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**BICENTENARY CELEBRATION OF THE  
INDIAN BOTANIC GARDEN  
—A PICTORIAL GLIMPSE**

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**Compiled & edited :  
U.P. Samaddar  
B. Roy**

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**Botanical Survey of India**

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Cover Photos : Top : Monument in honour of Robert Kyd

Bottom : Giant Water Lily [*Victoria amazonica* (Peepp.) Sow.]

—One of the attractions of the Garden

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## **Foreword**

It was the year 1987 when the Indian Botanic Garden set to create another record in annals of the history of Botanic Gardens. Feeling of pride and spirit of gayness seemed to be never ending as the celebration to commemorate the glorious existence of 200 years of the Indian Botanic Garden was observed in a befitting manner.

Designed initially with 310 acres of land, the idea of founding a Garden with the aims of trading in spices, plant products and timber for ship-building was due to the zeal of Lt. Col. Robert Kyd and it has now been playing an important role in the economic development of India by introducing, improving and distributing plants to various parts of the country. One of the famous Botanical Gardens of the world with spectacular scientific treasures, the Garden is considered to be the most important institution in Asia for research in Botanical Sciences and in matters of environmental concern.

A number of programmes to celebrate the bicentenary with the help and co-ordination of the members of an Organising Committee formed for the purpose were carried out. More than 5000 people from all walks of life, including the staff members of Botanical Survey of India, graced the occasion.

This publication presents an enlightening pictorial view of the different moments of the celebrations like ceremonial inauguration, planting of sapling, various exhibitions, awareness creation and a seminar on "Man, Plant & City"

I wish to congratulate all members of the Organising Committee, participants and Shri U. P. Samaddar and Shri B. Roy in particular for their enthusiasm and efforts in preparing this publication.

Botanical Survey of India  
Calcutta  
June 5, 1994.

P. K. Hajra  
*Director*

## **A few words**

In this publication a humble attempt is made to provide a glimpse on the various events organized by the Botanical Survey of India on the bicentenary celebration of the Indian Botanic Garden, one of the oldest of its kind in the world and the largest in South East Asia.

For any establishment, 200 years of its existence becomes a memorable and momentous occasion. The Indian Botanic Garden attained new heights with the passing of each year throughout this long history which is filled with examples of its pioneering role and significant contributions in different disciplines of botanical research. The researches in the fields of plant introduction and acclimatisation, agriculture, horticulture, forestry and crop plants of great commercial value undertaken in this Garden have largely contributed to the economy of the region.

In the recent years, the Garden, in addition to its traditional researches in plant introduction, taxonomy, etc., has taken up programmes on *ex situ* conservation and multiplication of rare and endangered species of flora and public awareness on the importance and need for conservation of our natural plant wealth.

The celebration connected with the bicentenary of the Indian Botanic Garden were held both in the Garden and in the Industrial Section, Indian Museum, Calcutta during the year 1987-1988 by the Botanical Survey of India with the active participation and help of several distinguished persons and members of the staff of the Survey.

The events, viz., Inaugural Ceremony, Planting of Bicentenary Sapling, Exhibition on the Indian Botanic Garden, Students' Day & Mass Awareness Programme on Plant Conservation, Sit & Draw Competition for school children, Exhibition with waste plant parts from the Garden, and the Seminar on 'Man, Plant and City' have been depicted through

photographs and write-ups included in this book. The Garden drew nearly two lakh visitors from within the country and abroad during the period. A symposium on "Higher education is not possible in vernacular language" was organised on the 5th June, 1989.

Efforts have been made to include speeches, deliberations, felicitations, messages and good wishes from important persons, dignitaries, citizens and national and international institutions. Many well-wishers and members of the Staff of the Botanical Survey of India have rendered active help to the Organising Committee in performing the functions.

Since the bicentenary is a foot print of the dedicated services rendered by several members of the Botanical Survey of India, we shall consider our effort duly rewarded if this book prompts the reader to know more about the Indian Botanic Garden, its plants and bring about awareness to preserve this natural wealth.

We thank Sarvashri A. R. K. Sastry, Joint Director, S. C. Pal, Publication Officer, R. G. Bhakta & H. M. Mukherjee, Publication Assistants, S. Roy & S. K. Sur, Sr. Proof-Readers, D. Sardar & A. K. Chatterjee, Proof readers and other members of the staff of Publication Section, Botanical Survey of India, Calcutta for their help in processing the publication of this book.

We also extend our thanks to Shri Subash Ghosh, Shri Amit Ghosh and Shri Nilim Shyam for taking photographs of the different events. Finally we are thankful to many of our colleagues, friends and well-wishers who have also assisted during the celebration.

Last but not the least, we are thankful to Shri Raj Kumar and Shri Deepak Laria of the Laser Computers & Co., Calcutta-700 001 and their staff for printing this book.

Botanical Survey of India  
Indian Botanic Garden  
Sibpur, Howrah.

U. P. Samaddar  
B. Roy

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## **Highlights of the Bicentenary Programme**

- \* The following programmes were organized to conclude the bicentenary of the Indian Botanic Garden.
- \* Press Conference was held on the 19th August, 1988 to announce the programmes.
- \* Special Publications to mark the occasion.
- \* Inaugural ceremony was held on the 16th September, 1988 with ceremonial planting of a sapling of *Agathis robusta* Bailey.
- \* Inauguration of an exhibition on the Indian Botanic Garden.
- \* Distribution of saplings to the public.
- \* Observance of Students' Day A mass awareness campaign programme held during the months: November, 1988 - March, 1989.
- \* Conducted trips / excursions in the Garden.
- \* Sit & Draw competition for School Children on the 8th December, 1988.
- \* All India Seminar on 'Man, Plant & City' held from 27th - 29th January, 1989.
- \* Symposium on 'Higher Education is not possible in vernacular languages' on 5th June, 1989.

## **MESSAGES**



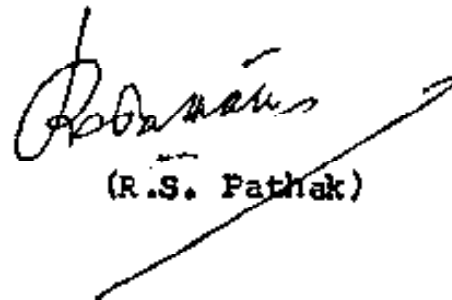
Supreme Court of India  
New Delhi

R. S. PATHAK  
CHIEF JUSTICE OF INDIA

29 August, 1988

MESSAGE

I am glad to learn that the Indian Botanic Garden, Calcutta is planning to celebrate its Bi-centenary during September to December, 1988. I send my good wishes for the success of the celebrations.

  
(R.S. Pathak)



## PRIME MINISTER

### MESSAGE

Fast eroding and depleting natural resources, flora and fauna, concern every citizen of this world. The mere enactment of laws for the preservation and conservation of the environment is not enough. What is more important is that there should be a continuous endeavour to make each and every citizen aware of the need for protecting our natural heritage and ensuring harmony between the needs of the people and the imperatives of ecology. In the various environmental activities to be undertaken, there should be a proper mix of fuel and fodder development, afforestation of degraded forest lands, and the preservation and enriching of existing greenery.

The Indian Botanic Garden, which is the pride of our country, has over the years acted as a great source of inspiration to many scholars. It has provided immensely varied opportunities for research scholars to study and analyse different plants for the benefit of humanity.

I am glad to know that the bicentenary of the Indian Botanic Garden is being organised this year. I wish it all success.

A handwritten signature in black ink, appearing to be 'Rajiv Gandhi'.

New Delhi  
September 15, 1988

Letter, dated North Terrace, Adelaide, South Australia 5000, the 26th September, 1988.

From : Dr. Brian Morley, F.L.S., Director and Secretary-General, I.A.B.G.,  
The Botanic Gardens of Adelaide and State Herbarium.

The Board and Staff of the Botanic Gardens of Adelaide and State Herbarium send thier congratulations to the Indian Botanic Garden and people of India on the 200th Anniversary of the founding of their famous botanic garden.

Botanic Gardens now have as large a contribution to make to modern society as when the Indian Botanic Garden was founded. We look forward to a continuation of the valuable work for which the Indian Botanic Garden has become well known.

\*

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\*

Letter, dated Berlin, the 28th September, 1988.

From : Prof. Dr. H. Scholz, Botanischer Garten und Botanisches Museum,  
Berlin-Dahlem.

The Berlin Botanic Garden has great pleasure in sending his congratulations on the occasion of the Bi-Centennial Celebrations of the Indian Botanic Garden, Howrah.

Letter, dated Murrells Inlet, South Carolina 29576 (803) 237- 4218, the  
28th September, 1988.

From : Gurdon L. Tarbox, Jr. Director, Brookgreen Gardens.

With pleasure I congratulate you on the bicentennial existence of the Indian Botanic Garden, Howrah, and the session on "Man, Plant and City". The creation, maintenance and continuing existence of botanical gardens throughout the world are an important endeavor to create a public awareness of the importance of plants to the life of man and to research which has the opportunity to raise the standard of living of the world's people and to preserve the ecological balances which make the earth habitable.

While we are unable to send a representative from Brookgreen Gardens our thoughts and spirit are with you on this memorable occasion.

With best wishes for a successful celebration.

Letter, dated 3501 New York Ave., N.L. Washington, D.C., 20002, the 6th  
October, 1988.

From : Erik A. Neumann, Head, Education and Public Services, United  
States Department of Agriculture, Agricultural Research Service.

On behalf of the staff of the United States National Arboretum, I  
would like to extend our most heartfelt congratulations on the occasion  
of the Bi-Centennial existence of the Indian Botanic Garden, Howrah.

Our National Arboretum is a young Institution, being established in  
1927, only a little more than sixty years ago. The United States, itself, is a  
young country. We celebrated our Bi- Centennial as a nation in 1976. As  
a part of this celebration we received a gift of bonsai from the Nippon  
Bonsai Association of Japan. One of the bonsai in this collection was a  
350 year old Japanese white Pine. At the time of this gift this pine was  
one hundred fifty years older than our nation.

Although I have not had the pleasure of visiting the Indian Botanic  
Garden, Howrah, I am sure that there are probably plants on your  
grounds which are as old as your garden and more than likely a great  
deal older.

While we are unable to send a representative to your Bi- Centennial  
celebration, we do want to offer our sincere congratulations on this  
historic occasion. Our thoughts will be with you as you celebrate. I am  
also enclosing a paper on the National Arboretum which I hope you can  
use as a part of the commemorative volume.

Letter, dated the 6th October 1988.

From : Xiao Ying-xiao, The Deputy Director, Hortus Botanicus  
Austro-sinensis Guangzhou, China.

I was much delighted to learn that citizens of India have planned to celebrate the BI-Centennial existence of Indian Botanic Garden, regarding this, a programme will be held as well. Please accept my warmest congratulation.

You have my best wish for your continued success.

\*

\*

\*

Letter, dated Washington, D.C. 20013-7127. The 23rd December, 1988.

From : Bennie C. Keel, Departmental Consulting Archaeologist, United  
States Department of the Interior, National Park Service.

Thank you for informing me that you have re-scheduled the dates for the symposium related to your celebration. Regrettably, even with this slightly expanded time frame, I am committed to activities here in the United States and will be unable to attend. I wish you the most success in your activities.

Again, accept my apologies for not being able to participate.



Letter, dated Munich, the 7th October, 1988.

From : Prof. Dr. Franz Schotz, Director, Botanischer Garten  
Munchen-Nymphenburg Menzinger Str. 61, D-8000 Munchen 19  
(Fed. Rep. of Germany)

The Director and Staff of Munich Botanical Garden send their sincerest congratulations to the great Indian Botanical Garden, Howrah, for its bi-centennial existence and its glorious history. They wish that the importance it used to have in the past will not grow less in the future and that it will continue to act as a mediator between man and plant to the good of both, to the benefit of science and education as well as to the pleasure of its visitors.

We deeply regret not to be able to participate personally at the bicentenary celebration.

\*

\*

\*

Letter, dated Ukraine, the 11th October 1988.

From : Dr. Grodzinsky A.M., Director of the Central Republic Botanical  
Garden of the Ukraine, U.S.S.R.

Thank you very much for your letter from 12.08.1988 and invitation to celebration of Bi-Centenary existence of Indian Botanic Garden, Howrah.

Unfortunately, lack of time not permit me or my colleague to attend the Session and Seminar.

Let us offer our warmest congratulations and to wish your remarkable botanical garden successful progress.

Letter, dated Surrey, GU23 6QB, the 13th October 1988.

From : P. McMillan Browse, Director, The Royal Horticultural Society's  
Garden, Wisley, Woking, Dutttry, GU23 6QB.

Thank you for your letter dated 21st August 1988 concerning the above, which has only recently been received. I regret that it is not possible for us to join you on this occasion.

The Royal Horticultural Society will certainly wish to be associated with all felicitations and congratulations on this memorable occasion for your establishment and will wish to offer you every opportunity for success in the future.

Best wishes for your seminar and every success.

\*

\*

\*

Letter, dated Old Shire Hall, Durham, the 8th November, 1988.

From : Professor F.G.T. Holliday, Vice-Chancellor and Warden, C.B.E.,  
D.L., F.R.S.E., University of Durham.

It is with great pleasure that we send congratulations and future best wishes to mark the occasion of the Indian Botanic Garden Bi-Centenary celebration, from the Botanic Garden, Durham University, the youngest English University Botanic Garden.

From : Royal Botanic Gardens, Kew, U.K.

“In the 200 years of its existence the Indian Botanic Garden has played an enormously important part in developing the economic botany in India as well as other parts of the world. It is to be hoped that the Indian Botanic Garden will continue to hold its high position in the scientific world and that relationships with the Royal Botanic Gardens, Kew will continue to be warm and profitable in the development and distributions of economic plants”

\* \* \*

From : Xu Zaifer, Director, Yunnan Institute of Tropical Botany, Chinese Academy of Sciences, China

“I would like to have this opportunity to send my congratulations to the Bicentenary of Indian Botanic Garden”

\* \* \*

From : Dr. Gehillean T. Prance, Senior Vice President, New York Botanic Garden, U.S.A.

“We send our congratulations and express our admiration of the active and varied programs of the Indian Botanic Garden and we look forward to the next hundred years of collaboration between our institutions”

\* \* \*

From : Dr. Wycherley, Director, Kings Park & Botanic Garden, Australia

“I am personally very much aware of the significant contribution by the Indian Botanic Garden and the Botanical survey of India as a result of my service in the Rubber Research Institute of Malaya and now in King’s Park and Botanical Garden”

From : Prof. Barradas, Estades Nacional de Plantos Elvas, Portugal

“I wish to express you my best wishes for a successful work of the most reputed Indian Botanic Garden. Both my colleagues and I wish an outstanding celebrations for the Bicentenary of your world famous scientific institution”

\*

\*

\*

From : Dr. Stephen K. M. Tims, Director, Brooklyn Botanic Garden, New York, U.S.A.

“The President, Mr. Donald Moore and I send our best wishes for a most successful celebrations of the Bicentenary of the Indian Botanic Garden. May it continue to prosper in the next 100 years”

\*

\*

\*

From : Prof. L. N. Andrev, Director, Main Botanic Garden, USSR.

“Good scientific and friendly contracts have been made between the scientists of the Main Botanical Garden and Indian botanists and particularly those who work in the Calcutta botanic garden the bicentennial jubilee of which is a great and remarkable jubilee for the botanists of the Soviet Union and the whole world”

## **Inaugural Ceremony**

The inauguration of the final part of the bicentenary celebration of the Indian Botanic Garden was held on the September 16, 1988 at the K. P. Biswas Hall in the Indian Botanic Garden. About 5000 people including members of the staff of the Botanical Survey of India were present on the occasion. The function started with an invocation presented by Smt. Swapna Ghosal and party. The session was presided by Prof. Manindra Mohan Chakraborty, former Vice-Chancellor, Jadavpur University, Calcutta (President, Organising Committee, IBG Bicentenary). Prof. (Mrs.) Asima Chatterjee, Programme Co-ordinator, UGC Programme Centre for Advanced Studies of Natural Products, Calcutta University and Member, Rajya Sabha, as Chief Guest, inaugurated the celebration by switching on the 200 electric candles to lighting. Dr. M. P. Nayar, Director, Botanical Survey of India welcomed the guests and participants to the meeting. Announcement of the programme of functions was presented by Dr. U. C. Bhattacharyya, Deputy Director, Indian Botanic Garden and the introductory speech was made by Dr. R. K. Chakraverty, Deputy Director, Headquarters, Botanical Survey of India. Shri U. P. Samaddar presented an address on behalf of the members of staff of the Survey.

Finally, Dr. B. D. Sharma, Deputy Director, Central National Herbarium offered vote of thanks to all those who took part in the function.

Among other dignitaries present were Prof. Tarak Mohan Das, Dean of Faculty of Agriculture, Calcutta University, Shri Alokudut Das, Mayor, Howrah Municipal Corporation, Prof. Santosh Bhattacharya, former Vice Chancellor, Calcutta University and Prof. Arabindo Poddar, former Head of the department of English, Rabindra Bharati University, to mention a few of them.

**Ceremonial planting of the sapling of *Agathis robusta***

To perpetuate the memory on the bicentenary of the Indian Botanic Garden, a sapling of the *Agathis robusta* Bailey was ceremonially planted in the lawns opposite to the K. P. Biswas Hall in the Indian Botanic Garden by Prof. Manindra Mohan Chakrabarty, former Vice-Chancellor, Jadavpur University, Calcutta who was invited to preside over during the day's function. This was followed by distribution of several seedlings of different species of horticulture raised in the Garden nurseries to the distinguished guests and other participants.



Gate-way to the nature - Indian Botanic Garden, in the service of the country and the mankind – celebrating the Bicentenary



Invocation is being presented by Smt. Swapna Ghosal and her party in the Inaugural Ceremony.



Prof. M. M. Chakrabarty being felicitated by the woman employee of the I.B.G. at the function.



Announcement of the Inaugural Ceremony of the Bicentenary Celebration of the Indian Botanic Garden being read by Dr. U. C. Bhattacharyya. Seen in the picture (L-R) : Prof. M. M. Chakrabarty, Prof. (Smt.) Asima Chatterjee, Dr. M. P. Nayar and Prof. T. K. Basu. Standing (L-R) : Dr. R. B. Ghosh, Dr. A. K. Sarkar and Dr. R. K. Chakraverty





Guests and Participants being welcomed by Dr. M. P. Nayar, Director, Botanical Survey of India at the ceremony.



Inaugural address delivered by Prof. (Smt.) Asima Chatterjee on the occasion



Speech delivered by Shri U. P. Samaddar on behalf of the staff members, Botanical Survey of India.



Ceremonial planting of *Agathis robusta* by Prof. M. M. Chakrabarty during the inaugural function.

**Welcome address by Dr. M. P. Nayar, Director,  
Botanical Survey of India on 16th September, 1988  
(Bicentenary of Indian Botanic Garden)**

On this auspicious occasion as we stand on the threshold of completion of bicentenary of this historic garden, it is my proud privilege on behalf of the Botanical Survey of India to welcome warmly our distinguished guests, honoured professors, scientists, our retired colleagues and all well wishers of this garden.

We are fortunate to have a galaxy of distinguished guests who need no introduction, excellencies Mayors, members of Legislature, Vice-Chancellors, Heads of Institutions. I am indeed thankful to them for sparing their valuable time.

We are having on the dais distinguished academicians, who again are well known to you. I am thankful to Prof. (Mrs.) Asima Chatterjee, distinguished Professor of Chemistry who is closely connected with plants and with this Garden for more than three decades, for accepting our invitation. I thank Prof. M. M. Chakrabarty, former Vice-Chancellor of Jadavpur University, a doyen among chemists, vitally interested in the environment, for accepting our invitation to plant the bicentenary sapling. To Prof. T. M. Das who is closely connected with the role of plants in mitigating pollution, I am thankful for agreeing to open the exhibition.

Over two centuries the Indian Botanic Garden has served our nation in immense measure in providing plant resources that almost all the cash crops which India is blessed with today and earn foreign exchange, were first tried and experimented in this garden : i.e. Tea, Rubber, Cinchona, Tobacco. I wish to say that this Garden has showed the way to earn bread for several generations to come.

Again over two centuries this Garden served the scientific community in shaping the development of botany in India through its scientific contributions on the Flora of India and served as a nodal point with its vast collections of living plants and rich reference collections of 1.5 million herbarium specimens.

Over the years, the custodians of this garden proudly preserved and enhanced the greenery of the Garden with its multistoried canopy of trees as if it is a tropical evergreen forest. We maintain a vast chain of lakes when wetlands are on the verge of disappearance and also pandanus, mangrove and estuarine flora, bamboo forests and unique palm collections. This is a garden of landscape beauty and not of artificial fountains, cement and bricks. This oasis of greenery of 272 acres, in the midst of highly urbanised Calcutta - Howrah twin cities serves as lungs giving fresh air and vitality.

As you are aware we are in an era of biological extinctions due to loss of habitat. It is estimated that we are losing 60 hectares of forest every minute throughout the world. This leads to soil erosion, loss of soil fertility and loss of biological diversity. In India the situation is grim and our forest cover is only 14% as per satellite imagery. Several steps are taken by the Government for the development of National Parks, Biosphere reserves and gardens.

The Flora of India is very rich in plant diversity and 10% of Indian flowering plants (i.e. about 1500 species) are considered as endangered. Botanical Survey of India has published Red Data Book enlisting the rare and threatened species. The present role of the garden is (1) to educate the public on why plants are important and why they need conservation, (2) undertake the gardening of endangered species and (3) to take the responsibility for conservation of local flora.

The bicentenary is an important event on the life history of an institution. In July, 1987 we inaugurated the bicentenary programmes of

the Indian Botanic Garden. As part of the programme we distributed saplings to schools and public. We published Bicentenary Commemoration Volume of Indian Botanic Garden wherein great Gardens of the world contributed scientific papers. Botanical Survey of India has launched a programme of writing the Flora of West Bengal and Flora of India series.

In order to strengthen infrastructural facilities, Ministry of Environment and Forests has sanctioned construction of Conservatories, Bicentenary exhibition rooms, Bicentenary Gate, Air conditioning of Central National Herbarium which houses valuable type specimens. Besides these, we are engaged in the renovation of lakes, historic buildings and a total of Rs. 242 lakhs has been sanctioned. We have developed Medicinal Plants Garden and it is proposed to construct one large Green House in the Garden. As part of Bicentenary Celebration, the Garden is organising following programmes in the coming months : conducted tours, educational programmes, film shows, children's day on 14th November, 1988, flower and foliage shows.

May I request you all to join in our celebrations and I again warmly welcome you to this Garden.

**Announcement of the inaugural ceremony  
by Dr. U. C. Bhattacharyya, Deputy Director,  
Indian Botanic Garden on the occasion of bicentenary  
celebration of the Indian Botanic Garden  
on September 16, 1988.**

Distinguished Guests, Ladies and Gentlemen,

As present In-charge of this prestigious and famous Botanic Garden it is my proud privilege to announce that the Botanical Survey of India have drawn up the programme to formally celebrate to-day the Inaugural function of the bicentenary of this famous Garden, under the final part of these celebrations, which had been initiated on the July 6, 1987. During the year-long programme of bicentenary of the Indian Botanic Garden, events related to scientific, developmental and recreational programmes, which include Flower Show, Conducted tours in the garden, Children's Day, etc. were drawn up and are being organised at intervals. Of these, Exhibitions, Flower Show, Conducted tours for public and student's education, are being planned in the coming months.

It is a matter of great satisfaction to all of us in the Botanical Survey of India that Scientists of eminence and several distinguished guests have responded to our invitation and have kindly come to grace the occasion and share our joy and happiness.

With these few words, I request Dr. R. K. Chakraverty, Deputy Director, Headquarters of the department to formally introduce the distinguished scientists and invitees to the gathering assembled here.

**Summary of Inaugural address delivered by  
Prof. (Smt.) Asima Chatterjee, Programme Co-ordinator,  
Centre of Advanced Studies on Natural Products,  
Calcutta University and Member, Rajya Sabha on the  
occasion of the bicentenary of the Indian Botanic  
Garden, Howrah on the September 16th, 1988**

Inaugurating the bicentenary of the Indian Botanic Garden, through ceremonial lighting of 200 lamps, Prof. (Smt.) Asima Chatterjee expressed her profound happiness on this celebration by the Botanical Survey of India. She vividly recalled and mentioned her close association for a long period with the Garden during her research and studies on different aspects with plants. She briefly dealt the important role the Garden played in development of plant taxonomy in India and also its contribution towards economic development in the country. Prof. (Smt.) Chatterjee pointed out that the Garden signifies the message on the vital need to study and conduct researches on plants, and inter-alia referred to the changing trends in natural ecosystems in the recent past and environmental degradation which are confronting mankind. She reminded the gathering on the imminent need to educate masses on the importance of developing and maintaining the Botanic Garden, its significance in plant conservation.

While extending her good wishes on this historic occasion, Prof. (Smt.) Chatterjee hoped that the Indian Botanic Garden would continue to play a key role in researches in plant taxonomy, economic botany and conservation of our declining floristic wealth and would serve as a living laboratory for students of botany for many more years to come.

She applauded the scientific researches and contributions in botany that have been made by the scientists of the Botanical Survey of India in general and of the Indian Botanic Garden in particular in the recent years in keeping with the best traditions laid by the earlier botanists who served the organisation.

**Address by Prof. M. M. Chakrabarty, Adviser, C. A. S. in  
Chemistry, Calcutta University and ex Vice Chancellor,  
Jadavpur University, on the occasion of the bicentenary  
celebration of Indian Botanic Garden, Howrah, on  
September 16, 1988.**

I am very happy to be associated in the Bi-centenary Celebration of the Indian Botanic Garden which is being celebrated under the auspices of the Botanical Survey of India. As it happens I have also been associated as a member of the Organising Committee and it was indeed my pleasure to observe that the authorities of the Botanical Survey of India and the employees have joined hands to organise this celebration.

I thank Dr. M.P. Nayar, Director, B.S.I. and all others who have organised this function to commemorate this great event.

Historically we have been serious minded about environment and the basic philosophy has been one of harmony with nature as against western concept of conflict with nature; unfortunately we followed the latter during the last 150 years or so.

In your invitation card you have very aptly quoted our Late Prime Minister Mrs. Indira Gandhi and I quote "The survival of man is dependent on the survival of animal and plant life". In fact it was our first Prime Minister Pandit Jawaharlal Nehru who way back in 1957 when he recognised the importance of having an ecological survey of the area in order to find out what the effect would be on the flora and fauna of the area before any river valley project or similar projects are launched.

Indeed, since then the importance of ecology has become to be recognised in the back drop of sustainability in development.



It has been recognised in recent years also that in an agricultural country like ours we have to have an integrated land use planning, possession of healthy cropland and grassland, the value of effective forest cover and therefore of wood-land and revegetation and of the importance of forestry in particular three broad types of forestry; namely Conservation, Production and Social Forestry.

The conservation forestry will cover natural vegetation in water sheds, fragile ecological areas and conservation areas like Biosphere Reserves, National Parks etc. where no commercial exploitation is allowed. Production or commercial and industrial forestry aims at meeting the raw material demands of all forest based industries.

In social, community or Agro-forestry which have similar or intergrading objectives and lastly the conservation of biological diversity of our country about which it is stated that our country is very rich with nearly 45,000 plant and 65,000 animal species. It is in this background that we have to view today the services of Indian Botanic Garden and the Botanical Survey of India.

The Indian Botanic Garden thanks to the Botanical Survey of India, has to a great extent been able to be a model for conservation of many plant species and also has been a nursery of propagation of many new plants that have revolutionised economic development of this country and many other countries. Thus Palm (*Elaeis guineensis*), Rubber seed (*Hevea brasiliensis*) were brought from South America, planted at Botanic Garden in this very soil and later transferred to territory now called Malaysia (Formerly Straits Settlements) where natural rubber and palm oil form the basis of industrial development. Generations of students have been brought to this garden to have a glimpse of the collection of rich flora not only of our country but those from the far off lands and have been trained in the science of botany, which forms the basis of agriculture which in its turn sustains us. A botanical garden has not only in its precincts the store-house or

knowledge which it has already acquired but also the knowledge to be acquired which can lead to the promotion of the further economic development. On a personal level, although I am a Chemist by training peripherally I have been influenced by this subject as it has been helpful in my studies of oil seeds which yields oils of different compositions which can be used in industries with benefit. Now that the society is alive about the importance of ecology, afforestation, new crops development and adoption of economic crops from other land I believe that Indian Botanic Garden will play an even more active role to play both for education and economic development. I would hope the Bicentenary Celebrations will be marked by further efforts in this direction and trust that the Botanical Survey of India will keep it the model it deserves to be.

I pray for the Botanic Garden to have many more centuries of useful existence in the service of the country.

Jai Hind.



Dr. T.M. Das overwhelmed by the unprecedented achievements of the I.B.G. through different themes after opening the exhibition.



Roxburgh House, built in 1795.



Old Herbarium building and the Library.



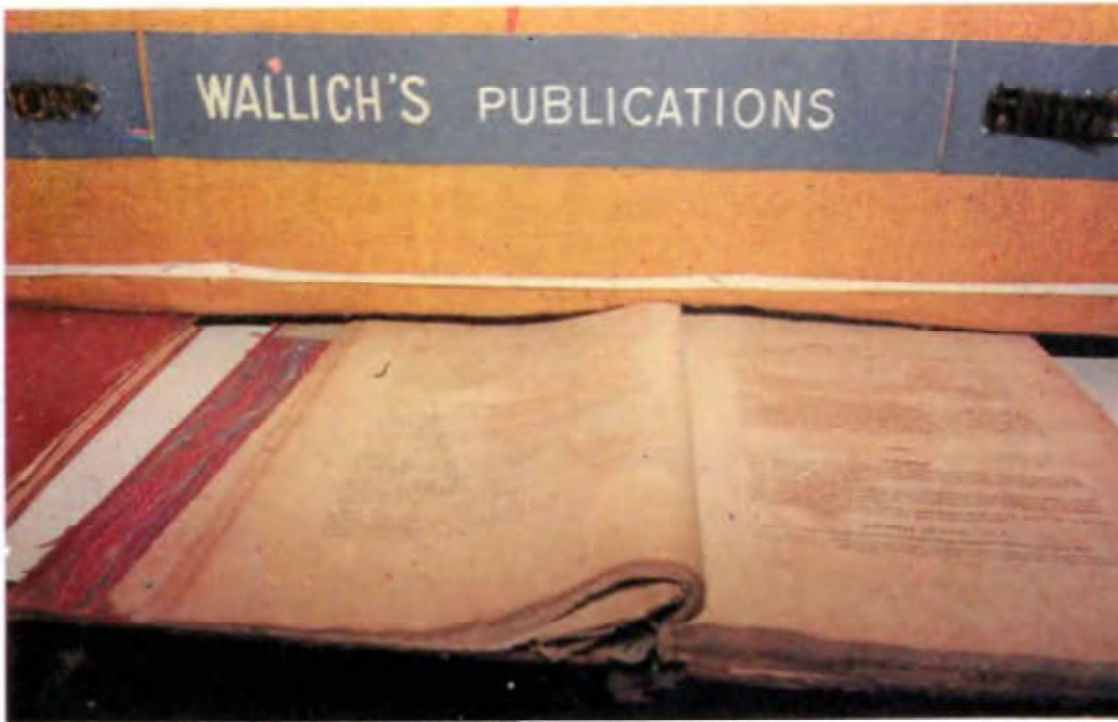
Central National Herbarium Building, built during (1965-1969) houses valuable materials for study of plants.



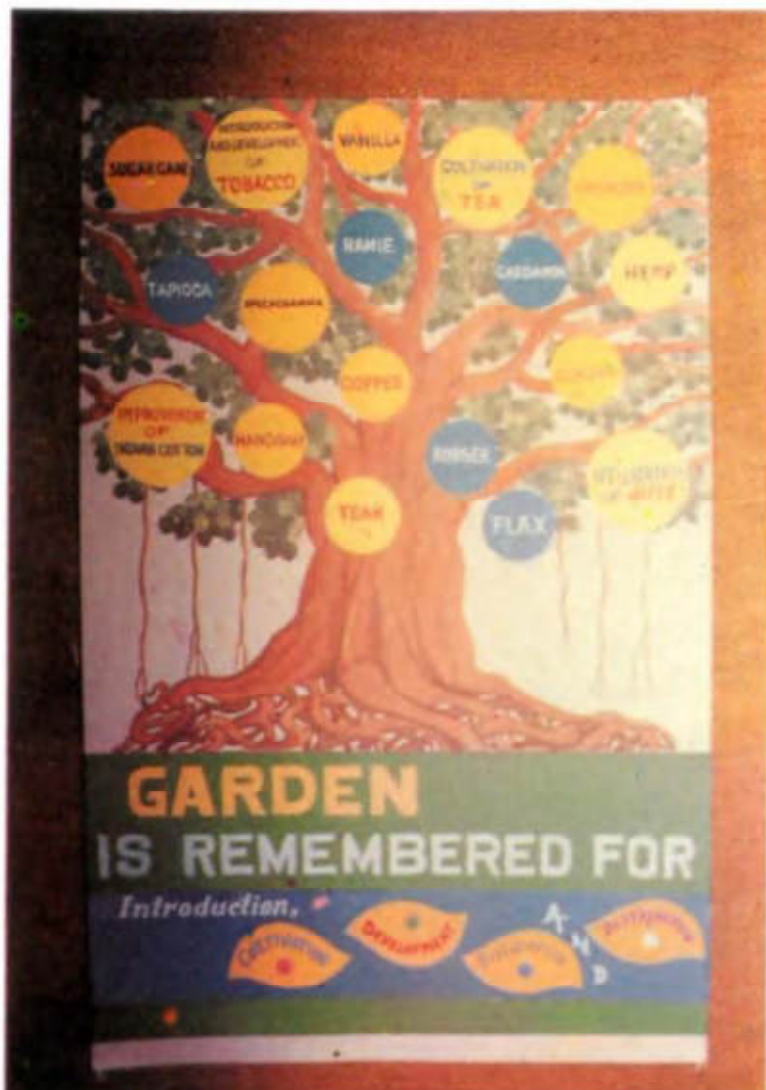
The Dome-shaped Glass Conservatory for Cacti and Succulents at the I.B.G



A portion of the exhibition – a smart way to enrich the knowledge about endangered, interesting plants and important publications.



Wallich's publications.



Display to mention the role of the Garden in the introduction, cultivation, development and distribution of Plant and Plant products.



Exhibition on Indian Botanic Garden at Central National Herbarium Building — one of the attraction of the Bicentenary celebration.



A Tea Plantation - Garden laid the foundation of the Cash Crop of India; *Thea chinensis* - the source of tea.



*Psilotum nudum* (L.)  
Beauv. of the I.B.G.



*Paphiopedillum villosum* (Lindl.) Stein — beautiful species (vulnerable status)  
among the Ladies Slipper Orchids at the National Orchidarium, Shillong.





Traveller's tree - *Ravenala madagascariensis* (Gmel) Senn. at the I.B.G.



"Krishnabol"  
(*Ficus krishnae* A.DC.)  
at the I.B.G.



The Double Coconut - *Lodoicea maldivica* (Gmel) Pers.



Cycad Grove with centuries old cycad trees at the I.B.G.

## **Address by Shri U. P. Samaddar on behalf of the employees of the Botanical Survey of India**

Distinguished participants, patrons, advisers, associates, members of the Organising Committee, colleagues, ladies and gentlemen :

On behalf of the employees of the Botanical Survey of India, I consider it to be an honour to first extend a warm welcome and secondly to convey our hearty congratulations to you all for being present on this historic occasion of celebration of bicentenary of the Indian Botanic Garden.

A new chapter in the history of Botany in India began when the initiative of Col. Robert Kyd to establish a botanic garden received green signal from the East India Company in London. Consequently, Col. Kyd founded this Botanic Garden in its present location in the year 1787, primarily to serve commercial and trading interests of the British in plants and plant products. The garden gradually grew into a scientific institution in botanical research, thanks to the interest and vision of those who developed it into its present position of prime importance in Southeast Asia. We are extremely fortunate to be able to celebrate the bicentenary of this Garden this year.

I may mention that in the course of its 200 years of existence, this Botanic Garden had to pass through testing periods too. Natural calamities like severe cyclonic storms uprooted many valuable and old trees and waist deep flood and tidal waters from the adjacent river Hooghly inflicted devastating damage on the entire garden resulting in the loss of many interesting plants. It is on record that a Curator of the Garden lost his life when attacked and killed by a tigress which strayed into the Garden. In spite of such heavy odds and adversities the Garden grew from strength to strength and moved forward keeping pace with the phenomenal progress in botanical research, modernisation and

further development in its plant holdings with addition of many interesting species from time to time. All this could be possible due to the dedicated work and care of all those employees and supervisory persons who served in the Gardens all these years. It is no exaggeration to mention that the Indian Botanic Garden with its key role in introduction and cultivation of many agriculturally and commercially valuable plants, has occupied a place of significance in its own way, in developing the economic fabric in our country.

The hope for survival of life on earth, as is well known, is closely linked to the existence of plants. Recent trends in rapid decline of vast stretches of forests due to a variety of reasons including the use of devastating arsenal in warfares is causing serious concern all over the world. The protective role of Botanic Gardens in conserving plant diversity is emerging as the best alternative against this backdrop. The staff members of this organisation raised their voice and joined hands with other peace and plant loving citizens in spearheading campaigns for public awareness on plant conservation and environmental protection through exhibitions, seminars, etc.

I may say that the survival and steady progress of the Garden over these two hundred years is a dream come true for all those who strived for this garden all these years and we all wish that this institution should be considered as to belong to us all as "Our Indian Botanic Garden" We seek your helping hand for its proper preservation and continuance for future generations to benefit from it and to celebrate many more centenary celebrations.

With these words I conclude my speech and express my thanks to you all for being with us on this happy occasion.

**Presentation of vote of thanks by Dr. B.D. Sharma,  
Deputy Director, Botanical Survey of India**

On behalf of Dr. M.P. Nayar, Director and my colleagues in the Botanical Survey of India, I consider it as an honour to propose a hearty vote of thanks to Dr. (Mrs.) Asima Chatterjee, F.N.A., Member, Rajya Sabha and Programme Coordinator, UGC Programme of Centre for Advanced Studies on Natural Products, Calcutta University for kindly accepting our invitation and presenting inaugural address for today's function. We are very grateful for her very kind appreciation of the scientific work being carried out in this organisation and also for the valuable suggestions. I express our sincere thanks and gratitude to Prof. Manindra Mohan Chakrabarty, former Vice-Chancellor, Jadavpur University for readily accepting our invitation and to be with us in today's function as the Chief Guest. We are indeed very obliged and thankful to Shri Alok Dut Das, Mayor, Howrah Municipal Corporation and to Dr. Santosh Bhattacharyya for gracing the occasion; to Prof. T.M. Das, Chief, Programme on Environmental Sciences, Life Science Centre, Calcutta University for readily accepting our request to inaugurate the Botanical Survey of India exhibition on the Indian Botanic Garden.

I also take this opportunity to express our sincere thanks to Dr. M. P. Nayar, Director, Botanical Survey of India for his keen interest and to all my fellow staff members for their untiring efforts and cooperation in organising the various programmes to celebrate the bicentenary celebrations of the Indian Botanic Garden without whose help the programmes would not have been so eventful and successful.

I also extend our sincere thanks to the authorities of the local Colleges and Schools who have sent their students in large numbers to the Garden to know of the rich heritage through visits and exhibitions organised in this Garden. The Central Public Works Department have helped us in erecting and decorating stages in the Garden; the Police

department have extended cooperation in maintaining order; we thank them sincerely. Our special thanks are also due to the Akashvani, Doordarshan Kendra in Calcutta and to the representatives of different Newspapers in Calcutta for their interest and steps for media coverage of today's function.

Finally, I thank the ex-members of staff of the Survey for their presence, members of the Organising Committee of the bicentenary celebration and all others who have taken interest and extended cooperation in making the function a success.

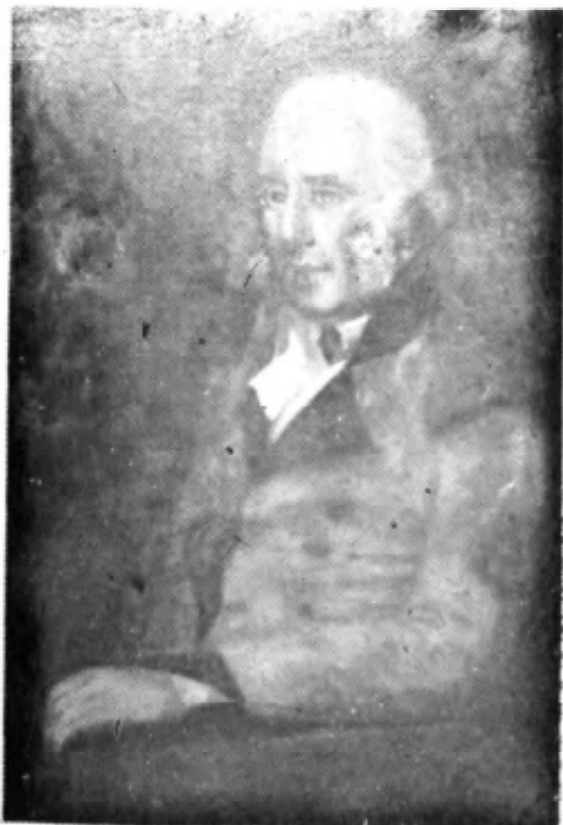
## **The Indian Botanic Garden : Some Significant Milestones**

The Indian Botanic Garden at Sibpur, Howrah established under the patronage of the erstwhile East India Company, and variously known at different periods of time as the East India Company's Garden, the Royal Botanic Garden and the Indian Botanic Garden since 1950, held an important place in the history of Howrah district with its distinctive role in the scientific research and economic development. The Garden is one amongst the oldest and largest botanic gardens in the world, and is situated on the west bank of the river Hooghly in the vicinity of Calcutta, the one time second largest city under the former British Empire. It has great similarity to that of the Royal Botanic Garden at Kew which is also on the bank of the river Thames near London but is almost 50 years younger to the Indian Botanic Garden. The premier institution of botanical research in the country though started with a little over 300 acres of land at present spans about 273 acres (110 ha). The establishment of the Garden was due to the efforts of Colonel Robert Kyd of the Bengal Infantry, the then Superintendent of the Hon'ble Company's Dockyard and Secretary to the Military Board in Fort William, Calcutta. He had a private garden at Shalimar, Howrah with many plants of economic importance. The recurrent famines and shortage of food and also the need for cultivation of spices and introduction of economically important plants to alleviate the sufferings of the people prompted the horticulturist Robert Kyd who suggested on the 1st January, 1786 to Sir John Macpherson, then officiating Governor-General in the absence of Warren Hastings to establish a botanic Garden. Col. Kyd's proposal was considered on 1st July, 1787 and with the subsequent approval of the Court of Directors in England, the present site was acquired. The Garden, since then, became the property of the East India Company which was a trading company, occupying a premier position of arbiter in the Indian Sub-Continent, but under the control of the Governor General in Council. The garden then

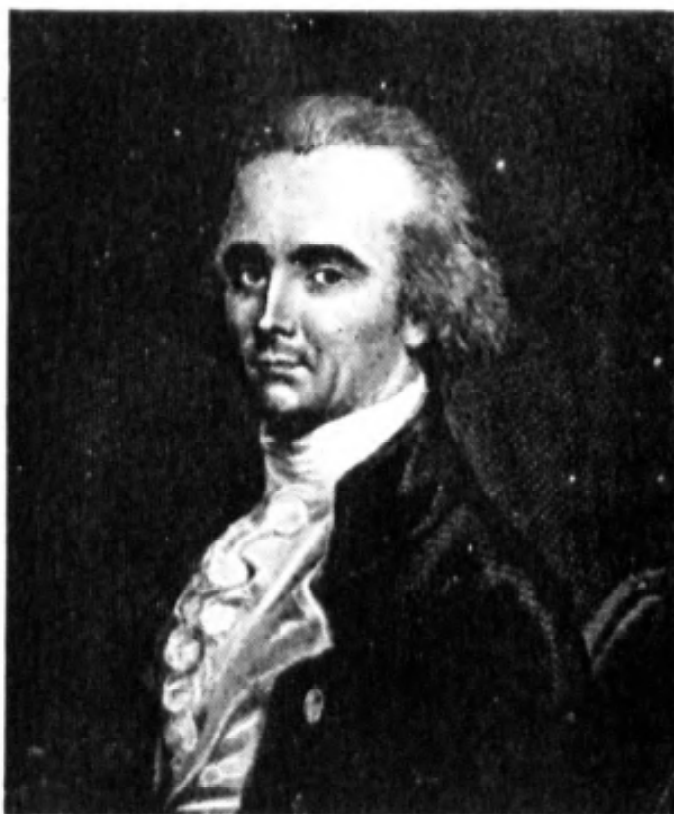
came to be known as the 'Company Bagan' and when the East India Company was dissolved, all the rights, duties and privileges were assumed by the crown and the garden became to be called as 'Her Majesty's Botanic Garden'. The Garden was passed on to the local government on constitution of the province of Bengal. The epithet 'Royal' came to be applied to it after the Queen's proclamation in 1885. As that was the time of rivalries among European nations for monopoly over trade in oriental spices and commerce of various plant products, timber for shipbuilding was most needed for successful competition in trade.

Thus playing an important role in the development of Indian economy by introducing, improving and distributing in various parts of our country, a number of economic plants, horticultural species and plants of medicinal importance, much money, bootless effort being thus saved to the country. The cultivation of teak for the sake of its timber invaluable for ship-building, the introduction of mahogany, jute and sugar-cane, trials on introduction of potato, cinchona, improvement of Indian cotton in the Garden conferred benefit to the country. The other numerous experiments in cultivation of economic plants deal with the Flax, Hemp, Rhoca or Rumie, Tobacco, Vanilla, Coffee, Indian rubber, Japanese Malberry, Cardamomum, Tapioca, Cocoa and plants of India, Burma, China, Japan, Philippines, Siam, Malay Peninsula, Australia, North East Asia, Europe, the Americas, Africa and Madagascar occupying the areas in accordance with geographical subdivisions of World. The great aesthetic beauty with its picturesque vistas, delightful lakes with lotuses, water-lilies and the spectacular Amazon Lily and the beautiful greeneries comprise the scientific treasure which serves as a source of inspiration, research and recreation to millions of visitors visiting the garden every year from different parts of the country and abroad. The unique undulating landscape, designed by Sir George King with artificial lakes mostly inter connected with





Col. Robert Kyd, established the Garden in 1787 and functioned as Honorary Superintendent of the Garden (1787-1793).



Dr. William Roxburgh, one of the Greatest Botanist of his time made the rest of the world interested in Botany of India's immensely rich and varied flora. First Salaried Superintendent of Botanic Garden.



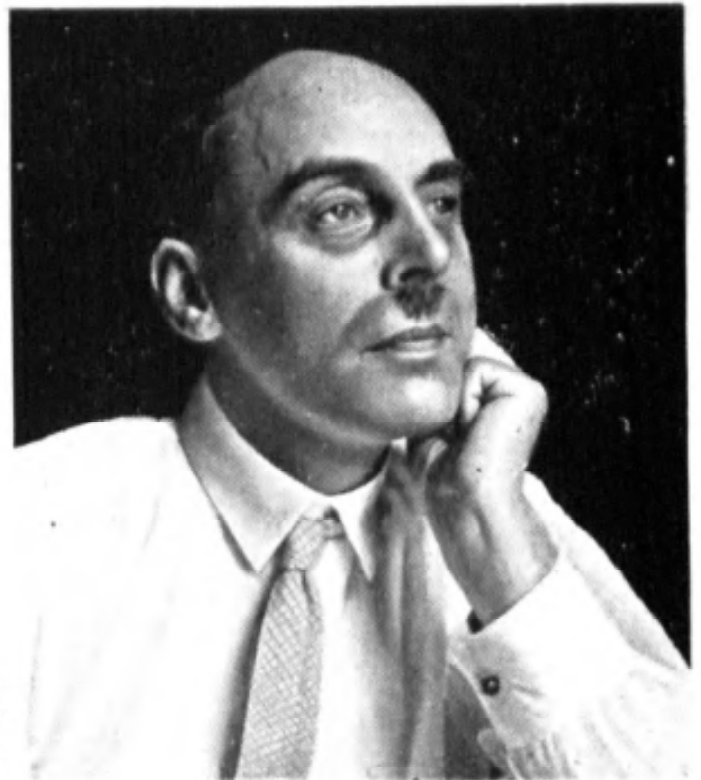
Dr. Nathaniel Wallich, a most distinguished Botanist and indefatigable explorer.



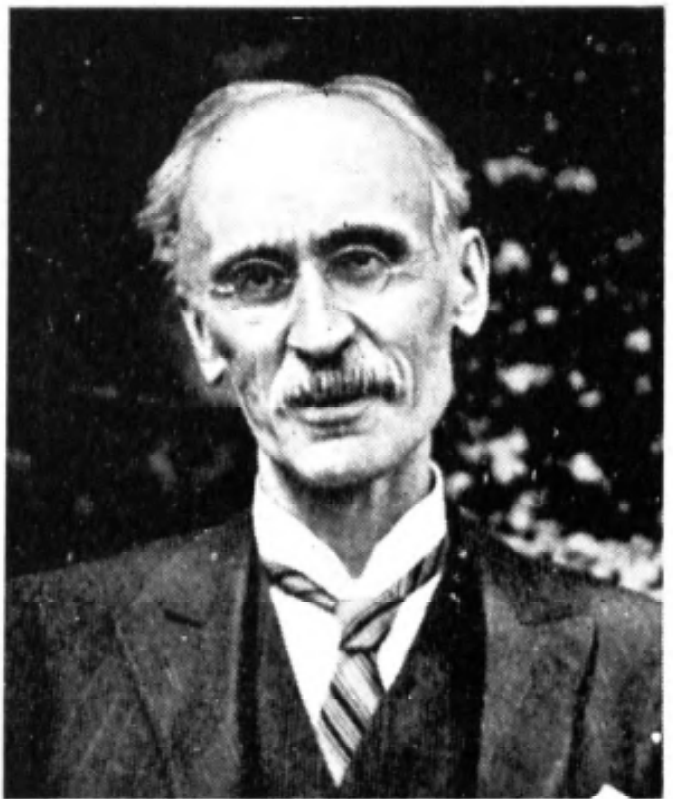
Sir George King, is remembered in the Garden as its Chief Initiator of the landscape design.



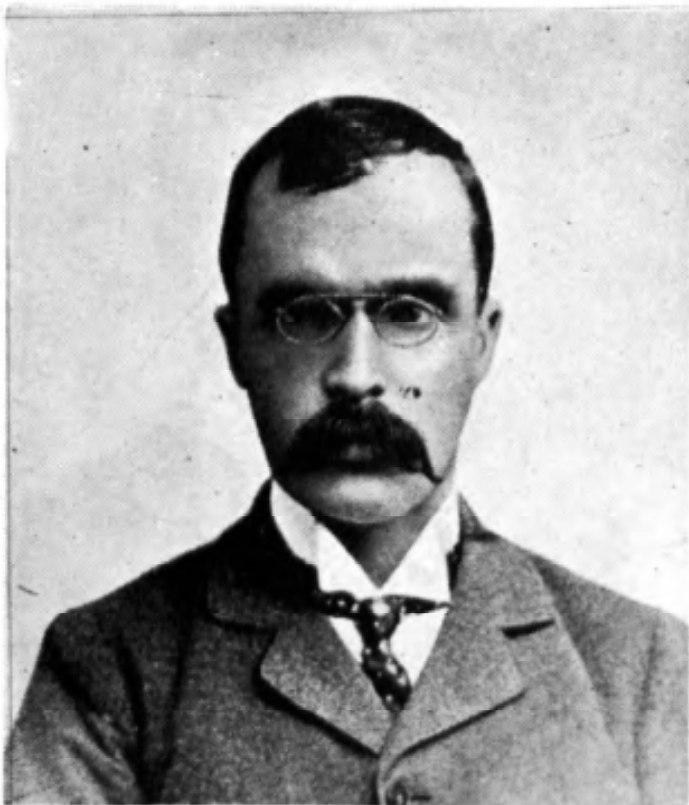
Sir David Prain, played the rôle in destinies of Indian Botanic Garden and Kew Gardens, enlivened the taxonomy of India preparing the "Bengal Plants".



Mr. C.C. Calder, succeeded Lt. Col. A.T. Gage and took charge of the Garden from 1923 to 1937.



Sir William Wright Smith, Curator of the Herbarium, officiated as the Superintendent of the Royal Botanic Garden.



Colonel A.T. Gage, Curator of the Herbarium, succeeded Sir David Prain as Superintendent of the Garden in 1906.

under-ground pipes receive water from the river Ganges. The avenues named after the celebrated botanists who served the Garden or some tree species, the Central National Herbarium, a large library with many historical and valuable books, journals, and monographs, the Palm houses, a National Orchidarium, Plant Nurseries, Kiosks located in the Garden are of immense value to scientists, students and even tourists. The Garden besides maintaining a large collection of different species of plants as a living repository of plant diversity, lays emphasis on collection and selective introduction, acclimatisation and assessment, ornamentation, conservation and dissemination of knowledge acquired through research and culture.

#### **BENGAL ENGINEERING COLLEGE AND ROYAL AGRI-HORTICULTURE SOCIETY**

During the year 1817 when Nathaniel Wallich was the Superintendent of the Botanic Garden, the eastern portion measuring about 40 acres including the experimental teak plantation was handed over to Dr. Middleton, the Lord Bishop of Calcutta as a site for a Christian College known as the Bishop's College. This college since 1880, became the Bengal Engineering College at Shibpur. In 1836, about 2 acres of land was allotted to Agricultural and Horticultural Society of India founded in 1820 by Rev. Dr. William Carey who was also its first President. This area was later expanded to 25 acres where from the Society carried on its activities with co-operation from the officers working in the Botanic Garden.

#### **THE HISTORY OF TEA INTRODUCTION**

Though tea plants brought from Canton (China) were under cultivation in the Botanic Garden at Shibpur from early times, sufficient interest among commercial growers' circle was lacking to grow as a plantation crop. Mr. Walker, a member of the East India Company's Board of Directors in London, having read about tea from Francis Buchanan's account at India House Library, London, moved the East India Company through the then Governor General Lord William

Bentinck to appoint a Tea Committee. Nathaniel Wallich, G.J. Gordon and William Grant (1788-1865) were members of the committee. On the advice of Wallich, his seed collector Robert Blinkworth tried tea plantation in the Garhwal hills. It was finally the efforts of Bruce brothers and Capt. Andrew Charlton that brought seedlings of tea to the Garden from the village Singphos near the Burhi Dihang river in upper Assam. However, it was Francis Jenkins (1793-1855) who in 1834 followed up the trials of cultivation of tea on a large scale in the Indian Botanic Garden. Wallich later identified the sample as the tea plant, *Camellia theifera*. Thus the foundation for large scale cultivation of the tea plant for commercial purposes in India was laid in this Botanic Garden.

#### INDIAN BOTANIC GARDEN IN INTRODUCTION OF CINCHONA

Thomas Anderson (1832-1870) who succeeded Thomas Thomson in 1861 as the Superintendent of the Garden took special interest and made successful trials of raising of seedlings of several species of cinchona in the Indian Botanic Garden from the seeds he brought from Kew in 1861, though there was an earlier recommendation for its cultivation in the Nilgiri hills. This was followed by introduction and large scale cultivation of cinchona in Sikkim Himalaya and hills of Darjeeling which helped the Government to a large extent in the control of malaria and alleviating sufferings of people. The Indian Botanic Garden thus can take pride in the administration of cinchona plantations and distribution of quinine at a reduced price to malaria-affected people.

#### RUBBER AND INDIAN BOTANIC GARDEN

Six plants of para rubber tree (*Hevea brasiliensis*) given by J.D. Hooker, Director, Royal Botanic Garden, Kew to George King in 1873 were brought by him to Calcutta. But owing to unsuitable climate in Calcutta, King sent the seedlings to Burma, Malaya, Sri Lanka (Ceylon) and South India.



*Cymbopogon citratus* DC.  
(Lemon grass) at the  
Medicinal Plants Garden of  
the Indian Botanic Garden.



*Adansonia digitata* L.  
(Baobab) in the Indian Botanic Garde



Branching Palm - *Hyphaene thebaica* (L.) Mart.



Palmyra Avenue in the  
Indian Botanic Garden.





Sri Alokedut Das, Mayor, Howrah Municipal Corporation alongwith Scientists, Botanical Survey of India, placing a wreath of Flowers on the Kid Monument.



Indian Botanic Garden - 'Here lives his genius' - William Roxburgh's monument erected in 1822.



**Dr.U.C. Bhattacharyya handing over sappling to the authority of the Institution during mass awareness\*campaign programme**



**Shri T.C. Dutta, I.A.S.,  
Chief Secretary,  
Govt of West Bengal,  
at the Annual Flower  
Show of the Garden.**

### INTRODUCTION OF MAHOGANY IN THE INDIAN BOTANIC GARDEN

Introduction of timber yielding mahogany species into India from the West Indies was first made in the Garden where it was successfully raised. J.D.Hooker was much interested in developing close links between the Botanic Gardens at Calcutta (Sibpur) and Kew, London, and was generous to send many species of mahogany through the Kew Garden to the Indian Botanic Garden. There are avenues of different mahogany species in the Garden.

#### MILESTONES IN INDIAN BOTANY AND ROLE OF INDIAN BOTANIC GARDEN

Col.Robert Kyd founded and functioned as Hony. Superintendent of the Garden from 1787 to 1793. He introduced many plants of economic importance of which cardamom, pepper, nutmeg, cotton, tobacco, Indigo, coffee, sago and teak deserve mention. A monument erected in 1795 in his honour exists in this Garden. William Roxburgh was appointed as the first salaried Superintendent in 1793. Besides his interest in developing the Garden, he laid foundation to plant taxonomy in India and also established a large herbarium in his residential building- 'Roxburgh building' built in 1795 on the bank of the Hooghly, which is kept as a monument to his memory even to this day. *Hortus Bengalensis* (1814) and *Flora Indica* (1820-24) published during his tenure, rightly earned him the appellations, viz., *Linnaeus of India* and *Father of Indian Botany*. He also left behind a valuable collection of about 2533 original drawings of Indian Plants coloured using mostly vegetable dyes, which are preserved in the library of the Garden.

A monument was erected in the year 1822 near the Banyan tree in the Garden in memory of William Roxburgh by his friends and admirers.

Dr. Nathaniel Wallich, a Danish Surgeon succeeded Drs. Thomas Henry Colebrooke, Buchanan Francis Hamilton, James Hare and Thomas Casey who worked as Superintendents between 1813-1816. His monumental work, - Wallich's Catalogue of Herbarium specimens was lithographed during the years 1828-1849 apart from his other classical

works viz., *Plantae Asiaticae Rariores* (3 vols., 1830-32) and *Tantamen Florae Nepalensis Illustratae* (1824-26). He played an important role in introduction of tea in India and botanised in parts of Singapore, Nepal, Kumaon, Tenasserim, Penang, N.E. India. He played an important role in the foundation of the Museum at Calcutta. A monument inside the Garden near Bambusetum exists with inscriptions on Dr. N. Wallich. Dr. Wallich was followed by Dr. Hugh Falconer till 1855. McClelland held the charge for a temporary period during which Sir J.D. Hooker in 1848 visited the Garden during his famous visit to the Sikkim Himalaya. A Garden map during McClelland's time shows the nature of the garden as it existed from 1816-1850. Falconer who worked in the Gangetic Plains was succeeded by Dr. Thomas Thomson, a friend, class-mate of J.D. Hooker and a botanist of much ability in 1855. He re-arranged the herbarium which remained unattended and co-authored the first volume of *Flora Indica* with J.D. Hooker. He was succeeded by Thomas Anderson who associated himself with introduction of cinchona in Sikkim and held the post of Superintendent of the Garden during the years 1861-1867.

C.B. Clarke was appointed Superintendent of the Botanic Garden during the years 1869-1871. He made extensive plant collections in Sikkim and S.E. Indian region, and made excellent contributions on the families: Cyperaceae, Compositae and Commelinaceae.

Brig. Surgeon Lt. Col. Sir George King took charge of the Garden in 1871. Due to his initiative the Botanical Survey of India as an organisation was established in 1890, bringing the earlier botanically active provincial centres at Calcutta (Sibpur), Saharanpur, Poona and Madras under its fold. The Calcutta Centre was acknowledged as the main centre of the organisation of the Botanical Survey of India with Sir George King, then Superintendent of the Sibpur Botanic Garden appointed as the first Director of the Survey. In later years, the Garden was also transferred under the control of the Botanical Survey of India. During King's Superintendentship, a

new herbarium building was built in 1882. Publication of many important taxonomic literatures, development of the Garden with a boundary wall with ditch, landscaping with artificial lakes with underground inter-connections, roads and avenues, dwelling houses and many improvements and plant introductions were made by him during his tenure. He started the publication of '*Annals of the Royal Botanic Garden, Calcutta*' and the '*Records of the Botanical Survey of India*'

After the tenure of W.S. Kurz as the Curator of the Garden in 1878, Lewis Jones Knight Bruce held the post up to 1886. Kurz made valuable contributions and authored the '*Forest Flora of Burma*'. David Prain of Indian Medicinal Service held the post of Curator in the Garden from 1887-1897 and later succeeded G.King in 1897 and held the post upto 1905. He brought out many important botanical works like *Bengal Plants* etc.

After Prain, Lt. Col. A.T. Gage occupied the chair from 1906-1923. A catalogue of non-herbaceous phanerogams cultivated in the Royal Botanic Garden, Calcutta was published during his time, and several unexplored regions were botanically surveyed. W.W. Smith officiated for a short time as the Superintendent during the absence of Lt. Col. Gage in 1908. C.C. Calder succeeded Gage in 1923 and held the post upto 1937, but for a period of absence between 1926-1927 during which Dr. J.M. Cowan held the charge, he made a good contribution on the rhododendrons of the Sino- Himalayan region. Dr. K.P. Biswas succeeded Calder and held the charge of the Garden from 1937-1955, and richly contributed to the development of the Garden and also to the Indian Botany.

After independence, the word "Royal" was changed to "Indian" for the Botanic Garden, in 1950. After Dr. Biswas, Dr. D. Chatterjee held the post of Superintendent till 1960, and was succeeded by Dr. J. Sen from 1961 to 1963. In the year 1963, the Garden was again transferred under the control of the Botanical Survey of India from the Government of West Bengal, and the post of Superintendent of the Garden was re-designated as Deputy Director, thus Dr. J. Sen became the first Deputy Director-in-charge of the Garden.

### THE HERBARIUM IN THE GARDEN

The botanical specimens (herbarium sheets) in the Central National Herbarium and the Library holdings are presently housed in a 4- storied Building since 1970s. The herbarium houses 1.5 million specimens. The collections in the Herbarium as well as in the Library are one of the most valuable historic collections of that type in the world, and represent the country's plant resources including several newly described plants and plants of other parts of the world. The Library in the Garden offers numerous valuable botanical literature, both historical and recent, in the form of periodicals, journals, books, paper, icons and even hand-written manuscripts of eminent botanists and are a source of great scientific information and inspiration to present day scientists.

### SETBACKS

The Garden was involved in some severe setbacks arising out of serious natural calamities that struck it at different times in its long existence of past two centuries. Devastating tidal waves and cyclonic storms raged the garden in 1863, 1867 and 1978, submerged the entire area uprooting many trees and destroyed the Lakes, inflicting much loss to many shrubs and nursery plants. A knee-deep silt was seen deposited in parts of the Garden and in the ground floor of the Roxburgh building after week long inundation of the tidal and flood waters from the river Hooghly (Bhagirathi). In 1925 the main trunk of the Great Banyan tree had to be removed due to severe fungal infestation.

In 1870, Mr. Adolph Biermann, then Curator of the Garden, was attacked and injured fatally by a tigress which strayed into the Botanic Garden. Another black panther was also sighted in the Garden during this period.

#### OTHER FEATURES

As many as 15,000 trees, shrubs, woody climbers, distributed under 2300 species, besides many hundreds of herbaceous species are in cultivation in the Palm Houses, Orchidarium, and in the open places which constitute the greenery.

The Great Banyan tree by itself looks like a mini-forest with its sprawling canopy. This tree grew originally on an Indian date palm and its main trunk was removed in 1925 on account of severe fungal attack. It is one of the largest trees in the world and is more than 230 years old now. In 1895 the girth of the main trunk measured 51 feet. There are 1825 prop roots and the area covered by the tree is about 1.4 ha and the length of the highest branch measures 24.5 m. On the south of the Palmetum, 'Branching Palms' or the 'Doom Palms' of Egypt, East Africa and Gujrat Coast are grown. The large Palm House lies in the north-west of Kyd Monument. A Kiosk building is seen by the river side. In 1933 this building was handed over to the Calcutta Electric Supply Corporation. A restaurant is presently located in the building.

Introduction of mahogany, teak, utilisation of jute, improvement of Indian cotton, cultivation of tea, cinchona, ipecac, coffee, cocoa, cardamom, flax, hemp, tapioca, tobacco, rubber, vanilla, sugarcane, etc. was made in this garden.

Among the buildings, the historical Roxburgh's house, the old Herbarium and Library building, the rest house, Garden Curator's Office, Dispensary, Pavilions, Labour welfare Centre can easily be located.

The Garden is accessible by road and steamer and remains open from morning to sunset.

#### RECENT ACTIVITIES AND OTHER SALIENT FEATURES

The Indian Botanic Garden is proud of cultivation of about 2350 species of plants. About 650 species of ornamental, economic, medicinal, rare and endangered plants have been introduced. Some important collections are mentioned below:

a) *Palm collection* : There are 109 species of palms of economic and ornamental value in the garden which is the largest in the country. Some of the well known species are : *Actinorhysis calapparia*, *Aiphanes acanthophylla*, *A. caryotaefolia*, *Archontophoenix alexandrae*, *A. cunninghamiana*, *Areca catechu*, *A. macrocalyx*, *A. triandra*, *Arenga engleri*, *A. obtusifolia*, *A. undulatifolia*, *A. pinnata*, *Benthea nicobarica*, *Calamus rotang*, *Caryota rumphiana*, *C. urens*, *Daemonorops jenkinsianus*, *Elaeis guineensis*, *Hyphaena bussel*, *H. indica*, *H. thebaica*, *Lodolcea maldivica*, *Rhopaloblaste augusta*, *Roystonea borinquena*, *Wallichia densiflora* etc.

Among the interesting and rare species mention can be made about *Elaeis guineensis* (oil palm), *Cinnamomum camphora* (Camphor), *C. tamala* (Tejpata), *C. zeylanicum* (Dalchini), *Ficus krishnae* (Krishnabat), *Lodolcea maldivica* (Double coconut), *Hyphaena indica* (Branching palm), *Pterygota alata* var. *diversifolia* (Mad tree), *Victoria amazonica*, *V. cruziana* (Giant water lilies), *Adansonia digitata* (Baobab), *Erythroxylum coca* (Cocain), *Psilotum nudum*, *Pterocarpus santalinus*, *Rhopaloblaste augusta*, *Bentheckia nicobarica*, *Rauvolfia serpentina*, *Cycas beddomei*, *Platyserium wallichii* etc.

b) *Bougainvillea collections* : About 141 cultivars of *Bougainvillea* are maintained in the garden which belong to two species viz. *B. glabra* and *B. spectabilis*. To name a few of these cultivars are Begum Sikandar, Golden Glow, Sweet Heart, President Roosevelt, Spring Festival, Mahatma Gandhi, Lady Mount Batten etc.

c) *Waterlily collection* : A Germplasm collection of 210 tub-grown plants belonging to 4 species and 30 varieties are being grown in the garden. The varieties include blue, yellow and pink flowering plants.



d) *Bamboo collection* : About 26 species of Bamboos are grown in the garden. Some of the species include *Arundo donax*, *Bambusa affinis*, *B. atra*, *B. gracilis*, *B. spinosa*, *Dendrocalamus strictus*, *Gigantochloa verticillata*, *Melocanna bambusoides* etc.

e) *Jasmine collection* : 25 species and same number of varieties are grown in the garden. Among these *J. auriculatum*, *J. caudatum*, *J. flexile*, *J. grandiflorum*, *J. pubescens*, *J. humile*, etc. are noteworthy.

f) *Orchid collection* : In the National Orchidarium 80 species under 32 genera are cultivated. The genera like *Aerides*, *Cattleya*, *Cymbidium*, *Coelogyne*, *Dendrobium*, *Eulophia*, *Phalldota*, *Sarcanthus*, *Vanilla* etc. need special mention. Efforts are being made to multiply these orchids through different methods for their conservation.

#### NATIONAL FLOWERS OF DIFFERENT COUNTRIES

The presence of National Flowers of different countries are of special attraction and importance the countries and their flowers are Argentina and Brazil (*Cattleya* orchid); Belgium and Switzerland (Poppy), Bulgaria and Czechoslovakia, England, Iran, Iraq, Italy and Turkey (Rose); Egypt and India (Lotus); U. S. S. R. (Sunflower) and Malaysia, Japan (Yellow Chrysanthemum).

## **Public awareness campaigns**

As part of the concluding programme of the BI-centenary of the Garden, STUDENTS' DAY was observed from the month of November 1988 and continued up to the month of March 1989. About 2500 students accompanied by their teachers from different Schools of Calcutta, Howrah, Hooghly and 24 Parganas were brought to the Garden to inculcate plant awareness among them. They were shown round the garden and important features were explained to them to get acquainted with plants and their importance in human life. They were entertained with film show on plants, animals and its impact on Environment. They also gathered knowledge visiting the BI-centenary Exhibition. Each school was presented with a mahogany sapling by the authority, Botanical Survey of India to plant, nurse and grow in their respective Schools after delivering a popular lecture, on plants Garden and Environment.

It is also proposed the programme will be organised every year by Botanical Survey of India.

## **Sit & Draw competition**

On 8th December, 1988, a "Sit and Draw Competition" was held at Keok Building, Indian Botanic Garden during the BI-centenary Celebration of Indian Botanic Garden. A committee with Shri U. P. Samaddar, Shri Amit Dutta Choudhuri, Shri H. N. Roy, Shri P. K. Das, Shri Saibal Basu, Smt. Dipali Ghosh, Smt. Manjula Mukherjee, Shri Bhupesh Banerjee, Shri D. P. Banerjee, Shri A. P. Bhattacharya as members and Dr. P. K. Sarkar as its head, was formed. Several students of different ages participated in the competition according to their respective groups. Dr. U. C. Bhattacharyya in his address highlighted the importance, meanings & perspective of the competition to the students. Dr. R. K. Chakraverty graced the occasion apart from participating of the other several enthusiasts. In a prize distribution Function held later where Dr. A. C. Roy, Chairman, Port Trust, graced the occasion.



Exhibits in the Annual Flower Show

Prizes are ready for distribution at the Annual Flower Show.





Students of Chakda Purbachal Vidyapith listening lectures from Guide-Scientist of Indian Botanic Garden during the educational tour in the Garden.



A visit by the students of Surendra Nath Collegiate Girls' School, Calcutta at the I.B.G. during the course of Bicentenary Celebration.

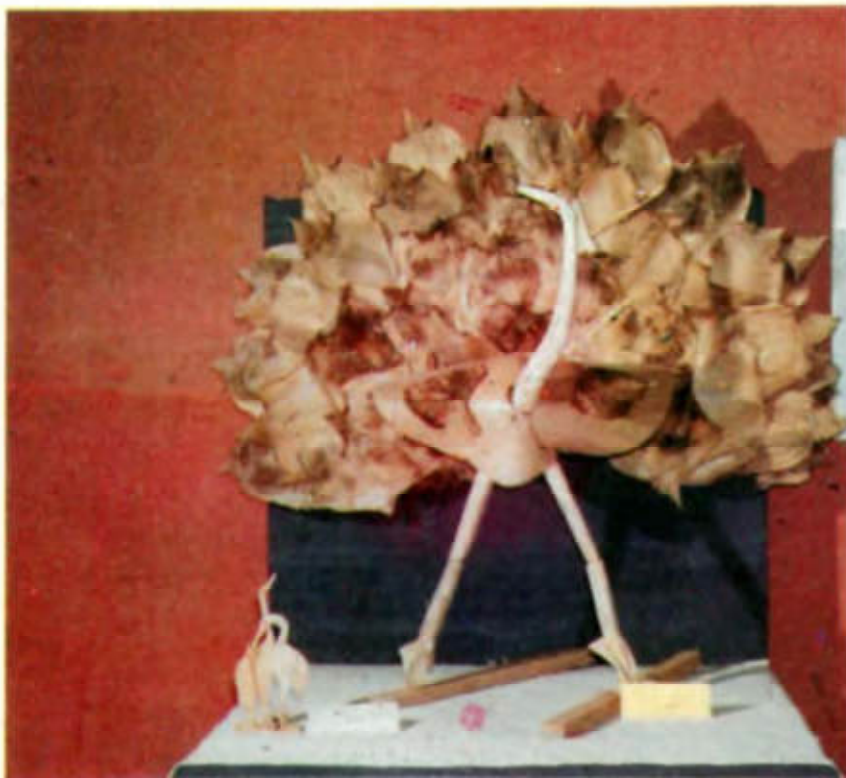


Assembly of the little masters,eager for participation in Sit & Draw Competition held on 8th December, 1988.

Last minute finishing touch to the thought.



Some beautiful exhibits of highest degree of artistic distinction made with waste parts of Bamboos and Palms displayed in the exhibition of Waste Plant Parts.



National bird made with legule of bamboos is in display during the exhibition of waste plant parts.



Monument inside the Garden in honour of Nathaniel Wallich.

Luminaries in the Seminar on Man, Plant & City with Shri Kamal Kumar Basu, Mayor, Calcutta Municipal Corporation addressing the Seminar.





Prof. M.M. Chakrabarty, Advisor, C.A.S. in Chemistry, Calcutta University & Ex Vice-Chancellor, Jadavpur University giving deliberation in the Seminar.



Seminar evoked a great response among Scientists, Sociologists and Common participants.





Shri Jyoti Basu, Hon'ble Chief Minister of West Bengal during his presence in the Garden.



Shri Profulla Kumar Mohanta, Hon'ble Chief Minister of Assam near the "Great Banyan Tree" at the Garden



**Sir Edmund Hillary and Shri Subhas Chakraborty, Hon'ble Minister in Charge of Sports & Youth Services, Govt. of West Bengal during their visit in the Garden.**



**Shri J. A. Kalyan Krishnan, Secretary, to the Govt. of India, in the Garden.**

## **Exhibition with waste plant parts of the Indian Botanic Garden**

An exhibition with waste plant parts of the Indian Botanic Garden was arranged by staff members of the Botanical Survey of India which was inaugurated by Dr. M. P. Nayar, Director, Botanical Survey of India, on 23rd December, 1988 and was open up to 4th January, 1989 in the K. P. Biswas Hall of Indian Botanic Garden. It was a part of the concluding session of the Bi-centenary Celebration of the Indian Botanic Garden.

### **Inaugural speech by Dr. M. P. Nayar, Director, Botanical Survey of India at exhibition with waste plant parts held on 23rd December, 1988 in the Indian Botanic Garden.**

Dr. Sharma, Dr. Bhattacharyya, colleagues and friends,

This exhibition brings out all that is considered wasted is really not waste. This brings out the creativity of considering each and every living and non living organism as an art of nature. This creativity with individual excellence of the employees who moulded waste parts like dried leaves, fallen barks and flowers into an art piece is to be highly appreciated. The exhibits are self recognition of the employees contribution in the field of art and craft. Some of the exhibits which are of highest degree of performance have fundamental importance to the development of earnings of the poor if produced commercially as already in vogue in the north eastern states.

A good exhibition is one that attracts large attention.

I am happy to inaugurate this exhibition and hope this exhibition will be attended by general public and students in particular and invoke great interest.

## **All India Seminar on Man, Plant and City**

The national seminar on Man, Plant and City evoked a great response among the scientists of different disciplines and also among common participants. More than 500 people alongwith a large number of experts took part in the seminar, 48 papers on the different aspects of plant science, culture, ecology were presented in the seminar. The seminar was graced by the noted scientists and public figures. Among them Shri Kamal Bose, Mayor, Calcutta Municipal Corporation was the Guest-In-Chief and Dr. B. D. Nagchowdhury was the special guest. And among the other important scientists, and educationists who delivered lectures were Prof. A. K. Sharma, Prof. M. M. Chakrabarty, Dr. A. K. Ghosh and Shri Hiren Dasgupta. The introduction of the seminar was made by Dr. R. K. Chakraverty, Joint Director, Indian Botanic Garden and Dr. M. P. Nayar, Director, Botanical Survey of India summed up the discussions besides the other works related to the organisation of the seminar. The seminar in its concluding session adapted a 14 point recommendation to high-light problems as well as the tasks of the Govt. and the people to tackle the Ecological and Environmental problems in relation to Man, Plant and City.

**Inaugural speech by Shri Z. R. Ansari, Hon'ble Minister of Environment and Forests, Govt. of India on the occasion of the seminar "Man, Plant & City" in connection with the bicentenary celebration of the Indian Botanic Garden on 27th January, 1989\*.**

Distinguished participants, delegates, guests, ladies and gentlemen,

I am happy that the Botanical Survey of India is organising a seminar on *Man, Plant & City*, as a concluding part of the Bicentenary of Indian Botanic Garden.

Plants sustain us by giving oxygen, food, medicine and materials for our industry. Indeed, plants are our renewable resources. Without plants there will be no soil, no animals and no life. Yet, the importance of plant-cover which acts as a green mantle preserving our life-system, is often forgotten.

Our country is fortunate in having rich biological resources and biological diversity. We have about 45,000 species of flora and 75,000 species of fauna which are our rich natural heritage. But the population growth and consumption are making heavy demands on our resources. Hence, it is necessary to develop sustainable use of our resources.

Sustainable conservation is defined as the wise management of our natural resources, so that it may yield greatest benefit to us and we may meet the needs and aspirations of the future generations. The concept embraces preservation, maintenance and sustainable utilisation and enhancement of the natural environment. It involves.

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\* Due to pre-occupation Shri Z. R. Ansari, Hon'ble Minister, could not attend the function at Calcutta and the speech was read by Shri A. K. Narayanan, Director, Ministry of Environment and Forests, Govt. of India, New Delhi.

- i) Maintenance of natural ecological processes,
- ii) Preservation of genetic diversity and
- iii) Sustainable utilisation of species and ecosystem.

Soil, water and forests are important life support systems. The preservation of genetic diversity involves the conservation of our rich flora and fauna.

The forests have a vital effect on the economy. As you are aware, human and animal pressures have led to considerable deforestation in India.

The basic objectives of the National Forest Policy, 1988 adopted as a resolution of the Government of India are as follows :

- Maintenance of environmental stability through preservation and restoration of the ecological balance.
- Conserving the natural heritage of the country by preserving the remaining natural forests with the vast variety of flora and fauna.
- Checking soil erosion and denudation in the catchment areas of rivers, lakes, reservoirs for soil and water conservation and for mitigating floods and droughts.
- Checking the extension of sand-dunes in the desert areas and along the coastal tracts.
- Increasing substantially the forest/tree cover in the country through afforestation and social forestry programmes.
- Meeting the requirements of fuelwood, fodder, minor forest produce and small timber of the rural and tribal populations.

The new forest policy conforms to the goal of sustainable development. Maintenance and preservation of biological diversity and the floral wealth of the country can be attained through proper implementation of the forest policy and infrastructural and organisational support.

Protection of biological diversity is done through survey and conservation. The Botanical Survey of India has so far surveyed sixty per cent of the area of the country, has published floristic accounts and has described several new species. Multiplication of endangered species is carried out under the scheme of captive breeding in experimental gardens and arboreta. Under the Wildlife (Protection) Act, 1972, 66 National Parks and 382 Sanctuaries have been set up in different parts of the country.

The Forest (Conservation) Act, 1980 stops unrestricted diversion of forest land for non-forest purposes. The Environmental (Protection) Act, 1986 provides a single focus for environmental issues. It has given powers to private citizens to complain to the Courts regarding the violation of the provisions of the Act. Through these legal enactments conservation has been accepted as an integral part of the policies responsible for the sustainable use of our resources.

My Ministry has established four Biosphere Reserves in different phyto-geographical regions in order to preserve genetic diversity and provide *in situ* conservation of plants. Besides Nilgiri Biosphere, Nandadevi Biosphere and Nokrek Biosphere, my Ministry has also declared Great Nicobar Island as a Biosphere Reserve. In all these efforts, the Botanical Survey of India has given scientific inputs and this is an important activity.

We have given particular attention for the conservation of our precious Mangrove forests, estuarine system and wetland ecosystems.

Action plans have been drawn up which involve management and research activities.

Public awareness and participation are of paramount importance for the conservation of nature and protection of wildlife. Of course, there are grass-root awareness and consciousness as seen in CHIPKO and APICO movements in our country.

The totality of biological conservation measures taken up by my Ministry, I am sure, would go a long way in enhancing the conservation activities of our country in the coming decades.

I am looking forward to the various inputs which the delegates may consider at this Seminar.

I have great pleasure in inaugurating the Seminar and wishing it all success.



**Speech on 'Man, Plant and City' delivered by Sri Hiren  
Dasgupta, Educationist in the Seminar held from  
27th to 29th January, 1989**

MAN, PLANT & CITY — ECOLOGICAL PROBLEM

OBJECTIVE

We propose this seminar with definite objective. Defence of the Environment against ever increasing pollution in which we are living specially in the cities, is one of the most pressing problems of today.

Our common endeavour should be to evolve certain concrete proposals which we can use in our campaign for developing mass awareness against pollution of nature by various means and how best plants can be used in combating the menace of pollution specially in the cities.

While preparing this paper, we are fully aware of our shortcomings and limitations of expert knowledge. But it is in the interest of the present and future generation, we must take immediate steps to make scientific and rational use of the land, its minerals and water resources, the plants and the animal kingdom to protect and preserve the purity of air and water, to ensure recreation and reproduction of natural wealth and most important to improve the condition of human environment. This understanding has prompted us to place before you this brief submission which is the product more of our experience & common sense with deep concern of the ever increasing pollution of nature rather than elaborate scientific knowledge.

ECOLOGICAL PROBLEM

Before we discuss the problem of environment in general and in cities in particular, we should have an idea of what we mean by the term environment. We are sure that the Ecologists and Environmentalists would enlighten us of its true meaning and the problems of Biosphere and factors responsible for creating ecological imbalance. It will not be out of context if we mention some of the factors responsible for the pollution and disturbing the ecological balance.

***Profit motive being the sole object of production*** : This profit motive feels very little concern about natural resources, whether it is Flora, Fauna or Mineral resources. If

profit hungry produces indiscriminately sacrifice them at the alter of their lust and greed for profit. In the name of production, natural resources specially the plants are being irrationally destroyed causing great imbalance in Ecology, as they care very little whether the atmosphere and water are being polluted by the smoke and industrial wastes of their factories.

Poverty of the people combined with illiteracy remains another serious impediment for maintaining ecological balance. So long as they will lack in food, shelter and fuel, they will indiscriminately destroy plant kingdom for the bare necessity of their existence, because to them plants do not mean anything else other than a bare means of substance.

So long as danger of Nuclear war in the present world would continue, the danger to cause tremendous hazards to ecology would persist.

In this background, we are to analyse why such situation has developed, when we have reached a critical point in several areas of man's impact on Nature. The defence of environment is one of the most important problem of today. Pollution and ecological imbalance is endangering the very existence of living being on earth, not to speak only of the human civilisation alone. If we follow the fundamental tradition of the investigating ecological problem, we would come to the conclusion that the indiscriminate destruction of plant kingdom has played the antithesis in the dialectics of man and nature relations. Man wanted to be master of nature and so long in the process of production and exchange, there was co-operation between man and nature, civilisation flourished. But whenever man out of greed tried to out space nature by its ruthless exploitation, the counter-productive effect has time and again seriously baffled the progress of the civilisation.

In our view economic activities based on profit motive which encourage ruthless exploitation of natural wealth, its anarchic and uncontrolled deployment is responsible for mounting negative effect on the environment. In our country under the colonial rule, this process was started and even after 40 years of independence, the monopolistic houses, the multinationals are protecting their own selfish interest and alarming the Earth's atmosphere, the water, the ocean, everything, by pumping out

dangerous gases and draining out its industrial wastes. This danger and monopolistic production are so interlinked that without taking concrete steps to stop this abuse, the fight against pollution and creation of ecological balance would be a far cry.

Cities are the worst victims of this process. Before dealing with the problems of the cities, we should take note of the importance of plants in the life of Ecology.

History tells us that rise and fall of many civilisations including cities are intimately linked up with the plant culture. Great cities in various part of the world sprang up, but wanton destruction of the plants around it for fuel, to build up habitat, furniture, article of communication, parts of tools and for agricultural purpose gradually changed the climate to aridity and ultimately creating drought and desert conditions of the area.

We know forests are supposed to be the earth's clothing. They preserve rivers and regulate their flows, it regulates and influence the climate and atmosphere. Researchers have proved that one hectare of green plants purify approximately 18 million cubic metres of air each year. During one hour a hectare of forests absorbs 8 kilogram of carbon dioxide. Plants influence crops, prevent soil erosion. They protect health, supply source of medicines and what not. Prof. Tarak Mohan Das has shown that a tree of 50 years of age produces things in money value in different ways up to 15 lakhs 70 thousands rupees, that is, it is only the plant that itself can purify the pollution and maintain the ecological balance to the extent of 75% of the total problem.

Unfortunately we are indiscriminately destroying the forests without any consideration of its adverse consequence on the environment in which we live.

The entire history of agricultural development and of the settlement has been closely linked with the destruction of forests. For centuries man has cut down and burnt forests without giving any thought to its consequences. It is a great tragedy to human civilisation that already human greed and foolishness has wiped out 2/3rd of earth's forest and vast tracts which were covered with trees are now deserts and semi-deserts. Today forests occupy approximately 3.8 billion hectares but the destruction continues specially of tropical forests in developing countries. We do not want to make the monograph heavy with the data of destruction of forests in western countries. Our

country being a developing country within the tropical region, it is necessary to mention some bare facts of this region.

Forests are dying in the tropical area, because of man's unlimited intervention. It is revealed that in every 2 to 2<sup>1</sup>/<sub>2</sub> minutes one hectare of forest in tropical area is destroyed. The enormous area, millions of square kilometre was covered with forests, with billions of trees, many of which are 100 metre high and more. But billions of them are cut down every year. In a twelve months time enormous area turns into empty deserts and are scorched by the sun. In Himalayan area in coming few years (Eight approximately) more than 2,00,000 trees will be cut down only to manufacture packing boxes for apples. These are mostly due to greed of unscrupulous people. How greedy and ferocious are these people is revealed, when we see that even the scientists are killed by them, only because they are protesting against such unbridled destruction of the forest; (only a few days back such a news has appeared in the press) when in Venezuela a scientist has been killed by the contractors of woods. Ecologists estimate that at current rates of cutting tropical forests, which now cover 12% of the Earth's land surface, will decline by two third by the year 2000 and will completely vanish shortly afterwards.

Researchers who met in Libreville (Gabon) to consider problems relating to the dwindling of forests have noted that the wealth that is supplied by forest has resulted from a very complex evolution of plants from over a period of terms of millions of years. Tropical forests constitute unique ecosystem that also serve as the Earth's 'lungs'. The destruction deprives the earth of oxygen and can bring irreparable harm to the entire human race.

As the number of such global 'lungs' disappear due to destruction of forests also entails global consequences. Due to destruction of forests their capacity to absorb carbon dioxides sharply reduced. The volume of carbon dioxide in the atmosphere increases partly as a result of natural cause and partly because of the increased use of energy derived from fossil carbon such as coal and petroleum. Subsequently in volume of carbon dioxide in the atmosphere increases the earth's temperature to an average of three degrees celsius a year. This would bring catastrophic global changes that are largely unpredictable. Particularly great damage would result in to-days

densely populated areas, mainly the cities. Droughts and declining harvests are one of the many devastating consequences.

In addition to this use of modern innovation of Science and Technology in Industries is combined with serious hazards. Every year we are throwing up into the atmosphere over 200 million of carbon monoxide, over 50 million tons of various carbons, 146 million tons of sulphur dioxide, 53 million tons of nitric oxides and so forth. During the past 50 years the concentration of carbon dioxide in the atmosphere has risen by 12% while the content of solid sulphur dioxide particles have risen by 12% just in last ten years. Several hundred million tons of poisonous waste are pumped and drained into the water. Oil pollution of seas/oceans is creating unpleasant consequences putting an oil carpet extending over thousands of kilometres. It prevents the oceans from absorbing carbon dioxide, it is changing the process of evaporation from the ocean. A litre of water in 0.01 millilitre of oil is sufficient to spell death and fry many species of fish and other varieties of oceanic life. Every year oil of 12 to 15 million tones are flowing through the sea. As a result of the screen on the atmosphere which is changing the very character of sunrays coming to the earth deadly poisonous gases as named earlier are threatening the very existence of life and causing various types of ailments.

Another effect of the pollution of water and air is not only the destruction of life but also the destruction of soil. The pollution of river and ocean is very fast turning large areas of land into barrenness.

Added to this is the constant arms race and threat to world peace. It is needless to mention how dangerous it is to the nature the explosion of nuclear and neutron Bombs.

The researchers are of the opinion that if pollution of atmosphere goes on at the present rate and is not stopped within a few years, the Earth will become uninhabitable and no war would be necessary to destroy the human civilisation.

#### CITIES

At present, cities occupy 0.3 percent of the Earth's surface. But more than 40 per cent of Earth's total population is concentrated in cities.

It is expected that in another 25 years the Earth will be transformed into an 'urban planet' and by the end of this century the greater part of the world's population will live in the cities. Moreover the general cry is for reducing the difference between a City and a Village. By 2000 A. D. nine out of every ten persons will become urban dwellers in North and South Africa. In Africa, which is at present an agrarian continent, approximately one half of the population will live in Cities. India is no exception.

All the available reports reflect a general crisis in the cities of the capitalist countries and in alarming proportion in the cities of the so called developing countries, where colonial legacy is still painfully felt. And India is of course one of them. Such factors as chaotic enormous growth, over crowding, dangerous pollution of their living environments, traffic congestion and totally inadequate public transport services, speculation in real estate, corruption of urban authorities, the problem of drugs, crime and other vices that derive from the entire capitalistic form of social organisation have produced a situation in which the problem of cities has become too acute.

Under the colonial rule city divided into rich and poor areas was deliberately started by the English rulers, but even after forty years of independence the situation is becoming worse every day. A progressive differentiation of cities was made into wealthy districts for the rich that possess all conveniences, including the luxurious ones, and many less favoured districts for the poor, who live in conditions that often fail to meet even elementary standards of sanitation, particularly with regard to air pollution and the need for greenery. In our country innumerable instances may be cited to show how in the nature of production material resources are being irrationally consumed causing great imbalance in the domain of ecology. They care very little whether the atmosphere and water are being polluted by the smoke and the waste of their factories. It is never considered before establishing a factory or industry if smoke, gas and water may pollute the atmosphere will kill thousands of lives as has happened in Bhopal Gas Tragedy. They never care green to plant belts with necessary plants which can prevent such pollution in all the adjacent areas. They are, by and large reluctant to adopt devices for combating pollution, because such expenditure would only tell upon their profits.

In a large city capitalist entrepreneurs are out of their way to realise the capital that they have invested in new enterprise as rapidly as possible. Such cities attract armies of cheap labour from rural districts. But it is society as a whole that has to pay the costs of these advantages to entrepreneurs.

Disproportion in the growth of the large cities produce growing problems in governing their economies, unemployment, serious housing problems, transport crisis and above all a catastrophic impairment of environment.

Cities are the worst victims of these unpardonable acts of commission and omission. In India the condition of almost all the cities are same. How polluted are the water and air of Benaras can be well understood when we know that only in Harischandra Burning Ghat at Manikarnika 32 thousand dead bodies are burnt in the open and out of these at least 10 thousand half burnt dead bodies are thrown in the Ganges every year. The experts are of the opinion that within 10 years Calcutta city for which we are proud will turn into a big poisonous vas. Most unplanned development of Calcutta, Howrah, indiscriminate construction of big as well as small and medium size factories and industries in and around Calcutta and Howrah is responsible for high pollution. It is strange to hear, but true that every day 1500 tons of poisonous gases are getting mixed with air in Calcutta and Howrah, of which 44% is suspended dust, coal dust which may very well cause cancer. Another 56% are carbon monoxide (34%), sulphur dioxide (9%), hydrocarbon (8%) and different types of oxide of nitrogen (5%). These are produced by the factories, smoke emitted from automobiles, power plants and smoke of hearth used for cooking. To fight such pollution we need more plant and tree culture, the same time every year in India we are destroying 1.5 million hectare of forests. What a shameless crime committed by man against man.

So we can very well ascribe this state of affairs to the socio-economic structure and ideas of a country.

Without global resistance to the mad exploitation of nature for profit we can not stop the fast growing danger to the human civilisation.

So without global resistance to arms race we can very little stop preserving and conserving the nature. The environmental tension arising out of the arms race also

cripple the economic growth of a country. To change the whole situation enormous amount of money is needed which would be easily available if arms race is stopped. According to UNO data hundred million people are suffering from hunger and under nourishment. In a country like India where about 60% live below poverty line and more than 40% of it are rather obliged to live a destitute life is bound to pose constant threat to the balanced existence of natural resources whether it is flora or fauna, aquatics or minerals. Our experience show that only for mere subsistence and meagre shelter from rain and cold, the aborigines, the tribes and poor people in the distant countryside indiscriminately destroy the forests thereby creating ecological imbalance. The situation is further aggravated due to unscrupulous contractors and corrupt forest officials who are in league to smuggle out the trees in huge quantities.

Naturally if profit motive goes unbridled elementary basic needs of life are not provided to the teeming millions. Hunger is not eliminated, the conservation sound 'nothing' Added to this is the illiteracy and ignorance of the people of our country that stands in the way of preserving the nature.

We therefore hope this Seminar will evolve some active and useful proposals with which we can move forward with our limited resources to tackle this problem.



**Summing-up of the Seminar on "Man, Plant & City" by  
Dr. M. P. Nayar, Director, Botanical Survey of India**

Distinguished participants, delegates, guests, ladies and gentlemen :

This seminar organised on the occasion of the concluding of the Bi-centenary Celebration of the Indian Botanic Garden involving splendid assemblage of luminous band of distinguished persons alongwith members of the Scientific community of India aroused great interest and enthusiasm among all sections of masses.

During the last three days quite a number of Scientists and public figures took part in the discussions on the theme "Man, Plant & City" and expressed valuable suggestions to tackle the environmental problems.

I fully endorse the stress given to the recommendations of the seminar taking into account of the programme oriented Mission.

In this connection, I would like to mention that in the year 1990 we are going to celebrate the 100 years of "Survey's" service to the nation. During the coming years the activities of the 'Survey' have to be purposeful for the development of National Parks, Biosphere reserves and gardens.

I am sure the seminar will bring forth frank and free discussions for the development of environmental ethos.

Lastly, I convey my gratitude to Hon'ble Minister of Environment and Forests Shri Z. R. Ansari for his kind Inaugural message. I am thankful to Shri Kamal Basu, Mayor, Calcutta Municipal Corporation, Dr. B. D. Nagchowdhury, Prof. T. N. Khoshoo, Prof. Mohan Ram, Prof. A. K. Sharma, Prof. M. M. Chakrabarty, Prof. Sunil Sengupta, Dr. A. K. Ghosh, Dr. G. Panigrahi, Dr. R. C. Sharma, Shri A. K. Narayanan, Shri Asoke Kapoor and Shri Hiren Dasgupta for participating in the seminar.

**The Recommendations of the Seminar on Man, Plant  
& City held on 27, 28 & 29th January 1989 at  
Calcutta for Mass Awareness Campaign  
regarding Environment**

**To do so let us take up the following for mass campaign**

*Recommendations*

1. Definite laws to make the industrialists to take appropriate and necessary measures for combating pollution by the industrial wastes, including necessary afforestation in surrounding areas.
2. Definite steps for decentralisation of large Industrial units and prohibitory measures to stop setting up of industries in residential areas.
3. Proper planning bodies for the afforestation of the cities which should include Ecologists, Environmentalists and other relevant scientific persons in those planning bodies; Proper and useful coordination among them to be ensured.
4. Effective measures to stop encroachment of open spaces in the cities.
5. Allocation at least 15% vacant land within the cities for parks and afforestation.
6. Mainly Indigenous plants and those of recommended varieties by competent authorities should be planted in and around the cities.
7. To build up mass awareness, the Indian Botanic Garden and Botanical Survey of India should publish regularly popular literatures for circulation among common people in regional languages.

8. Strict implementation of checks on automobile exhausts.
9. Proper disposal of sewerage and garbage, human wastes to prevent contaminations of natural resources i.e. air, water and soil.
10. To encourage setting up of Botanic Gardens and Parks in all major cities in India.
11. Every year during the winter, students of both Schools and Colleges to be brought to the Botanic Garden for developing plant awareness. A short course on environment should be included at least in the elementary form in School curricula.
12. Alongwith other works, Botanical Survey of India should pay special attention in research on plants which would be viable in combating pollution in different cities in India.
13. An elaborate study of Eco-systems as it exists and as it desirable should be regularly monitored by Botanical Survey of India.
14. Conservation of species diversity areas in different parts of country.

# **Monitoring and control of air pollution through plants**

**T. M. DAS**

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Calcutta University, Calcutta*

## **ABSTRACT**

Air pollution monitoring reveals that 35-45% of pollutant of the atmosphere of most part of India is composed of fine particulate matter. It has long been suspected that green areas can filter out dust, soot, smoke and many other fine particles disperse in air. An experiment was set up to find out which genera of trees exert greatest filter effects. For this purpose the dust per unit area of leaf surface was weighed and a list of avenue trees was prepared in order to their dust collecting capacity. It reveals that the shape of the leaf, presence of leaf-hair, phyllotaxy, age of the leaf, and type of plant association are the determining factors for the dust collecting efficiency of a tree. The ever-green trees with simple leaves are better dust collectors than deciduous trees with compound leaves. The chemical analysis of particulate pollutants indicates that besides various major and micro nutrients for plants, traces of toxic chemicals like Pb, As, also are present.

Most of the grasses including cereals possess copious auricular hairs at the junction between the leaf blade and leaf sheath. This study indicates that auricular hairs occupying a strategic position at the base of lamina can absorb various chemicals from air borne particulates that are deposited on their surface. Rice plants cultured in glass distilled water did complete their life cycle, though the vegetative and reproductive growth was extremely poor. Such plants contained more N, P & K than those found in their seeds. It indicates that particulate pollutants of the air serve as the supplementary source of nutrition to the grasses. It also suggests the reason for aggression of grasses in semi-desert regions where the soil is almost devoid of nutrients. It is apparent that this adaptive mechanism was evolved due to the intense selection pressure induced by the pollutant itself.

This study also indicates that a green lawn or a field covered with grasses can reduce the concentration of particulate pollutants of the air to a significant degree.

**Seminar**

**on**

**Man, Plant & City**

**SCIENTIFIC PAPERS AND ABSTRACTS**

## INTRODUCTION

In most part of India 35 to 45 per cent of the air pollutants consist of particulate matter. The results of the study of the author and his associate show that quite a large amount of air borne particulate matter is deposited on the crop plants, the rate of which increases during winter and summer months and decreases during rainy season. The microscopic analysis of air borne particulates deposited on the leaf reveals that in most cases these particulates form conglomeration i.e., a number of particulates gathered into clow or mass and in many cases they are partially or completely covered with black soots. Such soots contain a number of chemicals which are carcinogenic in nature. The chemical analysis of particulates show the presence of major and minor nutrilets of plants as well as toxic chemicals like As, Pb, etc. Effects of these air borne particulates on crop productivity indicate that the deposition of these particulates at normal rate does not adversely affect the growth and yield of rice plant, but heavy deposition of such particulates does retard crop productivity.

## MATERIALS &amp; METHODS

In order to study the dust filtering capacity of different avenue trees, leaves of different species of trees growing approximately in a same location of Indian Botanic Garden, Howrah, West Bengal and approximately of the same age were carefully collected from the same height from ground level and deposition of dust per unit area of the leaf surface was measured by removing the dust particles from the upper as well as lower surface separately with the help of very clean camel hair brushes and weighing them in a chemical balance (electrical) upto the fourth place of decimal.

In order to study the nutritive effect of particulate pollutants of the air on Gramineous species, rice variety C.R. 126 was grown from germination in two sets of plastic pots with replaceable lid having six holes in each. Glass distilled water (1st set) and Hoagland nutrient solution (2nd set) were taken as the media for growth. Pots were regularly aerated and the replacement of the solution was done at every three days. Dried samples of plants in distilled water (1st set) as well as that of in nutrient solution (2nd set) were subjected to chemical analysis for nitrogen, phosphorus and potassium at different growth stages. Records of vegetative growth also were determined at an interval of 15 days. The nitrogen, phosphorus and potassium contents of rice seeds were also determined.

## RESULTS

Aerosol includes any particle larger than single molecule but small enough to remain dispersed in the air for a significant length of time. This aerosol has great affinity to adhere to any solid surface when it comes in contact with it. When air current passes through a tree, some of the solid suspended particles adhere to the upper or lower surfaces of leaves, some of which are bounced back and become air borne again or are deposited at the base of the tree depending on the size and character of the particle, velocity of wind, and the nature of the surface of contact. In order to study the dust collecting capacity of different avenue trees the dust particles were removed from both upper and lower surfaces of the leaf separately and deposition of dust per square metre of leaf surface was determined following the method described earlier.

A list of Indian avenue trees has been prepared in order to their dust collecting capacity. Table 1 indicates the comparative dust collecting efficiency of some of the common species of trees and ornamental plants which are grown on the roadsides of India. It is revealed that ever-green trees with simple leaves, rough or hairy surface are better dust collectors than those of deciduous trees with compound leaves. In this regard *Ficus*, *Mangifera*, *Tectona*, *Polyalthia* are better dust collectors than *Cassia*, *Poinciana* or *Sesbania*. It is of interest to note that the upper surface of the leaf collects most of the dust particles, but the lower surface also collects an appreciable amount.

Most of the Gramineous species including cereals possess copious and numerous auricular hairs at the junction between the leaf blade and leaf sheath. The result of the study of the author shows that auricular hairs occupying a strategic position at the base of the lamina can absorb various chemical compounds from air borne particulates that are deposited on their surface. During the metabolic process of the plant, the carbonic acid is continuously formed (from water vapour and  $\text{CO}_2$  coming out through these hairs) and with the help of the water and carbonic acid some of the chemicals accumulated on the surface of the hairs are dissolved and ultimately absorbed by the plant.

The microscopic observation revealed that the auricular hairs of rice, wheat can absorb the colouring material of neutral red as was evidenced by the presence of the red colour inside the lumen of these hairy cells. In the next set, when the auricles

were treated with  $\text{CaCl}_2$  and oxalic acid solution subsequently, the Ca-oxalate crystals were found within the auricular hair cells indicating the absorption of these chemicals.

Table-1 : Dust collecting efficiency of different species of avenue trees.  
Figures are average per ten replication

Avenue Trees	Dust/sq m of upper leaf surface (g)	Dust/sq m of lower leaf surface (g)	Total dust/sq m of leaf (g)
<i>Trees with simple leaf</i>			
<i>Ficus religiosa</i> L. Peepal (Aswatha)	2.56	1.59	4.15
<i>Ficus infectoria</i> Roxb. Pakur	2.64	1.45	4.09
<i>Ficus benghalensis</i> L. Banyan	2.71	0.88	3.59
<i>Tectona grandis</i> L.f. Teak	4.10	1.26	5.36
<i>Shorea robusta</i> Gaertn. Sal	3.40	1.10	4.50
<i>Terminalia arjuna</i> Bedd. Arjuna	3.25	1.24	4.49
<i>Polyalthia longifolia</i> Thw. Mast (B&H)	3.92	0.64	4.56
<i>Mangifera indica</i> L. Mango	2.50	1.55	4.05
<i>Trees with compound leaf</i>			
<i>Saraca indica</i> L. Asoka	2.56	1.22	3.78
<i>Butea monosperma</i> (Lamk.) Taub. Flame of the forest (Palas)	2.20	0.85	3.05
<i>Azadirachta indica</i> A. Juss. Margosa (Nim)	2.20	0.72	2.92
<i>Cassia fistula</i> L. Indian laburnum (Sondaf)	1.82	0.12	2.24
<i>Tamarindus indica</i> L. Tamarind	1.56	0.52	2.08
<i>Poinciana regia</i> Bojer. (Syn. <i>Delonix regia</i> Raf.) Gold mohur (Gui mohor)	1.12	0.32	1.44

It is, therefore, suspected that air borne chemicals of particulate matter may play some significant role in growth and development of graminaceous plant. In this study an experiment was designed to study the accumulation of nitrogen, phosphorus



and potassium in rice plants which were grown in distilled water but freely exposed to air and rainwater, so that particulate pollutants would deposit on the auricular hairs. Following the method described earlier two sets of rice plants were grown, one in distilled water and other in Hoagland nutrient solution. The plant growth and nitrogen, phosphorus and potassium content of two sets of rice plants were measured at different growth stages.

It is of interest to note that rice plant in distilled water did survive and complete its life cycle during seventy five days of experimentation period (vide Table 2&3). The net accumulation of nitrogen, phosphorus and potassium in distilled water grown plants was much higher than that present in the rice seeds from which plants were raised. This result clearly indicates that a significant amount of these elements have come from a non-aquatic environment, that is from air. Plants in nutrient solution, however contained much more nitrogen and phosphorus and their growth also was much superior.

#### DISCUSSION

Pollution clearing capacity of trees has been demonstrated in England and Soviet Union with very impressive results. For example, considering the Hyde Park, a green area of only one square mile in size in the centre of London, an average reduction in the smoke concentration of 27 per cent was found in comparison with the non-green area surrounding it. An interesting study in the Soviet Union was set up to find out which tree genera exert the greatest filter effects. For this purpose the dust per unit area of leaf surface was weighed. The best vegetative dust filters in descending order and in  $\text{gm}^2$  of leaf surface were lilac with 2.33, maple with 1.11, linden with 0.61, and poplar with 0.26. It was calculated that 400 poplars which are the poorest dust collectors, spread over 2.5 acres, would filter out 0.375 tons of dust during leaf-bearing season.

In the present paper a comparative study of dust collecting capacity of different avenue trees has been made. Trees with simple leaf have been shown to be the better dust collectors than trees with compound leaf. Most of the dust particles are collected on the upper surface of the leaf, but the lower surface also collects an appreciable amount. The rate of dust collection by the tree is not uniform throughout

the year, it varies with the weather condition and other factors that determine the rate of dust fall.

Table-2 : Growth of the plants at the end of 75 days experimental period  
in nutrient solution and distilled water

	Plant in Haagland Nutrient Solution (cm)	Plant in Distilled Water (cm)
Height of the shoot	71.08	43.85
Longest Leaf	71.08	43.85
Breadth of the leaf	5	2.9
Number of tillers	16	3
Length of inflorescence	13.7	12.03
Number of fertile tillers	9	3

Table-3 : Presence of nitrogen, phosphorous and potassium per plant in mg.

	Seed	NS=Nutrient Solution		DW = Distilled Water			
		45 Days		60 Days		75 Days	
		NS	DW	NS	DW	NS	DW
Nitrogen	0.02	0.20	0.09	2.45	0.19	6.70	0.35
Phosphorus	0.0026	0.051	0.016	0.54	0.04	1.60	0.12
Potassium	0.021	0.55	0.02	0.62	0.048	1.92	0.15

The ultimate fate of the collected dust on the leaf surface is not known in detail. It is suggested that fine particles smaller than the diameter of the stomatal aperture directly enter in the sub-stomatal chamber and come in contact with the spongy parenchyma of leaf tissue. It is also quite likely that those particles which are larger than the stomatal pores may ultimately get access inside the leaf by dissolving in water and carbonic acid discharged by the stomata themselves. As the chemical nature of the particles is extremely diverse, a series of synergistic reaction may occur among these particles, which in turn, can affect the physiological functions of the plant in a number of ways. A further detail study may reveal the full picture.

Some of the dust particles, of course, are readily become air borne again, some of them conglomerate and become heavier and drop down at the base of the

tree. A sizeable amount of particles stuck up on the leaf surface for an indefinite period of time till washing out with rain-water or shedding of the leaf itself.

The dust collecting capacity of trees with compound leaf or needle shaped leaf of pine trees is rather poor, but these leaves also exert a significant filtering effect when air current passes through their dense formation. They act like sieves separating the suspended particles of the air by offering physical obstruction with considerable mechanical advantage.

The graminaceous plants are more advanced group of plants and have been evolved in the latter stage of evolutionary development. This group of plants have erect structure of leaf and bear a special cup like structure at the base of the lamina, which in turn bears a large number of unicellular hairs. These hairs are called auricular hairs. Each hair is connected with vascular supply. The dust particles fallen on the leaf surfaces slide down and are accumulated on the surface of auricular hairs at the leaf base. These hairs can absorb the coloured solution of neutral red,  $\text{CaCl}_2$  and oxalic acid solution resulting in the formation of Ca-oxalate crystals inside the hairy cells. So, there is a good reason to believe that these hairs can absorb from the particulate matters setting on them.

Previous study of the author and his associate showed that elements like N, P, K, Ca, Fe, Mg, C, Si, Zn, Cu alongwith toxic elements like Pb and As were present in the particulate pollutants of the air. Aggarwal, Kaul & Lahiri detected and measured different quantity of cations of sodium, potassium, calcium and magnesium as well as anions of nitrate, sulphate and chlorine in the rain-water over Rajasthan desert. It is obvious that these elements are present in the air and distributed on the plants through air current or rain-water. Graminaceous species with their special adaptive organ are quite capable of absorbing these elements. Present study shows that the rice plant grown in distilled water survived and completed its life cycle. It contained more N, P & K as compared to that of present in its seed from which the plant was raised. Most of the Graminaceous species possess auricular hair. It acts as a built-in-mechanism to exploit the polluted condition of the air. The vascular strand is also traversed at the base of the hair which facilitates absorption of water and chemicals directly into the system. It is quite apparent that this adaptive mechanism was evolved due to the intense

selection-pressure induced by the pollutant itself. The result of the study also reveals that air acts as the supplementary source of nutrition for this group of plants, which also may explain the aggression of grasses in soils which are almost devoid of nutrients.

A parallel example of utilization of polluted condition of air by the plant can be cited from orchids. Orchids are also one of the highly evolved plants and they have appeared at the more recent period of evolutionary history. Orchidaceae family with its 25,000 species comprises the largest family among the flowering plants. Most of the members being epiphytes live on exploiting the polluted condition of air. They collect all their major and minor nutrients from the air. Epiphytic habit is not the monopoly of orchids alone, some members of Bromeliaceae and Aroideae are also epiphytes. If the air of ancient world were perfectly clean the evolution of these epiphytes would not have been possible.

These grasses, epiphytes and tall trees by offering various self-cleansing mechanisms have been maintaining the purity of air through ages and thereby maintaining the balance of nature. But the self-cleansing mechanism has always some definite threshold limit. At some level of accumulation of toxic chemicals in the plant the self-cleansing powers are exhausted. It is, therefore, left to us to find out these threshold values with different species of plants with different types of pollutant and their synergistic effects on various physiological functions. The researches on this line would help us to formulate the strategy of survival of life on an infinite time scale.

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## **Man, Plant and Habitat - A retrospect in urban perspective**

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The city of Calcutta right now or even within this decade is of course different from the previous decades. The change is found to be continued if one looks back and passes through time. The alteration is found in many dimensions as the areal coverage, shape and size, population figures, etc. With time Calcutta is enlarging in dimension and the details of the same are making fast changes with the network of roads and streets the elevation and architecture of buildings, transport system and practically the total details which form the contents of the city of Calcutta.

There is another area in which the change is found to be very perceptible and that is related to other living objects. These include primarily the flora and fauna of Calcutta. It is known that both plants and animals are related to each other although the domination in terms of dependency is perhaps more in case of flora. On the basis of various kind of evidences, it appears that at one time, during the early Holocene which goes back to about 10,000 years, the present Calcutta was covered by sea. Due to eustatic movement, especially during the late Pleistocene period, the sea i.e. the Bay of Bengal receded further down and thereby Calcutta turned to be coastal line. Like the present coastal belt situated further south right now in the Sundarbans, the area of Calcutta was provided with mangroves. The remains of these floral assemblages have been unearthed from the deep digs from the modern city of Calcutta. The underneath of the city of Calcutta is formed of pits, associated with the remains of mangrove vegetations, and other plant remains mostly found in form of pollens.

The enquiry of the present undertaking is not so deep rooted in chronological scale. Rather, in the present case a comparative assessment has been attempted within a maximum range of about a century. There are some records (Hooker, 1875; Ghoshal, 1895; Duthie, 1903; Prain, 1903, 1905, 1963; Kirtikar, 1933; MacMillan, 1935; Biswas, 1964; Das Gupta, 1973; Benthall, reprinted 1984) on the basis of which detailed

information may be collected on the flora of this area, especially of Calcutta and its neighbourhood.

For the purpose of practical visualization the scene of Calcutta about 100 years ago may be depicted as,

"... the wild rhinoceros roamed near Alipore and panthers are often hunted in what is now part of the city of Calcutta. In those days jungles must have stretched from Sundarbans to the edge of the city..." (Benthall, reprinted 1984).

The above depiction is not mere imagination but it is historically true. Even in recent times, as of 1959, some information on Calcutta may be collected from the wardwise maps of the city of Calcutta. Even about quarter of a century or even further back most of the wider roads were provided with rows of large trees which made the canopy over the streets. In many of the wards there were parks and even tanks in which plants were found in abundance. In term of land-use of this city, quite an appreciable proportion of the city area was not under habitation. In such places there were trees, herbs, and shrubs.

At this point it is necessary to present a cursory list of the major plants which were abundantly present in this area. The list includes :

Chalta	—	<i>Dillenia indica</i>
Bena chiti	—	<i>Polyalthia cerasoides</i>
Benchi	—	<i>Flacourtia indica</i>
Ban jhau	—	<i>Tamarix gallica</i>
Simal	—	<i>Bombax ceiba (Salweenia malabarica)</i>
Ulat kambal	→	<i>Abroma augusta</i>
Kath bel	—	<i>Limonia acidissima (Feronia elephantum)</i>
Bel	—	<i>Aegle marmelos</i>

Ber	—	<i>Ziziphus mauritiana</i>
Jlyal	—	<i>Lanea coromandelica</i>
Am	—	<i>Mangifera indica</i>
Amra	—	<i>Spondias magnifera</i>
Sajina	—	<i>Moringa oleifera</i>
Karanja	—	<i>Pongamia pinnata</i>
Tentul	—	<i>Tamarindus indica</i>
Babul	—	<i>Acacia arabica</i>
Sirissa	—	<i>Albizia lebbek</i>
Kala Jamb	—	<i>Syzygium cumini</i>
Hid jal	—	<i>Barringtonia acutangula</i>
Kadam	—	<i>Anthocephalus indicus</i>
Ban Jam	—	<i>Ardisia solanacea</i>
Akanda	—	<i>Calotropis gigantea</i>
Kukur chita	—	<i>Litsaea chinensis</i>
Khudi jamb	—	<i>Antidesma ghaesembilla</i>
Bagh bherenda	—	<i>Jatropha curcas</i>
Jilan	—	<i>Trema orientalis</i>
Asvattha	—	<i>Ficus religiosa</i>
Bot	—	<i>Ficus bengalensis</i>
Dumur	—	<i>Ficus hispida</i>
Jogya dumur	—	<i>Ficus glomerata</i>
Khajur	—	<i>Phoenix sylvestris</i>
Tal	—	<i>Borassus flabellifer</i>

Another list may be brought out. The plant contents of which were not very abundant but were also present in gardens which were taken proper care of. These are :

Phalsa	—	<i>Grewia asiatica</i>
Kamranga	—	<i>Averrhoa carambola</i>
Ber	—	<i>Zizyphus jujuba</i>
Litchi	—	<i>Litchi chinensis</i>
Belati amra	—	<i>Spondias dulcis</i>
Deshi badam	—	<i>Terminalia catappa</i>
Jamrul	—	<i>Syzygium malaccense</i>
Ach	—	<i>Morinda citrifolia</i>
Bakul	—	<i>Mimusops elengi</i>
Amla	—	<i>Embilca officinalis</i>
Tunt	—	<i>Morus alba</i>

In the list of plants maidan formulated in 1944 there are about 60 plants names. A few of these have been given here which have not been incorporated in the earlier list. These are :

Debdaru	—	<i>Polythia longifolia</i>
Buddha narikel	—	<i>Pterygota akata</i>
Kanak champa	—	<i>Pterospermum acerifolium</i>
Jum	—	<i>Garuga pinnata</i>
Nim	—	<i>Azadirachta indica</i>
Mehagini	—	<i>Swietenia mahogany</i>
Kusum	—	<i>Schleichera oleosa</i>



Asphal	—	<i>Euphorbia longana</i>
Sisu	—	<i>Dalbergia sissoo</i>
Gulmohar	—	<i>Delonix regia</i>
Amaltas * *	—	<i>Cassia fistula</i>
Arjuna	—	<i>Terminalia arjuna</i>
Hid Jal	—	<i>Barringtonia acutangula</i>
Jarul	—	<i>Lagerstroemia speciosa</i>
Pitali	—	<i>Trewia nudiflora</i>
Jla pata	—	<i>Putranjiva roxburghii</i>
Kathal	—	<i>Artocarpus integra</i>
Jir	—	<i>Ficus retusa</i>
Pakur	—	<i>Ficus infectoria</i>

Earlier the city has blooming with flowers of various shades and colours. Some of these are :

Simal	—	<i>Bombax ceiba (Salmalia malabarica)</i>
Palitamandar	—	<i>Erythrina indica</i>
Palash	—	<i>Butea monosperma</i>
Gulmohar	—	<i>Delonix regia</i>
Asoka	—	<i>Saraca indica</i>
Sthal padma	—	<i>Hibiscus mutabilis</i>
Kokla	—	<i>Thevetia peruviana</i>
Gandharaj	—	<i>Gardenia florida</i>

Chinese cherry	—	<i>Muntingia calabura</i>
Kurchi	—	<i>Holarrhena antidysenterica</i>
Akash nim	—	<i>Mitlingtonia hortensis</i>

Benthall (reprinted 1984) remarked that in his book 276 plants have been recorded and described of which "69 may be considered native or naturalized in the neighbourhood ..." of the remaining 267 species, "91 are indigenous in the other parts of India; 50 though no native in India are indigenous elsewhere in Asia; 14 are natives of Africa; 42 of America; 9 of Australia and 1 of the Southern Islands" In Calcutta, even today some plants are found to occur which generally do not fit in with the prevailing ecosystem. Examples may be set forth with Pedaliaceae growing, especially *Pedalfum murex* which is provided with great utilization value. This is found in the area of Salt Lake City, filled with waste and dredged soil of the river Hooghly (Pal and Paria, 1986).

The list of plants, although partially, presented earlier show the presence of those plants in ancient Calcutta, including the vicinity areas. During the said period the area was undergoing through a process urbanization. After words Calcutta became a full fledged urban centre and in course of this city lost many plant species and population sharply dwindled down. In distant neighbourhood, the impact of urbanization was less and in the same area, plants of earlier Calcutta still survive. For the purpose of this present work a number of villages which are placed in the off periphery have been selected. List of plants present in those villages have been drawn. On the basis of comparisons between the lists of plants of earlier Calcutta and the present villages it shows that there is considerable amount of compatibility in terms of similarity. On the other many such plants are totally devoid of in the city of Calcutta. The plants still found are with conspicuously less frequency.

With the change of flora and extinction of the same from this city, remarkable shifts are found in the milieu of social, cultural, religious and economic matrix. Plants with many of its parts like root, stem, bark, leaf, flower and fruit, supply many of the necessities of life of the local populations. The needs may mainly be categorised on the following items :

Food and drink

Fuel

Fodder

Construction: Items

Furniture

Medicine

Decoration

Component of tools

Socio-religious consideration

Quite a good number of plants supply food and drink. In this case all the fruits and vegetables are included. Earlier, wood was one of the major fuels for domestic purposes and to serve this purpose an appreciable amount of wood was used. In terms of populations of trees and hearth there was some amount of balance and deforestation did not emerge. The lowland areas and swamps used to supply fodder which was used for domestic cattles. Wooden posts and planks both from other area and of local origin were serving the purpose of construction of houses similar as the case with furniture.

Earlier for many ailments, different parts of plants were used for remedial purpose and many of them work very efficiently. Decoration during festive occasions were made with leaves and flowers of local plants. In the situation of earlier Calcutta, many a tools were used both for domestic and professional purposes. Specific type of wood was used for specific tools.

In the area of social, cultural, religious and day to day economic activities, large number of plants were used. In absence of those plants, the belief, custom and norms have either been changed or replacement has been made with other artificial objects.

Man is dependent on plants since his emergence. The coverage of this dependence is quite wide. Even in future such dependence will surely be continued. On the other hand, the city is destroying plants which has resulted in the change of total culture. The difference between urban and rural culture may be accounted for in very many ways. Among large number of factors, deforestation in the adjoining of city is indeed a crucial factor.

The remedial measure is perhaps completely lacking. The change in continuity may be made retarded with afforestation measures both within the open space of the city and in the immediate periphery.

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# **Some possible ecological impact on the recent depletion of indigenous flora and introduction of exotic plants in Calcutta**

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## ABSTRACT

Uptil now 91 exotic plant species have been introduced into Calcutta. Owing to unplanned urbanisation and public unawareness, some of the indigenous plants are at present vanishing from this city. The present paper incorporates a list of introduced exotic species and a partial list of recently depleted indigenous plants. An attempt has also been made to throw some light on possible impact of such floristic changes on the bioecological situation of Calcutta.

## INTRODUCTION

Calcutta is world's second most thickly populated city. The existing *per capita* open space in this city is 1.85 square meter while the corresponding figures in London and Moscow are found to be 23.26 and 44, respectively. A recent population census (of 1981) show that the greater Calcutta is inhabited by 10.3 million people and the population density is constantly increasing. As a consequence, rapid and unplanned urbanisation has occurred in this age-old city. In the span of the last two decades, concrete jungle has replaced the green step by step, and this replacement is more pronounced in certain areas with an appreciable speed. In addition, various developmental programmes demanding new constructions and excavation have contributed much in clearing off the green cover of the city, and thus towards the depletion of its indigenous flora.

It is a well known fact that an adequate proportion of green canopy is of prime necessity in a congested city like Calcutta in maintaining a congenial bio-climatological situation. Keeping in view the aforesaid perspective, authorities have launched time-bound plantation programmes from time to time. Both indigenous as well as exotic species of plants have been used for the purpose. The present investigators had the opportunity to observe some of these programmes. This observation has provoked us to undertake a survey on the introduced exotic plants and depleted indigenous species

in Calcutta. A possible ecological impact on the city life has also been interpreted by reviewing the works of competent authorities, supported by field observation.

## OBSERVATION

**Table 1 : Exotic species introduced to Calcutta and their native lands**

Name of the species	Native land
1. <i>Abronia augusta</i>	Malaya
2. <i>Acacia auriculiformis</i>	Australia
3. <i>Adansonia digitata</i>	Tropical Africa
4. <i>Adenanthera pavonina</i>	China, Malaya
5. <i>Areca catechu</i>	Malaysia
6. <i>Barassus flabellifer</i>	Tropical Africa
7. <i>Cocos nucifera</i>	Tropical America
8. <i>Corypha elata</i>	Philippines and Burma
9. <i>Livistona chinensis</i>	Southern China
10. <i>Nyssa fruticans</i>	Indigenous to Indo-Malaya region and Australia
11. <i>Ptychosperma macarturi</i>	Australia
12. <i>Roystonea regia</i>	West Indies
13. <i>Ravenala madagascariensis</i>	Madagasy
14. <i>Strelitzia reginae</i>	South Africa
15. <i>Canna orientalis</i>	Tropical America
16. <i>Casuarina equisetifolia</i>	Australia, Malay and Pacific Islands
17. <i>Salix babylonica</i>	Europe and North West Asia
18. <i>Morus alba</i>	North West Asia
19. <i>Gravillea robusta</i>	Australia
20. <i>Artabotrys uncinatus</i>	Tropical America
21. <i>Annona reticulata</i>	Tropical America
22. <i>Cananga odorata</i>	Burma, Java and Philippines
23. <i>Polyalthia longifolia</i>	Sri Lanka
24. <i>Inga dulcis</i>	South America
25. <i>Leucaena leucocephala</i>	Tropical America

Table 1 : contd.

Name of the species	Native land
26. <i>Samanea saman</i>	Brazil and Central America
27. <i>Amherstia nobilis</i>	Burma
28. <i>Brownia coccoloba</i>	Jamaica
29. <i>Caesalpinia baccalaco</i>	South America
30. <i>C. crotaria</i>	West Indies
31. <i>C. pulcherrima</i>	West Indies
32. <i>Classia biflora</i>	Philippines
33. <i>C. fistula</i>	Malaya and Burma
34. <i>C. grandis</i>	Caribbean Islands and South America
35. <i>C. javanica</i>	Java and Sumatra
36. <i>C. multijuga</i>	Tropical America
37. <i>C. nodosa</i>	Malaya, Burma and adjoining hilly areas of Chittagong
38. <i>Colvillea racimosa</i>	East Africa
39. <i>Delonix regia</i>	Malagasy
40. <i>Parkinsonia aculeata</i>	Tropical America
41. <i>Peltophorum brasiliense</i>	Brazil
42. <i>P. pterocarpum</i>	Brazil
43. <i>Tamarindus indicus</i>	Tropical Africa
44. <i>Brya ebenus</i>	West Indies
45. <i>Millettia peguensis</i>	Burma
46. <i>Pongamia pinnata</i>	Malaya, China and Tropical Australia
47. <i>Sesbania grandiflora</i>	Malaya
48. <i>Citrus grandis</i>	Java
49. <i>Muraya koenigii</i>	Tropical America
50. <i>Ailanthus excelsa</i>	Queensland (Australia)
51. <i>Guassia amara</i>	Tropical America
52. <i>Cotinicida seplum</i>	Tropical America
53. <i>Azadirachta indica</i>	Burma

Table 1: contd.

Name of the species	Native land
54. <i>Melia azedarach</i>	Baluchistan
55. <i>Swietenia macrophylla</i>	Tropical America
56. <i>S. mahoganii</i>	Jamaica and Central America
57. <i>Muntingia calabura</i>	America
58. <i>Hibiscus mutabilis</i>	China
59. <i>Bombax ceiba</i>	Malaya
60. <i>Dombeya mastersii</i>	Malagasy
61. <i>Guazuma ulmifolia</i>	Tropical America
62. <i>Kleinovia hospita</i>	Tropical Africa, Malaya and Australia
63. <i>Pterosperrum acerifolium</i>	Burma and Chittagong
64. <i>Bixa orellana</i>	Tropical America
65. <i>Lagerstroemia indica</i>	Tropical Asia
66. <i>L. thorelli</i>	Vietnam
67. <i>Couroupita guianensis</i>	South America
68. <i>Gousteria augusta</i>	Tropical America
69. <i>Anogeissus acuminata</i>	Burma
70. <i>Terminalia catappa</i>	Malaya
71. <i>Callistemon citrinus</i>	Australia
72. <i>Eucalyptus citrodora</i>	Australia
73. <i>Syzygium malaccense</i>	Malaya
74. <i>Acharas zapota</i>	Tropical America
75. <i>Diospyros discolor</i>	Philippines and Malaya
76. <i>Pimenta alba</i>	Tropical America
77. <i>P. rubra</i>	Mexico
78. <i>Inevitia peruviana</i>	Peru
79. <i>Corofa rebestina</i>	Peru
80. <i>Citharexylum quadrangulatis</i>	West Indies
81. <i>Crescentia cujete</i>	Cuba



Table 1: contd.

Name of the species	Native land
82. <i>Jacaranda filicifolia</i>	Tropical America
83. <i>J. mimosaeifolia</i>	Tropical America
84. <i>Kigelia pinnata</i>	Mozambique and other parts of the Tropical Africa
85. <i>Millingtonia hortensis</i>	Burma
86. <i>Parrmentia cecifera</i>	Panama
87. <i>Spathodea campanulata</i>	Central Africa
88. <i>Tabebuia chrysantha</i>	South America
89. <i>Tecoma stans</i>	South America
90. <i>Gardenia jasminoides</i>	China
91. <i>Hibiscus palens</i>	Tropical America

## NAMES OF SOME INDIGENOUS FLORA DISAPPEARING FROM CALCUTTA

Name of the species	Vern. Name
1. <i>Astonia scholaris</i>	Chhatim
2. <i>Halarrhena antidysenterica</i>	Kurchi
3. <i>Michelea champaca</i>	Champa
4. <i>Mimusops elengi</i>	Bakul
5. <i>Saraca indica</i>	Asoka
6. <i>Crotaeva nurvala</i>	Barun
7. <i>Terminalia arjuna</i>	Arjun
8. <i>Lagerstroemia speciosa</i>	Jarul
9. <i>Albizia lebbek</i>	Silis
10. <i>Mangifera indica</i>	Aam
11. <i>Acalypha indica</i>	Muktajhuri
12. <i>Amaranthus spinosus</i>	Katanafey
13. <i>Andropogon aciculatus</i>	Chorkanta
14. <i>Butea monosperma</i>	Palash
15. <i>Calotropis gigantea</i>	Akanda
16. <i>Clerodendron infortunatum</i>	Ghetu

	<b>Name of Species</b>	<b>Vern. Name</b>
17.	<i>Datura spp.</i>	Dhutura
18.	<i>Ficus cunea</i>	Dumur
19.	<i>F. glomerata</i>	Jagya dumur
20.	<i>F. infectoria</i>	Pakur
21.	<i>Glycosmis pentaphylla</i>	Ash-Shaora
22.	<i>Heliotropium indicum</i>	Hatsur
23.	<i>Ipomoea alba</i>	Kalmi-lata
24.	<i>Jatropha spp.</i>	Bherenda
25.	<i>Lantana camara</i>	Chotra
26.	<i>Leonurus sibiricus</i>	Raktadrome
27.	<i>Leucus aspera</i>	Shetadrone
28.	<i>Nicotiana plumbaginifolia</i>	Bon-lamak
29.	<i>Nyctanthes arbor-tristis</i>	Sheull
30.	<i>Ocimum gratissimum</i>	Ram-tulsi
31.	<i>O. basilicum</i>	Babul-tulsi
32.	<i>Oldenlandia corymbosa</i>	Khetpapra
33.	<i>Pandanus fascicularis</i>	Keya
34.	<i>Pedilanthus tithymaloides</i>	Rangchita
35.	<i>Sida cordifolia</i>	Berela
36.	<i>S. rhombifolia</i>	laiberela
37.	<i>Solanum torvum</i>	Titabegun
38.	<i>Streblus asper</i>	Shaorah
39.	<i>Trimufetta rhomboidea</i>	Bon-Okra
40.	<i>Catharanthus roseus</i>	(Nayantara) Vinea is treated under catharanthus
41.	<i>Vitex negundo</i>	Nishinda
42.	<i>Vitis spp.</i>	Harjara; goallata
43.	<i>Ziziphus oenoplea</i>	Shlakul

## DISCUSSION

Exotic plant species introduced to Calcutta till date comprise mainly of ornamental variety. A complete list of these introduced species and a list of recently

depleted indigenous flora are incorporated. The present section intends to deal with some possible ecological impact, which might be correlated to such floristic changes, on the present bio-ecological situation.

It appears from our observation that selection of exotic species was made upon two primary considerations. First, the species are ornamental, and secondly they are fast growing as well as hardy enough to withstand harsh ecological climate of the urban area which is rather heavily polluted. The criteria of selection find an outright support especially when the air purifying role of plants is taken into consideration. It is also quite understandable that the plants used for the green within a short time. Selection of certain broad-leaved species, both indigenous and exotic, is also supportable when their ascribed noise-absorbing quality is taken into consideration.

An examination of the list of introduced exotic plants reveals that they are mostly natives of moist tropical regions of the globe, viz., South East Asia, tropical Africa and Central as well as South America. But a few species of *Eucalyptus* and *Acacia* are originally inhabitants of arid or semiarid areas. An important adaptation of these plants is that they develop a deeper rootsystem facilitating a greater and much efficient water absorption. As a consequence, these plants convert the substratum water-deficient, and thus not permitting the growth of a grass cover or undershrubs. In addition, a few other plants inhibit growth of other plant species through a more direct yet subtle influence. These *allelopathic* plants produce toxic chemicals which prevent encroachment of other species into the substratum underneath. Among the introduced species, *Sterculia foetida*, *Pterospermum acrifolium*, *Abroma augusta* and *Spathodea campanulata* have already been reported to produce *allelopathic* influence.

Plants are also concerned with public health, and this aspect demands a critical and careful consideration while working with the programmes of greening Calcutta. Palynologists constantly warn about the hazards of allergenic pollens of a few plants. Being microscopic these pollens are easily disseminated by wind. When inhaled, these pollen cause sneezing, bronchial inflammation and other serious ailments of the naso-respiratory tract. In order to ward off confusion, it may be pointed out that all exotic species do not produce such health hazards nor all the indigenous plants can be kept out of this allegation. Yet from the view point of compatibility and immunity

against the pollen-allergens, the exotic varieties may be considered more dangerous. For an instance, and accidentally introduced weed *Parthenium hysterophorus* is reported to produce quite serious health hazards particularly in some susceptible section of population.

It is established with certainty that some sort of interactions exist between the floristic composition of an area and its indigenous fauna. Plants support invertebrate communities comprising insects, millipedes, snails and many others. Birds also depend upon natural vegetation for food such as fruits, nectar and bark-dwelling insects, and also use suitable plants as nesting sites. All these species of plants and animals constitute the ecological set up of an area which is rather stable from the stand point of community dynamics. In many ways, all these species exhibit co-adaptation reflecting a long standing association through course of evolution. It is therefore, not very illogical to think that a rapid depletion of indigenous flora and introduction of exotic species would be a crucial factor in dissipating the ecological homeostasis. Albeit the disastrous effect may not be within the observable limit initially, this damage in the micro-ecology is capable of disrupting the macro-ecoclimate of the urban area in the long run. At least this possibility cannot be ruled out in a straight forward way.

The ecological disbalance in Calcutta is to some extent attested by disappearance of a number of animal species. A number of butterfly species, such as *Danals chrysiippus* (Plain tiger), *D. plexippus* (Common tiger), *D. limnace* (Blue glassy tiger), *Papilio demoleus* (Lime butterfly), *P. polytes* (Common mormon), *P. polymnestor* (Blue mormon), *Palanta phalantha* (Common leopard), *Terias hecabe* (Common grass yellow), *Leptosia nina* (Psyche) and many other species were not uncommon in Calcutta and some were abundant about 20 years ago but at present they are too infrequent. One of the causative factors for their disappearance might be the depletion in their food-plants. The same is true for certain birds such as *Haliastur indus* (Brahminy kite), *Ploceus philippinus* (Common weaver bird), *Dinoptum benghalense* (Golden-backed wood pecker), *Dendrocopos mahrattensis* (Mahratta wood-pecker), *Nectarinia asiatica* (Purple sunbird), *Pycnonotus cafer* (Red-vented bulbul), *Psittacula krameri* (Rose-ringed parakeet), *Orthotomus sutorius* (Tailor bird), *Dendrocitta vagabunda* (Tree pie) etc.

Ecologists are univocal regarding a relationship of vegetation to local climate, commonly interpreted as *bio-climatological mix*. It is apparent from the *meteorological* data and personal observation of the investigators that the climate of Calcutta is altered to some extent since late 50's. Some of these alterations include temperature and humidity fluctuations, delayed monsoon, inadequate and infrequent rainfall alternated with heavy showers in certain months of the year, short stay of winter etc. Although it is not very wise to draw a straight relation of these climatic shifts to the depletion in local flora, still it would not be rational to negate all possible interrelations, especially when the picture is not very clear regarding the casual effects of the exotic plants imported from the climatologically incompatible areas. Systematic researches in this arena are of prime necessity. Investigators also think that research programmes should be undertaken in order to find out the possibility of transmission and spread of *exotic pathogens* (if any) from the introduced varieties to the local flora.

Before closing the discussion, a few lines may be quoted from Etherington's (1975) book, *Environment and Plant Ecology* : "Disturbance of ecosystems and selective pressure by man and animals causes extensive variation in competitive status of plants in natural ecosystems. Such pressures may be visualized as deforming or displacing *niche-hyperspaces*, thus permitting some species to increase in numbers and others to regress"

#### RECOMMENDATIONS

1. Use of the indigenous species as far as practicable in various plantation programmes.
2. Importation of exotic varieties from eco-compatible areas.
3. Emphasis may be given in selecting indigenous plants having certain attachments to tradition, sentiment and culture of the cosmopolitan inhabitants of the city.
4. Scientific quarantine measures may be adopted before introducing an exotic plant.
5. Along with indigenous plants, selective ecological compatible exotic plants may be used.

6. Plants like *Gladiolus*, *Zinnia*, *Petunia*, maize and conifers may be grown in suitable areas; these plants function as pollution indicators being much sensitive to urban pollutants such as carbon monoxide and sulfur dioxide.
7. An organization "Society for conserving indigenous plants" may be constituted taking representatives from different socio-economic strata.

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## **Man and the vanishing forests**

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### ABSTRACT

India is losing 1.3 million hectares of forests every year according to the latest satellite data. The fast changing forest scenario, distortions in social forestry programmes and some possible remedies are highlighted in this paper.

### INTRODUCTION

According to the latest satellite data India is losing 1.3 million hectares of forests each year. The problem of deforestation is the greatest environmental problem facing our country. The motive force behind widespread deforestation is found to operate in our social forestry programmes which have been launched by several states with much fanfare and mostly with massive support of international agencies. These social forestry programmes are intended to meet the needs of urban and industrial markets instead of the needs of fuel and fodder of the rural poor. It is high time that the government pays serious attention to its afforestation (including social forestry) policy. In this paper the problems concerning the fast changing forest scenario, the present government policy and possible remedies are focused.

*The Forest Scenario :* The annual forest loss to the tune of 1.3 million hectares per year is eight times more than that claimed by the forest departments. The National Remote Sensing Agency (NRSA) studies classify forest cover under three categories closed forests, degraded forests and mangrove forests. During the seven years period 1975-82 the closed forests decreased from 14.12 to 10.96 per cent, degraded forests increased from 2.67 to 3.06 per cent and mangrove forests dropped from 0.099 to 0.081 per cent. Thus during this period the country lost 10.4 million hectares of closed forest and 63,000 hectares of mangroves while 1.3 million hectares of closed forests were transformed into degraded forests. The state-wise forest areas and relevant forest statistics are tabulated in Tables I and II.

Arunachal Pradesh, Manipur and Andaman & Nicobar Island only conform to the prescribed forest cover of 60 per cent in hill regions as per the National Forest Policy (1952). The deforestation status of the various states is summarised.



Madhya Pradesh	—	2 million hectares
Maharashtra	—	1 million hectares
Orissa, Andhra Pradesh, Jammu & Kashmir	—	1 million hectares
Himāčhal Pradesh, Rajasthan	—	$\frac{1}{2}$ million hectares

The states and union territories with low forest cover suffered the most in terms of proportion of forest area lost :

Punjab	—	50% forest cover
Rajasthan, Haryana and Gujrat	—	50%     "
Himachal Pradesh, Jammu & Kashmir	—	33%     "
Maharashtra	—	25%     "
West Bengal and Tamil Nadu	—	20%     "

Bastar in India's tribal heartland in Madhya Pradesh represents a glaring example of the vanishing forest frontier. It has the largest expanse of moist deciduous forests with bamboo, teak, laurel and about 15 other species. This together with rich mineral reserves—iron ore, bauxite, limestone, dolomite have attracted exploiters for many years. At present about 50 per cent of Bastar's forests have adequate tree cover but about 400,000 hectares of forest lands are thoroughly degraded with only a bare minimum of topsoil. The adjoining districts of Durg and Raipur, with rapidly growing populations and industries, provide constant pressure for unchecked deforestation. Truckloads of fuelwood heading out of Bastar to far away places like Delhi have become a common scene.

*Afforestation programmes Social Forestry* : As part of the Government policy on afforestation, social forestry has become the major thrust area. According to the National Commission on Agriculture (1976) social forestry means tree raising programmes to supply firewood, fodder, small timber and minor forest produce to rural populations. It has, however, become the storm centre of controversy.

The Government claims that a new green revolution is in progress. Against Rs. 483 crores of outlay during the period 1980-81, the 6th plan itself provided a budget of Rs. 693 crores. The union Government and World Bank are keen to extend social forestry programmes to all parts of the country. Several state Governments have undertaken social forestry programmes, mostly financed by international agencies eg. the World Bank, US Agency for International Development (USAID), Canadian International Development Agency (CIDA) and Swedish International Development Authority (SIDA). The Union Agriculture Ministry claimed that in 1982-83 social forestry was highly successful. Since 1980-81 over 1000 crores seedlings have been distributed to farmers for farm forestry and planted for afforestation and in addition, about 1.2 million hectares have been planted under social forestry programmes. By the end of 1988 the Government hopes to bring some 1.90 million hectares under social forestry plantations with Government investment of about Rs. 600 crores.

Social forestry programmes have three major components : farm forestry, encouraging farmers to plant trees on their own farms by distributing free or subsidised seedlings; woodlots planted by the forest departments for the needs of the community on roadside, canal side and other such public land; and community woodlots planted by the communities themselves on community lands.

But according to the World Bank's own reports on social forestry projects in U.P. and Gujrat, big farmers happen to be the major beneficiaries. In both these states farm forestry exceeded their targets whereas community self-help woodlots met barely 20 to 30 per cent of the target.

It may be noted that the major cause for failure in social forestry programmes is the acute shortage of building poles in the urban market and of pulpwood, required by the rayon and paper industries. The active campaign for farm forestry alongwith its

financial incentives has been a boon for the big farmers. When farmers switch from short term agriculture to long-term tree farming such as Eucalyptus plantation, they virtually become absentee landlords. This practice has spelled disaster for the landless in the villages, as they are virtually kept out of the picture and denied any benefit. Thus social forestry may usher in a new green revolution which will increase wood in the villages but at the same time it will also make the rural poor poorer in terms of energy. The entire cake virtually goes to the rich farmers while the poor villagers are denied their share.

*Gene Pool* : The tropical forests represent some of the most valuable natural resources on earth but these have been the object of indiscriminate destruction. The tropical rain forests are likely to disappear within the next 60 years if the current trends are not checked. These forests are specially rich in genetic, plant and animal resources, and should be preserved as Biosphere Reserves. Such preservation is essential for the present and future requirements of agriculture, medicine and industry. The Silent Valley movement in Kerala is a model for environmental movements for the protection of Biosphere Reserves.

*Mass Education* : Mass education on environmental awareness is the key to the solution of the prevailing environmental problems facing the country. Several non-government agencies are doing their bit in community crusade. A series of slides on trees and forest resources will perhaps serve as a model for such mass education.

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Table - I : State wise forest areas by Satellite data.

State/Union Territory	Forest area (million ha)	
	1972-75	1980-82
Andhra Pradesh	4.90	4.04
Assam	2.11	1.98
Bihar	2.27	2.01
Gujrat	0.95	0.51
Himachal Pradesh	1.61	0.91
Jammu & Kashmir	2.23	1.44
Karnataka	2.96	2.57
Madhya Pradesh	10.86	9.02
Maharashtra	4.07	3.04
Orissa	4.64	3.94
Uttar Pradesh	2.59	2.10
West Bengal	0.83	0.65

Table - II : Forest Statistics

	1972-75	1980-82
Forest Cover (million hectares)	65.62	46.35
Closed forests " "	46.42	36.02
Open forests " "	8.77	10.06
Mangrove forests " "	0.33	0.26
Forest Cover (% total land area)	16.89	14.10

Table - III : Foreign aid assisted social forestry project in India

STATE	TOTAL COST (MILLION \$)	FOREIGN AID (MILLION \$)	AGENCY	PERIOD	AREA PLANTED ( HA )
U.P.	40	23	World Bank	1979-84	0.5 lakh
Gujrat	67	37	"	1980-85	1.0 "
Tamil Nadu	47	33	SIDA	1981-86	1.0 "
M.P.	40	25	USAID	1981-86	1.0 "
W. Bengal	34	29	World Bank	1981-87	0.93 "
Maharashtra	56	30	USAID	1982-87	—
Karnataka	60	27	World Bank	1983-88	1.60 "
Andhra Pradesh	45	44	CIDA	1983-88	0.57 "

SIDA - Swedish International Development Authority.

CIDA - Canadian International Development Agency.

USAID - United States Agency for International Development.

## **Man, Plant and City - A view**

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### **ABSTRACT**

In the present popular-cum-scientific article interaction of man and plant has been discussed in various ways. Later, city came into existence but their survival like human beings also depended upon the existence of plants. There is world wide awareness about the presence of plants. Plants are considered best friends since they ask no questions or offer no criticism. They are always present in two extremes of lives i.e. happiness and sadness. A few important names are suggested as avenue trees; shrubs and medium sized trees for lawns; climbers for walls, hedge plants as tip for choosing plants by common man to pick up atleast one species in the first instance.

The mankind is provided with vegetation by nature which is indispensable to men, since its existence on earth. Plants not only give oxygen to breathe but also provide three basic necessities of life i.e. shelter, food and clothing. In addition to it plants benefit mankind by checking radiation, pollution, soil erosion, floods, wind velocity etc. The most recent researches by professional psychotherapists have shown that plants too help in maintaining emotional stability by defusing mental stress and strains. One can get relief from such ailments by growing, rearing up, feeding, pruning and watering of plants. Now it is a better campaign to say "Take a pill, if you will" but we say "Take a plant" In fact, plants are such friends which pose no questions and make no criticisms. It has been proved beyond doubt that the existence of mankind in this globe is due to existence of plants.

Let us turn to city. The association of the word with Greek "Polis" and Latin 'civitas' involves the ancient conception of 'city'. Cities have been planned for one purpose or the other from long time. Men first came together in closely built communities and replanned after congestion, inadequate sanitation, industrialisation, population explosion, increase in automobile etc. Later city depended upon the kind and extent of Municipal privileges, charters approved by Legislatures raising towns and villages to the rank of city. Subsequently, city planning came into existence through

proper housing, traffic restrictions, recreation facilities, landscapes, gardens and there was public awareness to form green belt etc.

The close relationship between man and plant does exist from time immemorial. Human beings have always considered flowers and plants as an inescapable necessity in times of both celebration and mourning thus pointing out that plants can help us through daily ups and downs of life just they do in times of extreme happiness or sadness. Addition to gardening whether indoor or outdoor, one plant or a thousand plants is welcome. During office boredom, stress, anxiety, tension etc. plants help in making life more pleasant merely by their presence.

The presence of plants indoors/outdoors/avenues etc. in various ways in cities has become part and parcel of our life. In urban life Plants utility as air conditioners, sound absorbers and natural disinfectants is undisputed. In spite of all these nature-gifts man has been cruel to plants and is destroying forests a two acres per second in the world. It is a well known fact that the dreadful drought of 20th century in Ethiopia is due to ruthless cutting of plants by natives. The soil erosion, floods, droughts, increase in sea level, green-house effect, acid rains etc. are the result of wanton destruction of vegetation by us. Plants need help, affection and protection for our welfare.

Garden-city movement has been launched by various ways viz., Government, voluntary organisations, social workers, private nurseries, architects etc. by providing landscape schemes, laying out horticultural, recreational parks, gardens for aesthetic and other different purposes etc. throughout the world. Plants can be easily obtained through state Government/private nurseries and are even sold door to door by hawkers in cities. The awareness regarding introduction/ establishment of plants had been known through ages and persons introduced/ established gardens as plants resources for food, fibre, flowers, fuel, furniture and drugs etc. But in course of time several weeds also found their way by various means everywhere in the world and in India also several such weeds have been acclimatized. The latin names of some of such common exotic weeds are mentioned along with name of the country in bracket from where they came into India, viz., *Argemone mexicana* (Mexico), *Cassia occidentalis* (S. America), *Croton bonplandianum* (S. America), *Eichornia crispes* (Brazil), *Fumaria indica* (N. temperate), *Heliotropium indicum* (America), *Lothyrus aphaca* (Europe), *Medicago lupulina*

(Europe), *Mellilotus alba* (Europe), *Oxalis corniculata* (S. Europe), *Parthenium hysterophorus* (America), *Xanthium strumarium* (America).

Some of the common hardy perennial trees, shrubs, climbers hedge plants are mentioned for everyone with the request to try atleast one species in the first instance. Latin names are given first with popular Hindi/English names in bracket to facilitate easy enquiry with Malis/laymen etc. Latin names are given to educate common people. Many more names may be added but due to paucity of space only a few names are listed. Regarding indoor/annual plants, nurserymen will be of immense value to advise and educate people, therefore avoided their names. Avenue trees : *Albizia lebbek* (Siris), *Astonia scholaris* (Chaitan), *Anthocephalus chinensis* (Kadamba), *Azadirachta indica* (Neem), *Bauhinia variegata* (Kachnar), *Bombax ceiba* (Semul), *Cassia fistula* (Amaltas), *C. grandis*, *C. javanica*, *C. siamea*, *Cochlospermum religiosum* (galgal), *Dalbergia sissoo* (Sheesham), *Delonix regia* (Golmohar), *Erythrina variegata* (Indian coral tree), *Ficus bengalensis* (Bargad), *F. religiosa* (Peepal), *Kigella pinnata* (Sausage tree), *Lagerstroemia parviflora* (Dhaura), *L. speciosa* (Jarul), *Madhuca longifolia* (Mahua), *Mangifera indica* (Mango), *Mitchella champa* (Champa), *Mimusops elengi* (Mauishree), *Pettaforium pterocarpum* (Yellow flame tree), *Pterospermum acerifolium* (Kanak champa), *Samanea saman* (Rain tree), *Saraca asoca* (Sita Ashok), *Spathodea campanulata* (African tulip tree), *Tabebuia chrysantha*, *T. donnell smithii*, *Tectona grandis* (Teak), *Terminalia arjuna* (Arjun), *T. catappa* (Badam), *T.chebula* (Haritaki), *Thespesia populnea* (Paras pipal).

*Shrub/medium-sized tree* : recommended for larger lawns- *Caesalpinia pulcherrima* (Guletura), *Calliandra haematocephala* (Pink powder puff), *Catesbaea spinosa* (Lily thorn), *Cestrum nocturnum* (Ratran), *Cardia sebastina* (Lal Lasorah), *Dombeya wallichii* (Wedding flower), *Euphorbia pulcherrima* (Easter flower), *Gardenia jasmenoides* (Gundhrui), *Halmstoldia sanguinea*, *Kleinhovia hispida* (Bhola), *Murraya koenigii* (Meethi Neem), *Mussaenda philippica* (Bedna), *Nerium oleander* (Kaner), *Nyctanthes arbor-tristis* (Harsingar), *Thevetia peruviana* (Pila kaner), *Vitex negundo* (Nirgundi).

*Climbers for walls and making arches : Argylia speciosa (Samudra Ashoka), Bougainvillea various species and varieties, Petrea volubilis, Porana paniculata (Bridal creeper), Quisqualis indica (Rangoon Ki bet).*

*Hedge plants : Carrisa carandus (Karaunda), Clerodendron Inerme (Lanjai), Duranta plumeri, Eupatrium triplinerve, Hamelia patens, Hibiscus rosa-sinensis (Gudhal), Ixora chinensis, Jasminum sambac (Mogra), Justicia gendarussa, Murraya paniculata (Kamini), Pithecellobium dulce (Jangal, Jalebi), Tabernaemontana divaricata (Chandini), Tecoma stans (Yellow bells).*

#### ACKNOWLEDGEMENTS

Grateful thanks are due to Shri Sital Adhikari, General Secretary, Organising Committee, Bi-Centenary Celebration of Indian Botanic Garden, Howrah for inviting me to contribute an article for Seminar/ Symposium. I am also thankful to Shri A. K. Dutta, Garden Curator for going through the manuscript and helpful suggestions.



# **Germination success of seeds of the banyan (*Ficus bengalensis*) through birds**

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## **ABSTRACT**

Germination success of seeds of *Ficus bengalensis*, was quantitatively estimated by comparing the germination of ripe seeds collected from the tree and from droppings of *Mynahs* (*Acridotheres fuscus* and *Acridotheres ginginianus*). After ensuring that the seeds passed through the alimentary canal of birds (BAC) germinate a few days before those obtained from the tree, direct (DIR), the main set of data was recorded. This showed that of 1679 seeds, 713 (57%) germinated while of the 1916 DIR seeds, 651 seeds (34%) germinated. The peak period of germination in BAC lot was 7 to 10 days after "sowing" while that in the DIR lot was the 15-16th days after "sowing". Birds therefore contribute to both aspects of germination, namely higher percentage and quicker sprouting, besides dispersal.

## **INTRODUCTION**

The Banyan tree (*Ficus bengalensis*) is one of the most important ecological scaffoldings in its area. It is a world unto itself, sheltering and providing food for numerous animals like birds and insects. In fact, the sacred character of the banyan may have been partly due to this fact, the ancient Hindu philosophers might have thought that the tree was gaining merit by supporting so many animals and also offering welcome shade for human beings (Benthal, 1946). A fruiting tree gathers huge numbers of birds and insects and fruit bats or flying foxes. That birds and fruit bat disseminate the seeds of *F. bengalensis* is well known, indeed (Misra and Puri 1954). Benthal (1946) says, "the tree usually originates from seeds dropped by birds on old walls and other trees". Santapau (1966) likewise states that "seeds carried by birds or otherwise may happen to fall on old walls. The seeds soon germinate."

To our knowledge, quantitative data on germination success due to passage through alimentary canal of birds have not been worked out for this very important tree, and we undertook this interesting, though tedious study. The results establish the positive contribution of birds.

## MATERIAL AND METHODS

Unfortunately, birds and flying foxes have now become very rare in the outskirts of Calcutta. The cuckoo (*Eudynamis scolopaces*), the common mynah (*Acridotheres tristis*), jungle mynah (*A. fuscus*), pied mynah (*Sturnopaster contra*), bank mynah (*A. ginginianus*) were nevertheless seen to eat a lot of ripening fruit. 3 bank mynahs and 1 jungle mynah were purchased\*. The seeds from ripe fruit together with the flesh were mixed with the bird food. For comparing germination success, seeds from two identical halves of ripe fruit from various parts of a tree were collected and placed in two separate parts. One of this was fed to the birds and the seeds passed through the alimentary canal within 18-44 minutes. These were then scraped up from the droppings and washed. These and the control seeds were put on wet blotting paper on separate glass plates. These were again covered by a blotting paper. For maintaining moisture, the plates were kept in plastic bags containing a little water.

(According to the experimental ethics of the authors, the birds were released in Nature at the end of the experiment after ensuring that they were able to fly and recognize natural fruit).

Most of the results were based on three different trees from three different areas in the outskirts of Calcutta.

There is a good deal of variability in the number, nature, colour, and size of seeds. The colour of ripe fruit is also variable, while the hardness or softness of ripe fruit may considerably differ. The germination success of seeds (DIR) also varied tremendously.

Preliminary data which helped us for later orientation indicated that after 18 days following "sowing" germination in both BAC and DIR fell to a very low level. Another set of data showed that germination of BAC seeds tapered off to Zero by 13 days but DIR seeds showed a peak on 19th day and fell to Zero on 24th day. Table '1' shows the final results.

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\* This was before the new ban on purchase of all domestic birds imposed in West Bengal.

*Table 1 : The comparison of germination success of seeds through the alimentary canal of birds (BAC) and those directly from ripe fruit (DIR).*

Days after "sowing"	BAC	DIR
6	4	0
7	190	6
8	152	7
10	395	45
12	174	69
14	35	124
16	8	169
18	3	111
20	4	81
21	—	26
22	—	13
	Total 965	651

The counting of *ungerminated* seeds was then undertaken. This is a very difficult and tedious task. These seeds were put in water, when the chaff and immature seeds floated. The seeds at the bottom were collected, placed on paper and counted. As shown in table 2, the germination success of BAC and DIR can then be compared.

*Table 2 : The % germination.*

	No. of ungerminated seeds	No. of germinated seeds	Total No.	Approximate germination %
BAC	713	965	1678	57
DIR	1265	651	1916	34

A further experiment was undertaken to throw light on the effect of ageing on germination. Weighed seeds, 2 gm of BAC and 2 gm of DIR, were preserved under identical conditions for 39 days. After that they were sown.

The number of germinated seeds was 107 in BAC and 251 in DIR though the peak period of germination was the same for both the lots, 10th day after sowing.

## DISCUSSION

Tables 1 and 2 very clearly pinpoint the importance of birds in the propagation of banyan seeds. In a sort of symbiosis, the tree offers shelter and life giving food huge numbers of birds and they in turn propagate the seeds. In the right climatic conditions, in late summer or early rainy season, the seeds will be propagated through the birds and on watering (rain) the germination would be both hastened (table 1) and elevated in percentage (table 2). These are two direct contributions of the bird, apart from dispersal. On the other hand, as is expected, the partial digestion of the seed coat which hastens germination, also reduces viability with ageing. Therefore, under unfavourable conditions, i.e., prolonged drought, the viability of BAC seeds will be reduced. However, in any case, the tree has to depend on birds, because, without dispersal the seedlings, even though germinated from ripe fruit, will wither away under the spreading banyan tree. It is therefore interesting to note that even after a prolonged spell of drought, the germination from BAC seeds, though lessened, will still take place. As we see, even after 39 days, a sizeable fraction still germinates.

Mr. S. Midya is an agronomist by training but has a wide interest in wildlife, ecology and conservation. He is currently working on seed biology including dispersal. His address is 57 A.T. Chatterjee Rd., Calcutta 31. Prof. R. L. Brahmachary is the Head, Unit of Embryology, Indian Statistical Institute.

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 SANTAPAU, H. *Common Trees*. National Book Trust, India 1966.

## ADDENDUM

It may be of interest to compare certain data (Van der Pijl, 1969) on *Lithospermum* and *Rumex* fruit/seed, only 1% of which germinate after passing through the alimentary canal of birds.

## REFERENCE TO ADDENDUM

- Van der Pijl, L. *Principles of Dispersal in Higher Plants*. Springer Verlag. 1969.

## **Urban Forestry in Calcutta - A review**

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### **ABSTRACT**

The forests and trees of our urban are as are essential elements of a community; essential to both the environment and to the people who spend their lives in the community. The urban forest is important to the city dweller in many ways viz. It has a great role in climatic amelioration and it has several uses like engineering, architectural, aesthetic, etc. Thus urban foresters have much to contribute to the quality of life in the communities of tomorrow.

Urban foresters need a unique combination of skills and knowledge to manage forests in people - dominated environments. They must understand both the physical and biological processes that affect tree growth and role of trees in the ecosystem. They also must be able to plan urban forestry programmes that meet the needs of residents, to promote these programmes among decision makers and residents and to manage the human and financial resources needed to accomplish urban forestry goals.

Urban forestry was initiated long back in England and North America; since then during last two decades the concept was very much appreciated and thus tree plantation programmes in city streets and parks were increasing day by day in major cities all over the world. Calcutta, being one of the major densely populated city, needs comprehensive development of urban forestry to maintain and improve the ecology of the city.

A comprehensive account of present status of urban forestry in Calcutta metropolis was analysed to build up future guidelines for development of urban forestry network, needed protection and improvement of City environment.

# **Urban greening in India**

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## ABSTRACT

Urban greening in India has a history of uneven development. During pre-independence period, the concept of well-laid garden, avenue plantation and other systematic greening could be noted in some townships under native states and metropolitan cities. The open-space, parks and gardens used to form a part of development plan. During 40 years after independence, the philosophy of urban planning in India has changed for the worse and more built up areas without any zoning system, became almost universal. Only in late seventies, the plantation programme in and around the cities have been accepted but again without any serious management plan. As a result, the species of plants selected for plantation, often become of no use as shade trees, avenue trees or ornamentals. That civic authorities must at first draw up a master plan for plantation, select species depending on the location and use, take steps for after care and monitoring of survival rate, has yet to be made a mandatory clause in Town and Country Planning Act. This can be studied with Calcutta as a case-study. The inventory of plants in the city of Calcutta, as also the Parks and Gardens available upto 1947, if compared with today's flora, parks and gardens will reveal the marked and striking difference. Plants in the city not only act as symbol of aesthetic sense, sink for pollutants, buffer against high noise level but also can create a biological environment offering habitat to birds and butterflies and help to release the man from the growing urban tension in a stress-ecological condition. Plants as such can play a vital role in offering a better habitat condition to man in the urban environment.

## **Man, Plant and Habitat - A retrospect in Urban perspective**

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AND

**P.G. Chatterjee**

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### ABSTRACT

Calcutta of today was not of this nature during the past, especially in the perspective of man and plant and the relationship thereof. With passing of time, the city has experienced two major phenomena. This is related to demography, i.e. populations, both of man and plant. In course of time the trend of these two issues is moving in opposite direction. This city is being overcrowded with people and the plants are in the process of being wiped out.

About Calcutta, it is difficult to understand the relationship between man and plant of earlier times. Such reconstruction can only be attempted and that may be far from practical reality. In the prevailing situation a different methodology has been adapted. With a view to finding out the relationship, one village has been selected which is far from the city. The same village is having the tradition and relationship between man and plant which existed in Calcutta during earlier times.

From the collected data, it is found that such relationship was in close harmony and it was of symbiotic type. On the other hand, Calcutta has lost the tradition for varied reasons and factors. The paper deals with the desirable relationship between man and plants, even in an urban setting.

## **Role of Botanic Gardens as mirror of the living nature**

**P.K. Mukherjee**

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### ABSTRACT

Among the several definitions of a botanic garden, the one which appears more appropriate is that : "It is an Institution organised to maintain plant collections,

usually representing a large number of genera and species... to serve educational, aesthetic, scientific and economic purposes. Recently, Botanic gardens offer a source of recreation" (Widmoyer, 1967 - American Encyclopedia).

With the establishment of first modern botanic gardens at Pisa by Luca Ghini in 1543 or 1544, the early gardens served their usefulness and aesthetics with collections of useful herbs and shrubs. Subsequent gardens played with introduction of trees in large scale as trees proved the easiest to maintain in cultivation. The monastic gardens dealing with training in medicines of early ages became testing stations for natural products and introduction of profitable crops. The establishment of the Calcutta Botanic Garden was ostensibly for the latter reason. Another major Botanic Garden of India, that of the NBRl at Lucknow had the same activities in mind in its establishment. Gradually, the development of herbaria stole the lead as a major tool in taxonomy which has led to the divorce between Systematics and living plants.

However, as most of the big gardens are public funded, they have to serve certain public services. Their design may vary. But at the centre of interest should be its function to instill interest and love for nature. A garden by displaying varied habitats created artificially, with collection of typical flora can serve as centre for nature study programme for school children. Awareness in environment and need for conservation can be achieved in this way. For higher class students it can serve by bringing them to visualize actual plant collections, systematically arranged, which are rare and of botanical interest.

The paper deals with this theme with examples seen in some foreign gardens. The emphasis is more on studying the living plants which one can do in a Botanic Garden, specially those living in cities.



## **Educational Role of Garden, Plants and Landscaping**

**S.L. Abbas and B.M. Wadhwa**

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### ABSTRACT

There has always been an intimate relation between man and nature. For the healthy and balanced development of a nation, (besides) various industrial developments, healthy environment and beautiful natural surroundings are important. The development of gardens has always been given importance by various rulers and India is famous for its Mughal designed gardens.

Forest species having beautiful flowers and also plants of economic importance have been cross-bred for horticultural and other uses for a very long time. Of late, stress has been laid for the *ex situ* conservation of various endangered, threatened and rare species.

The botanical gardens have been instrumental for introduction of very valuable economic plants and have played major role in the education also. This paper suggests aspects of education, the role of Botanical Gardens, the utilisation of wild flora and landscaping in preservation and protection of valuable plant material.

## **Plant Life and Man : Their interaction as seen in Auroville, Pondicherry**

**R. Rajan**

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### ABSTRACT

This paper deals about the Auroville colony, situated near the city of Pondicherry, explaining the social set up of the inhabitants, their efforts in afforestation, agroforestry, conversion of waste stretches of barren land into an ideal environment for man and plant to lead an harmonious and symbiotic life. Their methods for landscaping, green belting, soil and water conservation, land service programme and social forestry are explained.

## **Some aspect of pollutional impact of discharges, sewage and faecal wastes in the river Ganga**

**S. N. Sinha and R.D. Banerjee**

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### ABSTRACT

Due to fast-growing urbanization and population increase, the lower stretch of the river Ganga receives a large number of domestic and municipal sewage. In the absence of proper sewage system in most of the urban areas lying along the banks of lower Ganga, these municipal and domestic sewages are discharged in the river mostly in untreated condition. Besides, the river receives a large amount of faecal matters and other wastes that are discharged or deposited along the bank through run-off waters as well as through tidal washings. As a result, organic content of the water increased manifold and the ambient oxygen is depleted by the activity of heterotrophic bacteria which in turn leads to anaerobiosis. In such a condition, sulfate reducing bacteria develops and sulfate present in the waste is reduced to sulfide which is very toxic to aquatic microflora and microfauna. This has been reflected in our study. Removal of sulfide from such aquatic system is very important and some photosynthetic bacteria were detected in the waste water which could detoxicate the sulfide-toxicity by utilizing it as electron donor to some extent. Their population study and rate of sulfide transformation were determined under laboratory condition. The pollutional impact of toxic sulfide on the aquaatic ecosystem has been discussed.

## **Investigations damage to plants at the Haldia industrial complex in West Bengal**

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### ABSTRACT

During the storm and heavy rainfall in the southern part of W.Bengal in the second week of June, 1988, a large number of trees in Haldia Industrial complex have been severely affected. Due to this disaster the foliar parts of most of the plant species

extending in an area of 10 x 4 km were found damaged severely. A characteristic leaf-burn developed, showing marginal necrosis resulting in the drop-off of the leaves facing towards the windward direction. According to the intensity of foliar damages, the most severely affected plants were *Tamarindus Indica*, *Syzygium cumini*, *Eucalyptus amygdalina*, *E. tetreticorns*, *Laucaena leucocephala*, *Delonix regia*, *Albizia lebbeck*, *Acacia nilotica* subsp. *indica*, *Cassia siamea* and *Croton caudatus*; less affected plants were *Casuarina equisetifolia*, *Thespesia populnea*, *Nerium indicum*, *Callophyllum inophyllum*, *Pongamia pinnata*, *Anacardium occidentale*, *Typha angustata* and *Azima tetraantha*. Whereas, *Excoecaria agallocha*, *Acanthus ilicifolius*, *Clerodendrum inerme*, *Kochia scoparia*, *Pedilanthus tithymaloides* and *Araucaria* sp. remained unaffected. The field observation also showed that intensity of the foliar damage was severe within 1-2 km distance from the Hooghly river estuary, moderate between 3-10 km distance and unaffected beyond 10 km. The necrosis of the foliar parts was prominent in the leaves facing towards the wind directed side, but the leaves on the lee-ward side of the trees were found undamaged.

The possible cause of damage presumed to be effected of acid rain in this Industrial Complex. However, our investigation showed that the damage was caused due to the sprinkling of salt-laden water spray with the wind velocity of 180-185 km/h in the area. Detailed field and experimental studies on the cause of foliar damage have been discussed in this paper.

### **Study on an insect community in Botanical Garden and its utility in determining environmental pollution status of a City.**

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#### **ABSTRACT**

Botanical gardens are almost always located in large cities like Calcutta, Berlin or Kiev. They help in developing among the public, a clear idea about the vast range of plant life, on earth. At the same time a well-planned botanical garden necessarily

requires fairly different ecological conditions for survival of the different types of plants in the garden. This naturally again allows different types of fauna to inhabit different parts of the same garden. This natural advantage offered by a botanical garden had been utilized for the present investigation on the community structure of acridis, a group of short-horned grasshopper. Nine plots in three distinctly different zones — one humid, one dry and one intermediate in nature were selected for study in the Indian Botanic Garden, Sibpur. The study reveals that this community consists of twelve acridid species belonging to eleven genera under nine sub-families. Among these twelve species the relative abundance was very high in the *Spathosternum prasiniferum* (Walker) while in *Epistaurus sinetyi* Boliver it was very low. The population however, varied numerically in different seasons of the year in keeping with the change of vegetation. The total collection comprising of 59.65 per cent male and 40.35 per cent female indicated male dominance in acridid community in that locality, although this ratio differs when considered species-wise. In a few species the ratio was almost equal. Seven of the twelve species may be considered characteristic species for the zones as they occurred in the study area almost all the seasons of the year, while two appeared to be migratory within a short distance. The migratory nature of these species concerned was evident from the fact that no nymphs of those species were available at any time of the years but, the adult suddenly appeared in the study plots. Three were rare species which suggested that the environment in the study area was fairly unpolluted at the time of the study. Since it is known that environmental stress and strain usually leads to the extinction of some species from any area leading to an increase in the number of resistant species. The insect population can serve as a valuable index to the pollution load and its nature in a botanical garden. This may be easily compared with similar studies conducted at different time intervals or in city-parks and gardens to give a picture of environmental status of a city. Such findings can be very well utilized for monitoring public health.

## **Effect of N/P ratio on cyanobacterial growth**

**S.L. Gupta**

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### ABSTRACT

Bioassays which are mostly conducted with unicellular cyanobacteria (*Microcystis* spp.) as test organism, can be used for monitoring the quality of polluted water. The N/P ratio is widely used in freshwater system as an indicator of nutrient limitation. When phosphorus (as  $\text{PO}_4\text{-P}$ ) was supplied as a single nutrient, an increase in yield resulted but, the production was less than the yield with P and N together. Nitrogen was primarily limiting when the ratio between inorganic nitrogen and  $\text{PO}_4\text{-P}$  was lower than 7.5 and phosphorus was limiting when N/P ratio becomes higher (above 10). Frequently the maximum yield was not reached after addition of both P and N which suggests the presence of some other factor as limiting or inhibiting. Large amount of ammonium nitrogen (above 80 mg.  $\text{l}^{-1}$ ) and/or the presence of heavy metals might be the limiting /inhibitory factors as yield increased after the addition of chelating agents such as EDTA in the latter case.

## **The possible role of Botanical Gardens in combating anthropogenic environmental changes**

**Malahika Ray and Subroto Ray**

*Santiniketan*

### ABSTRACT

Man is believed to have turned into a biped only after giving up his arboreal way of living. Still he lived in forests and gradually learnt to walk erect. He depended on the forests to meet all his needs of life. Later, when he gradually became civilized and lived in villages, he was never far away from the forests on which he depended heavily for sustenance. Even now, when man lives in cities and industrial areas, his dependence on plants is as great as ever if not greater still; yet, the city dweller hardly ever sees plants except a few on the wayside and perhaps in his own flower pots. This anomaly has caused unlimited damage physically as well as psychologically.

Urban and industrial growth has resulted in heavy pollution of the atmosphere as well as of the water bodies. This is directly affecting public health severely. Not only in industrially 'advanced' countries but, even in India, dangerous diseases caused by industrial pollution have broken out in epidemic form in different parts of the country. This is particularly true of highly industrialized cities like Bombay and Calcutta including Howrah. On the other hand, many plants, though initially affected adversely by industrially polluted environment, adapt quickly to the stress, but all plants do not behave similarly. As a result the floristic composition of an industrialised area often changes drastically; consequently the associated faunal composition also changes, giving rise to extreme change in the ecological condition leading sometimes to imbalance. In purely urban areas on the other hand, collective or even individual likes, dislikes and biases dictate the selection of plants for road-sides, public parks and private gardens, without any reference to the natural vegetation and suitability; rather, exotic species and horticultural varieties tend to dominate.

The Durgapur industrial complex is a recent development and even within its short span of existence there have been drastic changes in the floristic pattern of the area, and some details are discussed.

Plants have a definite pollution-abating role which can be effectively utilised in urban and industrial areas and some of these findings are also discussed. Indoor plants have now become fashionable as decoration but, they have also high value as environmental monitorings and scavengers of the atmosphere. Again, close association with plant life from childhood gives man a sense of values and psychological depth which is in danger of being lost in urban and industrial life. These plants can even help to build up character and social outlook to develop better citizens.

The interactions among man, plants and cities are very complex and it is possible only for a well developed Botanical Garden to look into the problems and to utilize the possibilities fully by conducting research on the role of plants in specific urban and industrial conditions and applying the findings in the building up of city parks, avenues, etc. It can conduct coordinated research for preservation of endangered species as well as for controlled introduction of exotic species. Finally, through careful research, it can restore to historical places their original flora. Botanical Gardens thus

have a vital role to play in the shaping of the future of man, plant and city: the possibilities are discussed.

### **Some possible ecological impact on the recent depletion of indigenous flora and introduction of exotic variety in Calcutta.**

**K. C. Mukherjee, S. K. Das and S. Bhattacharya**

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#### ABSTRACT

Uptil now 91 exotic plant species have been introduced to Calcutta. Owing to unplanned urbanisation and public unawareness, some of the indigenous plants are at present vanishing from this city. The present paper incorporates a list of introduced exotic species and a partial list of recently depleted indigenous plants. An attempt has also been made to throw some light on possible impact of such floristic changes on the bioecological situation of Calcutta.

### **Plants and pollution**

**D. C. Pal and B. Roy**

*Botanical Survey of India, Howrah*

Plant and man are the two most important living components of the environment. City is the output of human civilization. The very existence of man on earth is intimately related to the healthy environmental and improved habitat conditions. Man has been using his intelligence to utilize the plant and animal resources to his maximum advantage. He cultivated plants and domesticated animals for food and many other needs. In spite of his large scale cultivation of some selected plants out of 2,50,000 angiosperms in the World Flora, exploitation of naturally growing flora also continued. In recent years population explosion has destroyed natural floras for his living, fuel, timber and material comforts. It is estimated that India with her 2,500 tree species (17% of the flowering plant species in India) in 75 million hectares forest cover provide most of the raw materials for man's needs. The increased human population needed

increased agricultural production, more and more land to live and subsistence. The development of modern techniques in demolishing forests for levelling land, road, building and construction of huge dams, township and factories have speeded up the disappearance of natural vegetation (60 hectares per minute in the world). The impact of this long-standing enthusiasm made a great loss of green cover in general and certain plant species or group of plants in particular.

It is clearly deteriorating the situation on the pollution front in the third world. A report of Environment Monitoring System (GEMS) indicates that air, water and food pollution have increased within last 10-15 years to a great extent. According to the report on air pollution, measured on five components sulphur dioxide suspended particulate matter (Dust and smoke) nitrogen dioxide and carbon monoxide; two-thirds of the world's 1.8 billion city-dwellers breathe air containing high levels of sulphur dioxide and dust. The report on water pollution indicates that sewage discharges and human waste constitute the major problems of river water pollution. The situation of food pollution indicates the presence of excessive levels of organochlorine, pesticides and carcinogens.

The environmental pollution in context to Calcutta and Howrah twin cities has already crossed the danger limit.

The Smoke Nuisance Directorate was of the opinion that the filling in of the fisheries in the eastern suburbs of Calcutta by the CMDA has reduced the quantity of oxygen in the atmosphere over Calcutta.

The Metro Railway, high ash content, fuel and vehicles which did not burn their fuel completely, all increased the quantity of suspended particulate matter which was the chief pollution of air over Howrah and Calcutta.

As the 68th Session of the Indian Science Congress at Varanasi in 1981, Prof. A. K. Sharma, the General President introduced the focal theme "Impact of the development of Science and Technology on Environment" which attracted the attention of the Govt. Of India. The result of this has been the establishment and functioning of a new department, the Department of Environment.



Several CSIR Laboratories have oriented their programmes towards the solution of Environmental problems and significant results are emanating from institutions like Industrial Toxicological Research Centre, National Environmental Engineering Research Institute, National Botanical Research Institute and others.

We as individuals in India are still lacking in efforts or even awareness to keep the atmosphere clean and pure. Attempts are being taken in various ways to overcome the problem. Botanical Survey of India is also trying its best to create awareness among the students and people through educational tours, Vanamahatsava, exhibitions, etc. for a healthy environment through greening of the twin cities.

### **Role of plants in city to check pollution**

**R. D. Dixit**

*Botanical Survey of India, Allahabad*

#### ABSTRACT

The inter-action between man, plant and city has been discussed in various ways. Plants are considered best friends since they pose no question or offer no criticism. City came into existence later mainly at the cost of plants but now the existence of man in city is dependent upon the presence of plants. Plants not only provide shelter, food and clothing but benefit mankind by checking pollution, radiation, soil erosion, floods, wind velocities and even provide emotional stability by refusing stresses and strains through various ways. Plants are always present in two extremities of life i. e. happiness or sadness. A few names of the trees, shrubs, climbers and hedge plants etc. are given with the appeal to grow atleast one plant in a house in the first instance.

### **Man and the vanishing forests**

**Anil Kumar De**

*Visva Bharati, University, Santiniketan*

#### ABSTRACT

India is losing 1.3 million hectares of forests every year according to the latest satellite data. The fast changing forest scenario, distortions in social forestry programmes and some possible remedies are highlighted in this paper.

## **Conserving the Flora of North Eastern Himalayan region: a view point**

**N. Dam, B. M. Wadhwa and D. P. Dam**

*Botanical Survey of India, Shillong*

### ABSTRACT

When the primary task of unveiling a detailed knowledge of distinctive floral patrimony of Eastern Himalaya is in demand for effective land use, conservation and possible economic exploitation of potential food plants, drug plants and other economic plants for industry, the urgent need of their protection/conservation from the destructive forces of secondary contradiction are being felt in recent years.

The plant resource of the region in relation to its vegetation and distinctive flora are discussed. An attempt has been made to identify the threats and to bridge the gap by *in situ* and *ex situ* conservation of germplasm. The current conservation status has been discussed and to combat the loss of threatened plant species certain measures are suggested.

## **Indian Botanic Garden : its role in introduction and conservation of plants**

**D. S. Pandey AND R. K. Chakraverty**

*Botanical Survey of India, Howrah*

### ABSTRACT

The Indian Botanic Garden (Calcutta) Howrah, with an area of 112 ha established in 1787, played an important role in the economic development of various parts of the country through introduction and plantations of a host of economic plants, a wide range of horticultural species and several plants of medicinal importance. It also played a key role in the introduction of species which are now growing either as avenue plantations or garden trees. The Garden serves as a living repository of plants of the country and also of selected exotic species. These include 109 species of palms, 141 cultivars in 2 species of bougainvilleas, 26 species of bamboos, 1500 sets of orchids in 80 species, 25 species of jasmines together with rich collections of *Pandanus*, cacti and

succulents and medicinal plants. Besides, specific collections as above, ferns, green house plants, gymnosperms, arboricultural plants, foliage and bulbous plants and annuals, total of which come to about 15,000 trees and shrubs distributed under 2,500 species. Interesting and curious plants generate awareness about value of plants to students as well as common people. Environmental pollution and ecological imbalance have the greatest impact on plant resources of the country and abroad have now been considered either rare, threatened or endangered. Botanic Gardens are the main centres for their conservation.

The paper presents the role played by the Indian Botanic Garden in introducing various endemic and exotic species and their subsequent release for plantation and beautification of the cities, Calcutta, in particular. The action programme for the conservation of rare, threatened and endemic species undertaken by the Garden will also be discussed.

## **Flora & vegetation of Assam -- a conservation perspective**

A. K. Baisya and B. M. Wardha

*Botanical Survey of India, Shillong*

### ABSTRACT

The Brahmaputra and Barak Valleys separated by Barail range of hills constitute the physiography of the state of Assam. Because of its geographical position, the flora and vegetation of Assam exhibit marked differences and have tropical evergreen, semi-evergreen, tropical deciduous and sub-tropical broad-leaved forests.

Due to degradation of environment for various developmental programmes and to some extent by shifting cultivation, the flora of the state is depleting. Suggestions have been made for *in-situ* conservation of the depleting forest wealth especially of rare, endangered and various economically important plants.

## **Six rare wild legumes — a plea for conservation**

**Arbinda Pramanik**

*Botanical Survey of India, Howrah*

### ABSTRACT

Natural vegetation is subjected to constant changes leading to gradual elimination of certain species that fail in the struggles for existence— here lies the importance of plant conservation. These struggles may be as against natural calamities, thoughtless commercial exploitation, urban developmental activities and so on.

Extinct, endangered (*i.e.* plants in danger of extinction), vulnerable (*i.e.* plants nearing to endangered category) or rare plants (*i.e.* a given taxon with very small world population is at risk) are now being region-wise surveyed by the Botanical Survey of India with top priority which results in publication of 'Red Data Book' of Indian Plants' (eds. Dr. M. P. Nayar & Mr. A. R. K. Sastry) Vol. I, 1987.

Keeping in view of the importance of the problem, six rare wild legumes (not included in the above) namely, *Christia vespertilionis*, *Uraria lacet*, *Hedysarum cachemirianum*, *H. microcalyx*, *H. astragaloides* and *Taverniera cuneifolia* are discussed here highlighting their present status, distribution, habitat and ecology, biology and potential value, cultivation and conservation measures taken along with proposals of conservation measures, etc. with a hope to draw attention for their conservation.

## **Floral wealth of North Eastern India and their conservation**

**A. S. Chauhan and B. M. Wadhwa**

### ABSTRACT

North Eastern region representing a wide range of physiography, climate and soil possesses rich gene pool of both wild and cultivated plant species. Several unique and endemic taxa are also growing profusely in this region. Besides, primitive cultigens are preferred still by the native people in some remote areas of this region. However, these plant resources are fast depleting due to socio-economic development, environmental degradation and exploitation which have resulted in considerable depletion

of certain taxa in their natural habitats and need immediate protection. The researches are required to intensify the studies on the basic and dynamic aspects, micro-climatic conditions which are essential for their survival. Emphasis is now given on the inventory of biological diversity, population dynamics of existing plant communities, ecology and floral biology of rare, threatened and endemic taxa of the region. It is imperative to formulate the conservation strategy for the natural co-existence of wide range of flora in virgin forests.

*In situ* and *ex situ* means of conservation has been suggested with special reference by setting up the biosphere reserves.

## **Conservation - a major and multipurpose role of a Botanic Garden**

**P. K. Sarkar and R. K. Chakraverty**

### ABSTRACT

Nature conservation has raised much hue and cry in the face of development-hungry human civilization who have plundered and gobbled up much of the green from this planet's surface. The machination and manoeuvre of the traders have taken away heavy toll of our great heritage of nature resources. We can not resign to such destructive impact that is sweeping out the ecology and adversely interfering with the eco-system for beauties and comforts of life. When we get entire food, half of medicines, much of clothing, virtually all the fuel, building materials and other socio-economic implements from genetic sources, the arable land and tropical forest will be just halved by 2000 AD with a population hike of more than 700 crores. The scenario will be still more alarming if it is continued unabated and a fight back with all powers at our commands is given to restore the degraded land and rejuvenate the depleted forest. Fortunately, Botanical Gardens, National Parks and Sanctuaries and other conservation efforts are now working for the same cause and effect and their new fruitful experiments and researches are in a take-off stage for implementation to the greater cause of human race. Conservation of germplasm in botanic gardens may lead to great role in improving scope of research and education of various kinds. It also gives nature in miniature, a fine perfect landscapæ and thereby a relief and

retreat to the hustle and bustle of city life. Nature reserve even at the risk of some deviation of genetic materials represented by threatened species or population is a time-appreciated task. The paper delineates plant conservation activities of the Botanical Survey of India with an implication of the "CITES"—family Orchidaceae as their plight in our country is in a frightening state. A steady collection of  $\pm 400$  spp. of them in the survey conservatories with about 50 spp. of Endemic, Endangered and Threatened ones has opened up avenues for economic and academic research of Orchid-enthusiasts. Indian Botanic Garden has been raising one hundred plants of eleven highly ornamental species of threatened orchids. Once plenty but, now rare in their original environment like some *Aerides* Lour., *Arachnis* Bl., *Dendrobium* Sw., *Renanthera* Lour., *Rhynchostylis* Bl., *Vanda* R. Br., etc. are now happily growing in its National Orchidarium.

## **Rare and endangered species of *Hedyotis* (Rubiaceae)**

**Ratna Dutta**

*Botanical Survey of India, Howrah*

### ABSTRACT

In course of taxonomic studies of Indian *Hedyotis* some rare, endangered and possibly extinct species were studied. *Hedyotis nagporensis*, *H. scabra*, *H. capitellata*, *H. brunonis*, are represented in herbaria by very few collections, and appears to be rare.

*Hedyotis ramarowii*, *H. barberi*, *H. buxifolia*, *H. hirsutissima*, *H. travancorica*, *H. albonervia*, *H. fulva* have been collected once or twice after original collection, though the area of original distribution have been explored repeatedly. These plants are endangered and threatened to extinction.

*Hedyotis kurzii*, *H. graminicola*, *H. beddomi* and *H. fruticosa* have not been recorded after original discovery, though the localities where they existed, have been further explored in recent years. This gives an impression that they are probably now extinct.

Efforts should be made to collect all these plants and grow in the Botanic Garden as a germplasm collection for the posterity.

## Rare and endangered species of *Allium* in India

Shymali Dasgupta

Botanical Survey of India, Howrah.

### ABSTRACT

In course of the taxonomic studies of the economically important genus *Allium* (Liliaceae) under the Flora of India Project it came to light that there is scarcely any recent collection of certain species in Indian herbaria.

Specimens brought on loan from BM, E and L for this study gives an impression that the species which were collected from India in the 19th or early 20th century have been collected from Nepal, Bhutan, Pakistan, S. E. Tibet showing extension of their distribution, but these species have not been collected in recent years from the present political boundaries of India. This shows that exploration by BSI as far as *Allium* is concerned was not intensive or the species are not in existence.

Of the indigenous species of *Allium* in India, some species like *A. stracheyi* Baker, *A. fasciculatum* Rendle, *A. macranthum* Baker and *A. sikkimensis* Baker have not been gathered at all in recent years from India, while those have been collected from Nepal, Bhutan, China. Some indigenous species like *A. cousanguineum* Kunth, *A. humile* Kunth, *A. roylei* Stearn and *A. jacquemontii* Kunth have 1 or 2 recent additions in India proper. All these species except *A. jacquemontii* Kunth which have been gathered many times from Pakistan appears to be endangered.

Of the other species of *Allium* having wide distributional range outside India proper, *A. pamiricum* Wendelbo, *A. oreoprasum* Schrenk, *A. autropurpureum* Waldst. & Kit and *A. chinense* G. Don collected in the past from India have not at all been collected from this end in recent years, and *A. autosanguinum* Schrenk, *A. griffithianum* Boiss. and *A. przewalskiana* Regel have only few collections from Kashmir, Nepal and Pakistan and appears to be rare.

Some species of *Allium* are found to be of new records such as *A. caesium* Schrenk in H. P., *A. mairei* H. Lev. in Assam in India and *A. filifolium* Regel, *A. eremoprasum* Vved in Pakistan.

## **On conservation of certain palms and orchids in and around Port Blair**

**P. S. N. Rao**

*Botanical Survey of India, Port Blair*

### **ABSTRACT**

The present paper highlights the importance of conservation of economically important palms and interesting orchids in and around Port Blair city. It is disheartening to note that the palms like *Licuala peltata* Roxb. get indiscriminately cut from natural gardens for thatching purposes and the populations of tender ground orchids viz. *Nervella punctata* (Bl.) Makino get disturbed due to tourist influx and related activities. Some measures to conserve certain other fast disappearing palms and orchids also are discussed.

## **Role of plant conservation in improvement of a city and city life.**

**A. V. N. Rao, M. Mohanan and A. Subramanian**

*Botanical Survey of India, Experimental Garden, Yercaud*

### **ABSTRACT**

A city is the climax of urbanisation. The human being endowed with limitless capacity for building and creation brings up cities as climax in the urbanisation process and with his equally great powers of destruction and annihilation, knowingly or unknowingly damages the entire life support system prevalent in the region ultimately risking even the existence of life.

Any developed city comprises in it series of industries whose wastes pollute atmospheric air, available water and add on components not easily disintegrated in the soil system around.

The biological waste produced by the biomass in the city add on to the pollution of the environment, the water supply and even the soil around deteriorating the environment sometimes to an extent not fit for human existence. The pollution of air by influence of obnoxious and poisonous gases, dust particles etc. are yet a few



hazards from which human life is to be protected. It is needless to mention the ravages caused by severe sun light, solar radiation, climatic hazards - effluents from tanneries, textile concerns and so on. The only remedial measure is through conservation of forests in the vicinity of cities, development of a green belt around the city, planting of avenue trees, development of parks, gardens and conservatories, richly, so that the discussed constraints can be minimised thereby rendering the city fit for better existence of life. These details are elaborated in this paper and measures for further improvement suggested.

### **Burdwan Plants (through the ages)**

**P. K. Bhattacharyya**

*Deptt. of Botany, University of Burdwan, Burdwan*

The comparison of pre-independence land use pattern in Burdwan indicates that the areas for the growth of natural vegetation, orchids, bamboo-grooves, gardens and sugarcane fields have been diminished significantly but the areas for the human habitation and the monocultural short duration crop fields have been accentuated. In this district, 1308 embryophytes i.e. liverworts, mosses, ferns and flowering plants have been collected, identified and preserved revealing 72% indigenous (native) and 28% exotic (introduced) or 58% wild and 42% cultivated plants. These plants are included in 781 genera and 193 families. Ten families e. g. Leguminosae, Gramineae, Compositae, Euphorbiaceae, Acanthaceae, Rubiaceae, Cyperaceae, Convolvulaceae, Verbenaceae and Malvaceae are dominant elements in this flora. Five genera of Burdwan plants, e.g. *Hoppea*, *Hemidesmus*, *Caesulia*, *Hamiltonia* and *Holmskioldia* are endemic in the Indian region but most of the prevalent genera are wide-tropical. Many genera of Burdwan plants are also disjunctly distributed. Almost all indigenous Burdwan plants are available in "Madras flora" but a few extra peninsular plants like *Dillenia aurea* Sm., *Abutilon avicennae* Gaertn., *Pterospermum acerifolium* Willd., *Styidium tenellum* Sw., *Mosla soabra* (Thunb.) Riz., *Derringia amaranthoides* (Lamk) Merr. are extended upto this area. Only one species, *Luvunga scandens* (Roxb.) Buch.-Ham. ex Wt. et Arn. is reckoned to be extinct from Burdwan. Only one species *Utricularia foveolata* Edgew., is endemic in Burdwan. But there are two endemic vegetables :

*Benincasa hispida* (Thumb.) Cogn. (*Ghimia*) and *Citrullus lanatus* Matsum. & Nakai (Khero).

Life forms of the vegetation and biological spectrum of the flora have been determined and a comparison with normal spectrum shows phanerophytic climate which accords with the normal trend. The percentage distribution of species within the plant communities having the characteristic life forms shows the following pattern: 5.5% species being hydrophytes and helophytes cover water and marsh; 37.3% species being therophytes (27%) and mesomorphic hemipterophytes (10.3%) grow in meadow, 7.7% species being chamaephytes occur in heath, 41.7% species being mostly deciduous phanerophytes find elbow room in scrub of woodland and 4.7% species being geophytes or xeromorphic hemipterophytes appear to be in the grasslands.

The cultural and the natural landscapes are respectively distributed in 88% and 12% of the total area of the district. The anthropogenic stress is very high on the vegetation. Due to cultural practices, the following grades of weeds e.g. epiphytes, saprophytes, parasites, pteridophytes, mosses and liverworts are threatened in the present environment. The quotients of the climbers (C1, Q.:3) and the carnivorous plants (Cr, Q.: 7) are larger than one. It shows that the present environment is favourable for the growth of climbers and carnivorous plants.

## **Man, Plant and City in the Sanskrit Puranas**

**Priyadarsan Sensarma**

*Dept. of Botany, Bangabasi College, Calcutta*

### ABSTRACT

Man constructs cities for better organized and collective living and also for protection from the attacks of wild animals and other enemies. The process of urbanisation causes shrinkage/destruction of natural vegetation. As the loss of vegetation endangers the existence of man and other animals, modern city-planners give attention to have roadside trees, green parks and green belts in the cities. But how were the conditions of Indian cities in olden days? In search of the answer to this questions the

following four Sanskrit Puranas have been investigated—(i) the *Kurma Purana* (c. 550 to 650 AD), (ii) the *Matsya Purana* (earlier than 800 AD), (iii) the *Agni Purana* (between 800 and 900 AD), and (iv) the *Brahma vaivarta Purana* (between 800 to 900 AD).

The study of these Puranas reveal that the *Brahma vaivarta Purana* grades some plants as beneficial for a town, and it states that the city of Dwaraka had a thick protective palisade of trees on its periphery. Though none of the Puranas instructs that there should be gardens, bowers and floral by rich lakes in and around cities, all of them contain descriptions of the same in appreciative tenor. The Puranas ordain that dwelling houses, the important constituents of cities, must have gardens and trees. The Puranas also give lists of plants which should not be allowed to grow within the boundary of residential houses. From these information it may be said that the plants had sufficient importance in the cities of ancient and early medieval periods of India.

## **Pune, People & Plants**

**N. P. Singh**

*Botanical Survey of India, Western Circle, Pune*

In keeping with the theme of the present Seminar on 'Man Plant and City' this paper is presented. Pune is the cultural centre of Maharashtra and one of the best education centres of India with equitable and pleasant climate throughout with a series of gardens, parks and avenues.

The present paper deals with the geography, topography, physiography, geology, climatology, and history etc. of Pune along with its cultivated and forests areas. Its population along with industries and vehicles & festivals etc. are discussed. The main crops of the area are given while the old and historical gardens and modern parks including those of the civil as well as the defence establishments besides the Corporation owned parks and gardens are accounted for.

There is a great awareness about plants & gardens in Pune for over 2 decades now and many voluntary environmental protection organizations have come up in addition to those sponsoring flower & vegetable and rose shows. A small island with its healthy and rare plants is detailed. The common trees, shrubs, hedges and climbers of

Pune are furnished besides the common flowering and ornamental shade plants etc. with first hand experience of Botanical Survey of India gardens, particularly the one being developed at Mundhwa. The noxious, common weed of Pune is indicated along with its biological control.

It is concluded that Pune has a glorious future ahead.

## **Role of Botanic Gardens in the conservation of desert Flora**

**V. Singh**

*Botanical Survey of India, Arid Zone circle, Jodhpur*

### ABSTRACT

A variety of plants are grown in the gardens not only for the purpose of pleasure or recreation, but also to promote knowledge on their identity, variability, plasticity and potentiality with an overriding consideration of conserving them for welfare of humanity and posterity. With the growing environmental awareness, the conservation of plant resources has assumed a greater significance and has become a national issue. In this context, the fire-brigade action of botanic gardens in conserving the depleting plant resources has recently been realised all over the globe (Mohararam, 1983; Walters, 1983; Nayar, 1987). The role of botanic gardens in conservation is so vital that it earlier also formed the subject of two International Conference held in 1975 and 1978 at Royal Botanic Gardens, Kew. The botanic gardens can not only be used as centres for enhancing genetic diversity, but also serve the purpose to reintroduce the depleting taxa from their holdings.

In the areas like Thar desert where *in situ* conservation is not possible, the role of conservation-oriented botanic gardens becomes further important. Thar desert, which is eastern extension of great Sahara desert, occupies an area of about 1,96,150 sq km in the west of Aravalli in Rajasthan. The particular topography of sandy plains and stabilized and shifting sand-dunes of various magnitude and orientations and edaphic and climatic conditions of the desert have attracted the attention of ecologists and botanists since long due to peculiar floristic assemblage and local forms and endemics,

not found elsewhere. The climatic and biotic activities have greatly disturbed the desert ecosystem, as a result the fate of certain endemic and rare taxa is at risk, particularly also due to their low range of adaptability and inadequate reproductive mechanism. Some of the taxa like *Farsetia macrantha*, *Ipomoea callica* var. *semine-glabra*, *Pavonia arabica* var. *massuriensis* are still confined to the type locality. Indiscriminate felling or cutting of trees and shrubs like *Tecomella undulata*, *Ephedra fallata*, *Commiphora wightii* etc. for timber and fuel and collection of mature fruits of *Citrullus colocynthis* for seed oil have brought them under the vulnerable category of threatened plants.

Hence, the conservation of desert flora, particularly of the local forms, endemics and those which have come under threat due to over exploitation for various uses, is the reasonable demand of today. The National parks and Wild-life sanctuaries have been found inadequate and ineffective for the conservation of desert flora.

The author feels that the goal can only be achieved by bringing the depleting forms under controlled conditions and, therefore, on the occasion when one of the biggest botanical garden of Asia is celebrating its bicentenary, urgently emphasize the need for establishing Desert Botanic Garden to preserve and increase the depleting desert germplasm.

## **Important visitors**

During the course of the Bicentenary Celebrations of the Indian Botanic Garden more than 1,80,000 visitors visited the garden. Among them several were distinguished from within and outside, Teachers and students. A few importants are listed here.

### **Foreigners :**

Mr. Lean, Chief Justice, Virginia, U. S. A; 33 Belgian Tourists; Mr. Akira Matsuehita, Oyawa, Machida City, Tokyo, Japan; Miss E. Humbert, 31 Rue des Cottages, 67100, Strasburg, France; Mr. Router Peter, Bettinger Str. 65, CH 4125, Switzerland; Mr. I. L. Phillipe, 481 St. Kilda Rd., Melbourne, Australia; Mr. R. J. Burton, 110, Frederick St, Toronto, Ontario, Canada; Mr. Maut Bergglaw, Royal Norwegian Embassy, Shantipath, New Delhi; Mr. Peter George Hood, British High Commissioner, New Delhi.

### **Indians :**

Apart from Patrons, Advisers, Members and Associates of the Organising Committee, Shri T. C. Dutta, Chief Secretary, Govt. of West Bengal and Mrs. Puspā Datta, Shri Prafulla Kr. Mahanta, Chief Minister, Assam State, Shri Indrajit Basu, Ministry of External Affairs, Govt. of India, New Delhi; Dr. N. P. Singh, Faculty of Forestry, Birsa Agricultural University, Ranchi; Sister Superior, Queen of Missions, 34 Syed Amir Ali Avenue, Calcutta, with 23 students and 5 staff; Sri Tapan Raksh it, Court Keeper, Calcutta High Court, with P. A. to Hon'ble Chief Justice and the Judicial Deputy Registrar; and 2500 Teachers, Students of following different Schools.

### **Institutions :**

Madarhat Girls High School, Baruipara, 24-Parganas. Barisha Boys High School, Barisha, 24-Parganas. K. B. R. Girls High School, Salkia, Howrah. Dinabondhu School, G. T. Road, Howrah. Chakdaha Purbachal Vidyapith (H. S.) Chakdaha, Nadia. Islamia High School (H. S.), Calcutta. Khardah Shibnath High School, Khardah. 24 Parganas. Jagacha Girls High School,



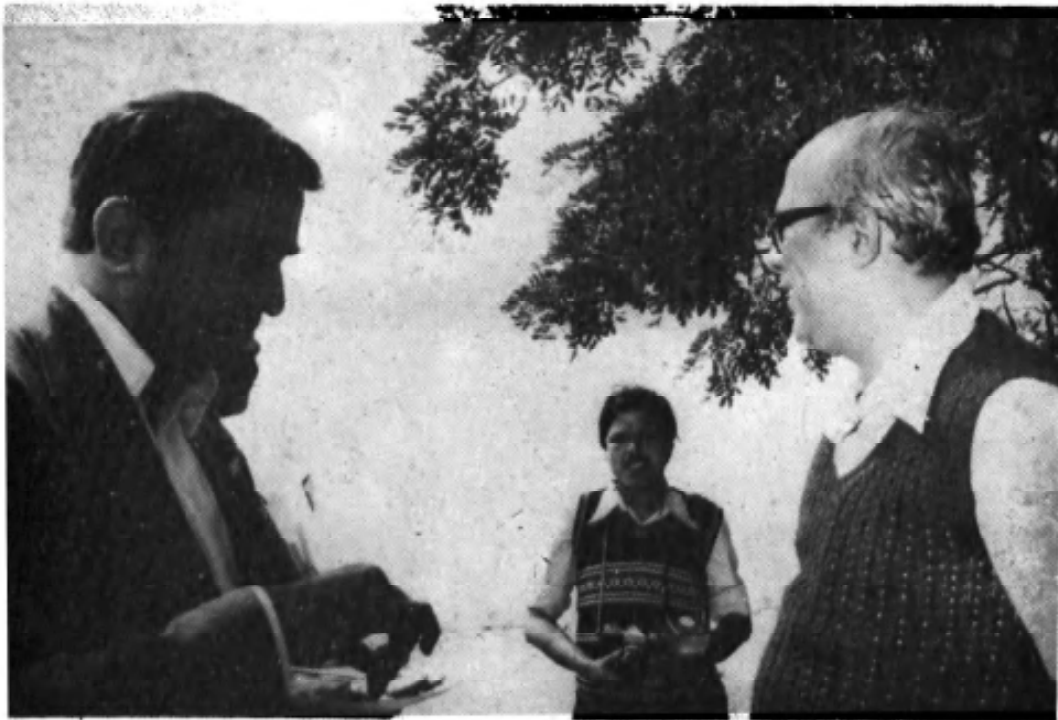
**Shri Sanjeeva Reddy, Hon'ble President of India at the Garden.**



**Shri Prafulla Chandra Sen, former Chief Minister, West Bengal and Shri Humayun Kabir, former Union Minister – Garden is honoured by their presence.**



Shri A.R. Kidwai, Hon'ble Governor of Bihar, during his visit in the Garden.



Shri Digvijoy Singh,  
Hon'ble Environment  
Minister, Govt. of India,  
in his visit to the Garden.





Dr. S.Z. Kasim, Secretary to the Govt. of India at the 32nd Vanamahotsava at the Garden.



Dr. T. N. Khosoo,  
Secretary to the Government  
of India in the Central  
National Herbarium.



Rev. Fr. H. Santapau,  
Chief Botanist, BSI at the Garden.



Smt. Padma Khastagir, Hon'ble Justice, Calcutta High Court at the 196th Anniversary and 34th Vanamahotsava Programme of I.B.G., 1983.

Howrah. Rishra High School, Rishra, Hooghly. Bidhan Nagar Govt. High School, Salt Lake, Calcutta. C. M. O. High School, 11 Peter Lane, Calcutta. Rahara Bhabanath Inst. For Girls, Durgapur Pallymangal Vidyamandir, Howrah. Bhadrakali, High School. Bhadrakali, Hooghly. Lake View High School, Panchanantala, Calcutta Rasbihari Coaching Centre, Calcutta. Ashokegarh Adarsha Vidyalaya, Chetla Boys High School, 29/2, Chetla Central Road, Calcutta. Ramjyoseal Sishu Patsahala, Calcutta-6. Santoshpur Govt. Colony Netaji Subash Vidyalaya, South 24- Parganas. Surendranath Collegiate Girls School, Calcutta. Taltala High School, Calcutta. Durgapur Pallymangal Balika Vidya Mandir, Durgapur. Nischinda Chittaranjan Boys High School, Howrah. Brahma Balika Shikshalaya, Calcutta. Kanaipur Kanya Vidyapith, Hooghly.

## **Organising Committee : Indian Botanic Garden bicentenary celebration**

Hon'ble Shri Manasnath Roy  
Former Acting Chief Justice  
High Court, Calcutta

Shri Kamal Kumar Basu  
Mayor, Calcutta Municipal  
Corporation

Shri Alokendut Das  
Mayor, Howrah Municipal  
Corporation

Shri Mani Sanyal  
Deputy Mayor, Calcutta  
Municipal Corporation

Dr. Pratul Chandra Gupta  
Former Vice Chancellor  
Visva-Bharati

Dr. Sushil Kumar Mukherjee  
Former Vice Chancellor  
University of Calcutta

Prof. Hiren Mukherjee  
Ex M.P.

Prof. Santosh Bhattacharjee  
Former Vice Chancellor  
University of Calcutta

Prof. Munis Raza  
Vice-Chancellor,  
Delhi University

Prof. Asima Chatterjee M.P.  
Eminent Scientist

Prof. Bhabatosh Chatterjee  
Vice Chancellor  
Rabindra Bharati University

Prof. Debpada Bhattacharjee  
Former Vice Chancellor  
Rabindra Bharati University

Prof. Sankari Prasad Banerjee  
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University of Burdwan

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Debabrata Ghosh

Ajit Sardar

Debi Saha

Aloke Bhattacharjee

D.G. Dutta

Aloke Mukherjee

Dilip Sardar

Amarendra Nath Panja

Dipali Ghosh

Amit Dutta Chaudhury

D.P. Banerjee

Amit Ghosh

Dr. D.P. Mukhopadhyay

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Dulal Hazra

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Ashoke Chanakya

Girdhari Lal Saha

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Basabendra Ghosh

Gaur Mohan Palley

Bholanath Khare

Habul Dutta

Bipradas Kar

Haramohan Mukherjee

Chitta Ranjan Mondal

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D.B. Kayal

Hiten Roy



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Hrisikesh Chakraborty	Nilim Shyam
Jabed Ali Laskar	Nilkanta Set
Jayanta Das	Nimai Patra
Jogen Bhumij	Niranjan Parui
J.P. Ghosh	Nirmal Mandal
Kalinath Munda	P. Adhikari
Kanai Ghosh	Pankaj Kr. Dutta
Kanai Lal Das	P.K. Das
Kashinath Ahir	P.K. Roy
Llaquat Ali Laskar	P.K. Sen
Madhu Ghosh	P.N. Garu
Mahatma Sardar	Dr. Prabir Sur
Mangra Munda	Prasanna Kr. Das
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M.L. Rajak	Ramesh Sardar
Mohan Pal	Ramu Baner
Mohan Sardar	Ranjit Ghosh



A portion of the  
Great Banyan Tree  
(*Ficus bengalensis* L.)



Students and staff in front of Bicentenary Gate at the Andul Road inside the Garden