



**REPORT ON NATIONAL SYMPOSIUM ON “THE GENOMIC AGE
CHALLENGES AND OPPORTUNITIES IN TAXONOMY AND BIOLOGY
OF INDIAN PTERIDOPHYTES “ON 3-4TH MARCH 2017”**



at

IISER, Pune.

ORGANISED BY

BOTANICAL SURVEY OF INDIA, WESTERN REGIONAL CENTRE, PUNE

IN ASSOCIATION WITH

THE INDIAN FERN SOCIETY, CHANDIGARDH

Botanical Survey of India, Western Regional Centre, Pune in association with Indian Fern Society, Chandigarh in support with Department of Science and Technology (DST), New Delhi organized a two days National symposium. entitled with “**THE GENOMIC AGE CHALLENGES AND OPPORTUNITIES IN TAXONOMY AND BIOLOGY OF INDIAN PTERIDOPHYTES** “on 3-4th March 2017 at the Indian Institute of Science and Education Research (IISER), Pune. The Symposium was inaugurated by Mr. Achyut Gokhale (Former, Secretary, Govt. of India), as an honoured Chief Guest, with Prof. B. D. Sharma (President, Indian Fern Society), Prof. S.C. Verma (Editor-in-Chief, Indian Fern Society), Prof. S.P. Khullar (Secretary, Indian Fern Society), Dr. P. Lakshminarasimhan (Coordinator) and Dr. A. Benniamin (Organizing Secretary) on the dais. Dr. Rashmi Dubey (Scientist D, WRC, Pune) introduced the guests and Dr. P. Lakshminarasimhan Scientist E, Head & Coordinator of the Symposium welcomed all the dignitaries on the dais and the participants. Dr. A. Benniamin, Organizing secretary, highlighted the importance & objectives of the technical sessions of the Symposium. He elaborated upon the main aims of the scheduled Symposium and impressed upon the frequent need to bring together the National scientific community involved in in-depth studies on Pteridophytes and to disseminate research findings in various aspects of taxonomy & systematics, genomics, medicinal importance, and phylogeny. It aims at establishing a forum for such discussions between scientists, and senior academicians and the young researchers of today.

During the inauguration function a New book entitled : **An Annotated Checklist of Indian Pteridophytes- Part 1** (Lycopodiaceae to Thelypteridaceae) by C.R.Fraser Jenkins, K.N.Gandhi, B.S.Kholia and **A.Benniamin** 2017 was released by Prof. S. P. Khullar, Secretary, Indian Fern Society. This release was followed by Chief Guest's address and release of the Book of Abstracts by Mr. Achyut Gokhale (Former-Secretary , Govt. of India), Pune

Prof. S. P .Khullar, Secretary, Indian Fern Society, elaborated upon the activities of the Indian Fern Society. A few of the distinguished Pteridologist, namely, Dr. Smitha Hegde, Dr. Nirupama Goswami, Dr. A. Benniamin, and Dr. V. K. Rawat, were honoured and presented the **Prof. S. S. Bir Gold Medal in Pteridology**. Announcement of these awards had been made during the last conference held at IHBT, Palampur, December, 20- 21, 2014. Dr. Shyam Srivastav, Secretary-Convener, Birbal Savitri Sahni Foundation, announced the conferment of the prestigious **International Birbal Savitri Sahni Foundation presented the Birbal Sahni Centenary Award and Birbal Savitri Sahni Foundation Honour to Dr. Paramjit Singh**, Director, Botanical Survey of India. These Awards were received by Dr. P. Lakshminarasimhan on behalf of Dr. Paramjit Singh, Director, BSI. The inaugural session concluded with the vote of thanks by Dr. J. Jayanthi, Scientist D, BSI, WRC, Pune.

The Symposium at Pune attracted a much larger number of pteridologists from all over India. Their number was much more than the earlier National Symposia on Pteridophytes. This is a very encouraging sign for the growth of pteridology in India. The Abstracts received cover a wide spectrum, from fossil studies, morphology, cytology, ethanobotany, anatomy, floristic *etc.* covering almost all aspects of pteridological research. The two-day symposium comprised of six technical sessions, for invited lectures as well as oral and poster presentations.. The number of lead lectures delivered were 14, out of the 17 invited, and 78 papers were presented as oral/poster presentations. On the first day 4 Sessions were held, including the inaugural session. It included 7 lead lectures and 15 Oral Presentations. There were 3 Sessions on the second day, which included 7 lead lectures and 10 Oral Presentations.

It was decided to give 3 Best Oral and 3 Best Poster Presentation Awards so as to encourage the young researchers. For the selection of best oral presentation Dr. H. K. Goswami, Dr. Nirupma Goswami, Dr. A. S. Ahluwalia, Dr. Alka Kumara and Dr. Karthikeyan as judges for the oral presentations, and Dr. P. K. Rajagopal, Dr. Radhanath Mukopadhyay and Dr. Sreenivas as judges for the poster presentations.

After the inaugural session, the Presidential address was delivered by Prof. B. D. Sharma, President, Indian Fern Society. In his Presidential address he discussed about Glimpses of Investigations on Pteridophytes. Pteridophytes are good material for cytological researches because of wide variations in chromosomes number and polyploidy level. He also mentioned that Resemblances in structure and development of the gametophytes of *Psilotum* and *Tmesipteris* to those of *Stromatopteris* and *Actinostachys* of Schizaeaceous ferns look justified but certainly needs further investigations.

Dr. S. C. Verma, Editor-in-Chief of the Indian Fern Journal and Prof. Emeritus Panjab University, Chandigarh, delivered the **key-note** address titled '**Opportunities and Challenges of Exploring Ferns and Lycophytes in the Genomic Age -An Overview**' to highlight the challenging issues and to resolve them by application of opportunities in the genomic age. In his key-note address, he impressed upon seizing the opportunities available in the modern times to explore ferns and lycophytes, because of their antiquity and unique life-cycle, and as an important evolutionary link to the flowering plants. He brought out the as yet debated questions to be addressed. He emphasized that Research in Pteridophytes over the past two decades has witnessed transformation by the application of DNA methodologies, shelving temporarily the unresolved questions about their high fern chromosome numbers. The focus was shifted to a few of plant's newly identified genes. There has been a noticeable upsurge to fathom several questions on evolutionary biology based on molecular approaches. He highlighted an urgent need to prepare a detailed inventory of 'biodiversity' [ecosystem, species, genetic] of ferns and lycophytes of various regions of India, and the taxonomists must seize this opportunity and rise to the occasion for an in-depth study of Pteridophytes in natural populations. He made an appeal to fellow pteridologists to focus on curiosity-driven as well market-driven research, and to explore possibilities of collaborative research. In the end, he wished to quote Robbin C. Moran "Given recent advances, there has never been a more exciting time to study ferns and lycophytes". After the lead lectures, four oral presentations were made.

The afternoon session started with the talk entitled 'Cell Biology of Pteridophytes' by Prof. Emeritus, Panjab University, Chandigarh, **Dr. S.P. Khullar**, Secretary, Indian Fern Society. He presented most elegantly the characteristics of ferns, their high gametic chromosome numbers, revelations of Fern Cytology, Molecular Studies and Fern Classification, Impact of Cytology on Phylogeny and Taxonomy. He further questioned as to why not Divorce the Heterosporous Ferns from the extant Ferns! Aquatic ferns are heterosporous, have a different habit and habitat and sporophyte morphology, gametophytes are endosporic and entirely different. Aquatic ferns therefore should NOT be in the same Clade as the rest of the ferns and should be treated as separate from the rest of the ferns and perhaps be treated on an equal par as the Lycopodiales and Ferns.

Prof. Radhanath Mukhopadhyay, University of Burdwan, Burdwan, delivered a lecture on 'An overview of genus *Selaginella* P. Beauv'. He highlighted the important findings made on this taxon and to give up-to-date information thereto. After the lead lectures, six oral presentations were made. After a tea-break, the fifth lead lecture was delivered by **Dr. Shyam C. Srivastava**, of the Birbal Savitri Sahn Foundation, Lucknow. Through his experience he talked about "Pteridophytic Jungles Million Years Ago". He highlighted the Pteridophytes during the Palaeozoic Era, and in habit they were both terrestrial and hydrophytic. Several species of *Lepidodendron* trees and identical genera appeared, about 50 feet tall, with root system of thick forking branches having root buttresses known as *Stigmara*.

A lead lecture was next delivered by **Dr. P. B. Khare**, Former-Chief Scientist, National Botanical Research Institute, Lucknow. He discussed about "**Pteridology in India: Shining or Declining!**" In his talk he explained that like population and diversity of Pteridophytes, the number of researchers in Pteridophytes is also declining. Once upon a time several 'schools' of thoughts were actively engaged and contributed quality research work on Pteridophytes, which were having higher impact factor when compared with Pteridologists working in developed countries in those times. He brought a stark contrast between the high-quality contributions of yester-year workers and the current contributions given the opportunities of the present times. He stressed upon to improve the status of Pteridology in India.

The lead lecture was by **Prof. Ashwani Kumar**, Former Head of the Department of Botany, University of Rajasthan, Jaipur. He discussed about 'Plant Biotechnology and its applications *in vitro* propagation and conservation of ferns-A review'. He emphasized how *In vitro* tissue culture techniques with application of biotechnology techniques show a great promise in ferns with respect to their conservation, molecules of interest, and mysteries of their life-cycle and sexuality. It includes also *in vitro* technologies and cryopreservation for mass propagation and long-term storage of fern germplasm.

After 7.30 P.M, a joint meeting of the Executive Council and the general body of the Indian Fern Society was held at the same venue. Executive Committee members for the years 2017-18 were selected unanimously. Dr Paramjit Singh, Director, Botanical Survey of India, Howrah was elected as **Honorary Fellow of the Indian Fern Society**. Prof. Rajagopal will be the next President of the Indian Fern Society, and Prof. B L Yadav, (Bhilwara) and Dr Kakali Sen (Kalyani) will be the Vice-Presidents. The complete list of all office bearers is printed on the Reverse of the title page of this volume. The Awards of the Society were also announced. These awards were for: Honorary Fellow; Life Time Achievement Award for the years 2016, 2017; Fellows; S S Bir Gold Medal in Pteridology and Certificate of Merit. A complete list of the awards can be found at the end of this proceedings.

The second day began with the lecture by **Dr. P. K. Rajagopal**, (Retd. Professor of Botany, M. G. M. College, Udupi). He discussed about the '**Characters and Evidences in Fern Classification – Linnaean Period to Genomic Age**'. The classification of ferns and fern-allies has been changing overtime and the complexity and difficulty of the classification is perhaps matched by no other group. As consequence of genomic studies now it is known that the so-called fern-allies (except the lycopods) are indeed Ferns and many long-standing questions in fern systematics answered.

The second lecture was delivered by **Dr. Harvinder K. Cheema**, Department of Botany, Panjab University, Chandigarh. She talked about the '**Ferns as an Excellent Experimental System for *In Vitro* Morphogenesis**'. She introduced the *in vitro* methodologies to induce apospory and apogamy in ferns and the results obtained at the Panjab University under the leadership of late Professor P. N. Mehra. She emphasized that sometimes during experimentation structures having the characters of both gametophyte and sporophyte are formed which are generally referred to as the intermediate structures. In such types of differentiation there is a lot of confusion and misunderstanding in the minds of the young scientists, and she had selected this topic to clear the concepts with the help of suitable examples available in the literature.

After the tea-break, the third lead lecture was delivered by **Dr. V. Irudayaraj**, Associate Professor, St. Xavier's College, Palayamkottai. Dr. Irudayaraj dealt with '**Utilizing and Conserving RET (Rare, Endangered and Threatened) Pteridophytes of the Western Ghata**'. His presentation was definitely full of curiosity on south Indian ferns. He had developed protocol for analysing the rarity of the presently studied RET species. Besides the impact of habitat/forest destruction and global climate change, he emphasized that some biological features, like the presence of dimorphic fronds, diploid chromosomes, epiphytic habitation and chlorophyllous spores comprise the major reasons for the rarity of such species. He concluded that in the genomic age knowledge about reproductive biology, along with intense field survey of RET species is the basic requirement for their conservation. It was followed by another lead lecture of **Dr. N. Punetha** (Pithoragarh, Uttarakhand) on '**Leaf Vasculature and Epidermal Features in Gleichenoid Ferns**', and brought several interesting features. Soon after there were the oral presentations.

After the lunch break, the fourth lead lecture was delivered by **Dr. M. K. Seth** (Himachal Pradesh University, Shimla) on '**Peculiar Features of Pteridophytes and Peculiar Pteridophytes**' .

He brought out some interesting facts and discussed fertilization in Pteridophytes, nitrogen fixation in *Azolla*.

The next lecture was delivered by **Prof. A. S. Ahluwalia**, Department of Botany, Panjab University, Chandigarh on '**Azolla Biology and Its Potential in Environment Conservation**'. He emphasized that *Azolla* is one such plant that accumulates heavy metals such as nickel, cadmium, chromium and mercury. Its biomass is easy to harvest and desiccates very fast. These characteristics make it a perfect candidate for bioremediation systems although it is always important to assess the potential impact of introducing a new species into an ecosystem. This aquatic fern also improves upon environment by reducing the load of chemical fertilizers in the fields thereby improving upon the texture and nutrient make-up of the soil/water.

The last lead lecture of Day 2 was by **Dr. Hit Kishore Goswami**, (Retd. Professor of Genetics, Bhopal University, Bhopal). It concerned an important issue on '**Fern Farming: a Noble Challenge**'. He explained the problems and prospects involved in Fern Farming and that it can be a great Plant-Industry for Pharmaceutical companies and can earn huge amount of revenue if cultivation is done on scientific recommendations.

Valedictory Function:

Er. Agarwal, EMU, DRDO, Pashan, Pune was the Chief Guest at the Valedictory Session. Dr. B. D. Sharma (President, Indian Fern Society), Prof. S.C. Verma (Editor-in-Chief, Indian Fern Journal), Prof. S. P. Khullar (Secretary, Indian Fern Society), Dr. P. Lakshminarasimhan (Co-ordinator) and Dr. A. Benniamin (Organizing Secretary) were the Guests of Honour. **Dr. J. Jayanthi**, Scientist D, WRC, BSI, Pune, welcomed all the dignitaries on the dais. Dr. P. Lakshminarasimhan summarized the symposium sessions briefly to apprise the chief guest. The Chief Guest, Er. Aggarwal, appreciated the efforts taken by BSI and IFS to popularise the importance of pteridophytes and raised the hope of further augmentation of such activities at various different BSI centres. During the Valedictory session three Prizes each were announced for Oral and Poster Presentations and were presented by the Chief Guest. The recipients of Oral Presentation were Dr. M. Shunmuga Sundari, Young Scientist, University of Pune (first prize), Dr. Sachin Patil (second prize), and Dr. S. D. Shaikh (third prize). For Poster Presentation the recipients were Dr. Brijesh Kumar, BSI, Dehra Dun (first Prize), Dr. M. Shunmuga Sundari (second prize), and Dr. K D Chawla (third Prize). All the distinguished pteridologists at the dais shared their views about the symposium and congratulated Botanical Survey of India and the Indian Fern Society for conducting such a wonderful National Symposium on Pteridophytes 2017. The awards announced at the joint Executive Council and General Body meeting of the Indian Fern Society were presented..Dr Paramjit Singh, Director, Botanical Survey of India, Howrah and Dr. P. Lakshminarasimhan, Scientist E b& Head of Office, BSI, Pune were decorated by the Indian Fern Society by making them Honorary Fellows of the Society. Dr Benniman received the award on behalf of Dr Paramjit Singh, the Director. The **Life Time Achievement Award for the year 2016 was awarded to Prof P K Rajagopal**, Udipi and for the year 2017 to Prof (Mrs.) H Cheema, Chandigarh. Dr Sarvesh Kumar, Alahabad; Dr M S Sundari, Pune and Dr. M Johnson Pallayamkottai were presented The **S S Bir Gold Medal in Pteridology** . Prof Dominic Rajkumar, Gorakhpur, Dr S N Purohit, (Jodhpur) and Dr Alka Kumari, Lucknow were **Elected Fellows** of the Indian Fern Society.

Dr. N. Punetha, Dr. Raju Antony, TBGRI, Trivandrum, Dr. B. L. Yadav, Rajasthan and Dr. B. K. Chawla gave their feed-back by saying that the National Symposium was very well organised, well-coordinated, and the organizers deserved congratulations. They expressed that all the sessions were very informative and the lead lectures were inspiring, and that the deliberations would definitely be helpful in carry out curiosity-driven taxonomic, reproductive biology and experimental research on Indian pteridophytes.

Finally, **Dr. J. S. Jalal**, Scientist, Botanical Survey of India, Pune, proposed the Vote of Thanks and the programme concluded by 'Pasayadan' (which literally means 'offerings' composed by a well-known Saint in Maharashtra, Sant Dnyaneswar), and followed by the National Anthem.

INDIAN FERN SOCIETY AWARDS

At the joint meeting of the Executive council and the General Body meeting of the Indian Fern Society on March 4, 2017 at Pune, the following Awards of the Society were announced and later presented during the :

Honorary Fellow:

1. Dr. Paramjit Singh, Director, Botanical Survey of India, Howrah.
2. Dr. P. Lakshminarasimhan, Scientist E b& Head of Office, BSI, Pune

Life Time Achievement Award:

1. Prof P. K. Rajagopal, Udipi 2016
2. Prof (Mrs.) H Cheema, Chandigarh 2017

Elected Fellows:

1. Mr. C. R. Fraser-Jenkins
2. Prof Dominic Rajkumar, Gorakhpur
3. Dr S N Purohit,
4. Dr Alka Kumari, Lucknow

Gold Medal:

1. Dr Sarvesh Kumar, Alahabad
2. Dr M. S. Sundari, Pune
3. Dr. M Johnson, Pallayamkottai

Certificate of Merit

Dr. Shashank Kumar Singh, Gorakhpur

Secretary-Treasurer
Indian Fern Society

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on 3-4th March 2017 at IISER, Pune.



Introduced the guests by **Dr. Rashmi Dubey**



Dignitaries on the Diaz



Felicitation to **Mr. Achyut Gokhale**
(Ex – Secretary of Govt. of India)



Welcome speech by
Dr. P. Lakshminarasiman – Co
Ordinator



About the Symposium by
Dr. A. Benniamin, Organizing
Secretary



About the Indian Fern Society by
Dr. S.P. Khullar, Secretary, Indian Fern
Society



Abstract Book released by **Mr. Achyut Gokhale** (Ex – Secretary of Govt. of India),



A New Book Released ; An
Annotated Pteridophytes Checklist
of India Part -1 Released by
S.P. Khullar, Secretary, IFJ



Chief guest **Mr. Achyut Gokhale** –
Introductory speech



Inaugural Function Vote of thanks by
Dr. J. Jayanthi



Presidential Address by
B.D. Sharma



Keynote Address by **Prof. S.C. Verma**



Lead Lecture -1 by **Dr.S.P.Khullar**



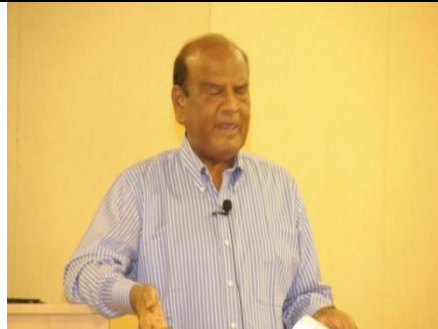
Lead Lecture -2 by **Dr. R. Mukhopadhyay**



Lead Lecture - 3 by **Dr.Ashwanikumar**



Lead Lecture – 4 by **Dr.P.B.Khare**



Lead Lecture -5 by **Dr.S.C.Srivastava**



Lead Lecture -6 by **Dr.P.K.Rajagopal**



Lead Lecture - 7 by **Dr.H.C.Chemma**



Lead lecture -8 **Dr.V.Irudayaraj**



Lead Lecture – 9 by **Dr. Prof.A S Ahluwalia**



Lead Lecture -10 by **Dr.N.Punetha**



Lead Lecture -11 by **Dr.M.K.Seth**



Lead Lecture -12 by **Dr.H.K.Goswami**





Oral Presentation by the Participants



Chair persons during oral presentations



Indian Fern Society - Executive Committee Members Meeting

Felicitation to Mr. Rinchen Dorji (Bhutan)



Poster Presentations



Valedictory function



Oral First Prize –Dr.M.S.Sundari



Oral second Prize –Dr.Sachin Patil



Oral third Prize - Dr. S. D. Shaikh



Life time Achievement Award to Dr. P.K.Rajagopal by Indian Fern Society



Life time Achievement Award to Dr. H.K.Cheema by IFJ



Honorary Fellow Award –DR.Dominic Rajkumar



Honorary Fellows Award



Certificate of Merit Award



Certificate of Merit Award



Feedback by the Participants



Lunch Break



Group Photo



Vote of Thanks by Dr.J.S.Jalal