formed into individual clusters (CAM2, CAA2, CA9, CAA10, CAA5, CAM9, CA7 and CAM7). The isolate CAA3 was highly similar with the isolate CAA4. Few isolates were formed within the clusters and showed less similarity to one another, but majority of the isolates showed high level of genetic diversity among the isolates. Cotton endophytic bacterial biocontrol agents, *Bacillus* and *Pseudomonas* were tested against *Alternaria* leaf blight of cotton in combinations under field conditions. Seed treatment (10g/kg) and foliar application (0.5 %) of *Bacillus* EBs2 + *Pseudomonas* recorded minimum disease incidence and higher seed cotton yield in both seasons compared to the untreated control.

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e. A success story of classical biological control of invasive papaya mealybug, *Paracoccus marginatus*

The exotic papaya mealybug, *Paracoccus marginatus* of Mexican origin was first recorded in Tamil Nadu in 2008 on papaya which spread to cassava, mulberry, cotton, vegetables, flower crops and many weeds including *Parthenium hysterophorus*. By 2010, it invaded the entire state of Tamil Nadu causing a monetary loss to the tune of 435 crores per annum in crops like papaya, mulberry and cassava.

Normal methods of pest management strategy developed, though gave temporary relief, could not effectively check the spread of the mealybug.

Taking a cue from the success story of melaybug control in Florida, Caribbean Islands, some South American countries, Guam, Palau, Hawaii and Sri Lanka through release parasitoids *viz.*, *Acerophagus papayae, Anagyrus loeckii and Pseudleptomastix mexicana,* it was decided to test the same at Tamil Nadu.

USDA Assistance

The National Bureau of Agriculturally Important Insects (NBAII) with the help of USDA-APHIS imported the parasitoids during August, 2010 and mass multiplied. *Acerophagus papayae* was found most efficient among the three.

Mass production

The Centre for Plant Protection Studies of TNAU took the lead and obtained nucleus cultures of the parasitoid from NBAII. Training on mass multiplication of parasitoids was imparted to Plant Protection Scientists of TNAU involving seven colleges, 36 research stations and 14 Krishi Vigyan Kendras (KVKs) within a fortnight in order to take up mass production throughout Tamil Nadu.

Release of Parasitoids in mealybug infested fields

A. papayae was mass multiplied on a war footing and released in fields infested with mealy bug during October, 2010 onwards. Within one year, 57,00,000 parasitoids were mass multiplied and released in farmers' fields @ 100 parasitoids / village in all the 30 districts of Tamil Nadu involving scientists, farmers, District Collectors and officials of Extension Departments. And now, the invasive pest is kept under control in Tamil Nadu in papaya, mulberry, cassava, vegetables and flower crops.

The farmers were advised not to spray insecticides in the parasitoid released field. In Tamil Nadu, this classical biological control strategy adopted on a war footing effective checked the mealy bug and the spread was totally contained. This is one of the successful examples of effectively checking an invasive pest employing classical biological control method.

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6. An appeal to contribute for corpus fund

You are aware that the Corpus Fund for **Prof. S. Kannaiyan Memorial Award** is being mobilized. We profusely thank all the 48 members who have contributed to the cause. We earnestly appeal to all the rest of the Life members, NABS Fellows / Associate Fellows, Corporate Life Members, Corporate Fellows and well wishers to contribute to this noble cause. The amount may be paid as Cash directly or through a Demand Draft / Multicity Cheque drawn in favour of **National Academy of Biological Sciences** payable at Chennai.

The fund can also be electronically transferred to the Savings Bank account of the Academy.

The details :

The SB Account No. : 104 9697 8637
Bank: State Bank of India / Branch: Valmiki Nagar, Chennai-600 041 / Branch code: 11721
IFS code: SBIN0011721.

Address for Communication :
Prof. T. Marimuthu, Ph.D., FNABS.
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7. Enroll yourself as a member and be a part of NABS

Types of Membership		
A. Life Membership	:	₹2,500/- or US$ 100/-
b. Corporate Life Membership	:	₹10,000/- or US$ 400/-
c. Corporate Fellow	:	₹1,00,000/- or US$ 4000/-

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