

form of different names existing for the same plant, arising sometimes from names provided by folklore, cultural and regional roots handed down through generations. In some cases false identification has led to repetition in assignment of names. The need of the hour is to straighten these glitches and have a precise number and type of plant species presently available. Else, in this highly patent-oriented society we shall lose credit for discoveries which naturally belong to us.

The compilation of flora of higher plants is underway. There has been considerable work by several researchers to provide reliable biodiversity atlases and reports based on monitoring of India's biodiversity<sup>1</sup>. Ganeshaiah from the Department of Genetics and Plant Breeding and Uma Shaanker of Crop Physiology, both at the University of Agricultural Sciences, Bangalore have stressed the need to have a national agenda for mapping biodiversity using 'contours of conservation'<sup>2</sup>. In collaboration with Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore and networking with various sources for information collection, they have arrived at a consolidated view titled 'Conservation/Contour Maps of The Biogeography of India – The Plants'. This will be available soon. An expected date for its formal release is slated for the third week of November 2000. The release would be in the form of a CD-ROM whose contents can be accessed via the web. The exact details will be known at the time of release.

These maps have been achieved by forming a database of all available information on the flora of plants. Inventory of the floras, published literature, unpublished yet accessible data and an

estimate of collections held at national herbaria have provided inputs. These have then been linked to a spatial distribution. The spatial distribution includes parameters such as where a particular species is located (state, region, latitude and longitude of occurrence), together with type of forest, rainfall and soil conditions, etc. The standardization of the various modules of the relational database that contains information about the characteristics of the species and their taxonomic linkages has been accomplished. Algorithms to detect redundant entries as well as synonymous names in botanical nomenclature or records have been developed. This reduces the error bar for obtaining an exact number of plant species in India. For the end user of these maps, accessibility to information is simple due to a user-friendly system developed consisting of standard and custom built querying.

Contour maps provide for a three-dimensional view of species richness as depicted in Figure 2 (ref. 2). The figure shows data for the *Dalbergia* species (some of which are commercially important) found in India whose areas of maximum availability are in the Western Ghats and the North-eastern regions. The latitude and longitude were assigned for each record and mapped. The density of species in each grid of size  $1^\circ \times 1^\circ$  was computed and contours for the density obtained. Based on the contour data, the three-dimensional view was constructed using a suitable Geographic Information Systems (GIS) software.

Bamboo and rattan-based industries are of importance in India. The natural forests of India provide the raw material for the industry. India is the richest

source for bamboo and cane next only to China. The country possesses about 130 species of bamboo in 24 genera and 45 species of canes in 5 genera. The map of the distribution of the species richness of bamboo in India is shown in Figure 3. The map indicates a clear concentration of species in the two mega-diversity centres, Western Ghats and Eastern Himalayas. Updating the records of bamboo and rattan in India is ongoing with the development of an exhaustive species distribution map. This would give vital information on the depletion of the species due to over harvesting or conversion of forest land for other uses.

Utility of these conservation maps is multiple. One immediate use is in pinpointing areas deserving species conservation including identification of rare species. The composite map for the spatial structuring of the plant diversity profile would also provide important inputs for national conservation strategies for our rich plant heritage. Therefore allocation of resources in conservation activities would be resources well spent. A national initiative for a complete digitized inventory of our plant reserves, other than medicinal species, by a national team is in the offing.

1. *Curr. Sci.*, 1998, **75**, 201–298 (Special Section: 'Use of GIS and RS in ecology and conservation biology').
2. Ganeshaiah, K. N. and Uma Shaanker, R., *Curr. Sci.*, 1998, **75**, 292–298.

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## Geometry conference to commemorate Patodi

An international conference on Geometry, Analysis and Applications was organized in the Department of Mathematics, Banaras Hindu University, Varanasi (21–24 August 2000) in which about 150 delegates participated. Amongst them 17 were from abroad. It was a fitting tribute to the University alumnus, late V. K. Patodi that this con-

ference was held in the World Mathematical Year 2000. His joint work with Atiyah and Singer is well known in physics literature as well {see review by T. Eguchi *et al.* (*Phys. Rep.*, 1980, **66**)}. Patodi did M Sc from BHU in 1966, and in a brief active period enriched mathematics by his lasting contributions in the field of geometry and topology; he

died at the young age of 31. The Aitayah–Patodi–Singer index theorem (APS) proved in the first half of 1970s is an extension of the index theorem to the manifolds with boundary. APS was applied to quantum gravity and Hawking's Euclidean Taub-NUT metric immediately. Recalling the Hodge theory (1930s) relating topology to algebra

using linear elliptic equations, and topological invariants in Yang-Mills nonabelian gauge theories which are nonlinear elliptic equations, the importance of the index theorems can be realized, which essentially relate the analytic index with the topological index of elliptic complex over manifolds.

The proof of the APS was presented by B. L. Sharma (Allahabad). L. Rodino (Torino) discussed asymptotic expansion of the heat equation for quasi-elliptic operators, while P. Panarese (Bologna) found asymptotics of the  $L^2$ -unbounded operators on a class of non-compact Riemannian manifolds. R. Sharma (New Haven) gave a talk on contact Riemannian manifolds. H. Pedersen (Odense) presented his group's work on hyper-complex manifolds. That quantum-state space may be Weyl-Kahler was proposed by S. C. Tiwari (IONP). S. Pattanayak's (Bhubaneswar) talk was on the Toeplitz operators.

R. D. Carmichael (Wake Forest) reviewed generalization of the Hardy H functions, and H-J Glaeske (Jena) presented a survey on the convolution structure of Hermite transforms, M. W. Wong (York) on localization operators on the Weyl-Heisenberg group, M. Nagase (Osaka) on Garding's inequality, P. K. Jain (Delhi) on imbeddings of Sobolev spaces and several contributions on these topics were included in the session on analysis. Colombeau's generalized functions were the focus of attention in the review by M. Oberguggenberger (Innsbruck), and J. Schmeelk (Virginia Commonwealth) introduced Stieltjes transforms in the study of these functions. Microlocal filtering with orthonormal wavelets was discussed by R. Ashino (Osaka Kyoiku).

Modern trends relating to computers in mathematics and application-oriented research was reflected in the opening remarks of H. P. Dikshit (M. P. Bhoj Open Univ.). Most of the papers presented by Indian institutions were on

the applied mathematics, however there were good contributions on geometry and analysis too. Patodi's teacher S. N. Lal and class-mate I. K. Khanna shared their reminiscences with the audience during the inaugural function. Convener of the conference R. S. Pathak and the sponsoring agencies NBHM, CSIR and UGC/BHU deserve appreciation for conceiving and making this event possible. It was intriguing that in spite of the key role of geometry and topology in the current fundamental physics, there was no presence of physicists in this conference. Perhaps it would be a rewarding exercise to organize a conference on APS and Physics exclusively.

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## MEETING REPORT

# Biotechnology of plant protection: Application and technology development: A report\*

A national symposium on 'Biotechnology of Plant Protection: Application and Technology Development' was organized by the Mycology and Plant Pathology group of the Centre of Advanced Study in Botany, Banaras Hindu University. The 3-day long deliberation centred around eight major themes: (1) Genetic engineering and plant protection; (2) Biochemical and molecular approaches to plant defence mechanism and immunization; (3) Plant pathogens: ecology, biology and epidemiology; (4) Molecular identification and detection of plant pathogens and diseases; (5) Biotechnology and biocontrol:

new options; (6) Forest/post-harvest technology; (7) Plant protection and emerging technologies; and (8) Biotechnology: Basic and applied aspects.

The opening lectures were delivered by Anupam Varma (IARI, New Delhi), Paul Bridge (University of London, UK), A. N. Mukhopadhyay (Assam Agriculture University) and B. L. Jalali (Haryana Agricultural University). Varma elaborated upon the emerging trends in biotechnology of plant protection, Bridge highlighted the use of 'molecular markers' in understanding the epidemiology of fungal plant pathogens, and Mukhopadhyay dealt with the role of biotechnology in management of plant diseases in agriculture, especially within the framework of integrated disease management system. Jalali discussed the role of molecular biology in plant disease management in the next millennium. Rakesh Tuli (NBRI,

Lucknow) deliberated upon the commercial release of genetically engineering plants for durable pest management and the need for studying variations in insect populations, spontaneous frequency of native resistance genes, type of dominance, migration and mating behaviour of insects and computer simulation of population dynamics-based knowledge strategies for the lasting release of transgenic plants. Sunil Mukherjee (IARI, New Delhi) gave an account of molecular characterization of UIMYMV genome and viral replicase with emphasis on possible use of *Rep*-DNA to induce viral resistance. K. Narayanan (Project Directorate of Biological Control, Bangalore) highlighted the impact of molecular biology and genetic engineering aspect of insect viruses with emphasis on their efficient utilization in pest management. D. V. Amla (NBRI, Lucknow) delivered a lecture on

\*A report on the 'National Symposium on Biotechnology of Plant Protection: Application and Technology Development' held at the Centre of Advanced Study in Botany, Banaras Hindu University, Varanasi during 25-27 February 2000.