



Sudhakar



SACHINDRA NATH DASGUPTA*

(1902 - 1990)

Elected Fellow 1958

BIRTH, PARENTAGE AND EDUCATION

SACHINDRA NATH DASGUPTA, the third son of Dwarka Nath Dasgupta and Uttama Sundari, was born at Jalpaiguri (West Bengal) on November 4, 1902. Both his parents hailed from an area, Vikrampur (now in Bangladesh), which had over the centuries acquired a legendary reputation as the home of great many distinguished men and women. His father belonged to the illustrious Das family of Telirbag (Vikrampur, Dacca), in one branch of which was born CR Das, the President of the Indian National Congress in 1922. Sachindra Nath's own grandfather, Sarat Chandra Das, an eminent educationist, rose to become, in British administered 19th Century Bengal, the first Indian Inspector of Schools. His mother Uttama Sundari was from another well known family (Laskarbari Sens) of Sonarang. Sachindra Nath was more than aware (actually proud) of his intellectual heritage. His eldest brother, PN Dasgupta was an Income Tax Officer, while his second brother BN Dasgupta was Professor and Dean, Faculty of Commerce, Lucknow University, Member Tariff Commission and Founder Vice-Chancellor, North Bengal University. His younger brother MN Dasgupta was an Agricultural Graduate of Aberystwyth Wales, England, who resigned his high position in the Ministry of Agriculture, India, to devote his life for the development of agriculture and the upliftment of the poor people of Parcha, Sahabad, Bihar upto the end of his life. He had four sisters. He himself remained a bachelor.

EDUCATION IN INDIA

His early education was in Minor School, which was followed by education in Government Zilla School at Jalpaiguri, from where he passed the Matriculation Examination in First Class in 1919.

He came to Calcutta for college education and stayed in YMCA playground branch, this he considered helped him "to mould my future". He passed his Intermediate in Science from Bangabasi College in the First Division, and BSc honours in Botany from

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Presidency College in the Second Division. He passed his MSc in 1925 in Botany (with special paper in plant physiology) from the University College of Science, standing First Class first, and was awarded the University Gold Medal. He received inspiration for quest of knowledge from Prof Paul Bruhl, a most impressive teacher.

EDUCATION ABROAD

He sailed to England for higher studies and research. From 1926 to 1933 he was at the Imperial College of Science and Technology in London. After taking an advanced course, both theoretical and practical, in plant pathology, plant physiology, mycology and bacteriology, he was admitted in the middle of 1927 for research in plant pathology under Prof VH Blackman, ScD, FRS. In 1929 he was awarded the Diploma of the Imperial College and PhD of the University of London. By January 1933 he had published six papers, some of which in Prof Blackman's opinion were of great mycological interest and importance and one of which he submitted for publication in the *Proceedings of the Royal Society*, London. Overcoming the desire to join Iowa University, USA, that offered half scholarship, he continued further researches for DSc under Prof Blackman with the help of Grant-in-Aid from the High Commissioner of India for a period of three years as well as Old Boy's Scholarship of Imperial College. For compelling domestic reasons he had to return to India in 1933 while on the verge of completing his DSc thesis. He was however, permitted to submit the thesis from India. Thus, delayed, the DSc degree of London University was awarded as late as in 1946. Years later in 1979, the University of Kalyani, Kalyani, West Bengal awarded the DSc *honoris causa*.

During the course of his tours of mid-Europe during recesses he visited Netherland in 1929. There he sought interview with Hugo de Vries of mutation fame, who was living a retired life in Lunteren. He kindly received Sachindra at his residence among the relic of his garden of *Oenothera lamarckiana*. This meeting was a most satisfying experience for Sachindra. FM Went in Utrecht, who was associated with Boysen-Jensen in demonstrating (by very refined techniques) the direct relationship between auxin and tropism, showed him, with rare courtsey, the most exciting revealing film, depicting the successive stages of the experiment. Not far from Utrecht, in Doorn, he watched the rare spectacle of an old man howing a log of wood in a Villa. The man was none other than Kaiser in exile, and even the view from outside the boundary wall of the villa, was exciting. In 1932 in Berlin in front of Reichstage he saw Adolf Hitler addressing a mammoth gathering and swaying the multitude with his impassioned oratory, while nearby Hindenburg was reviewing the parading troops.



SERVICE CAREER

Lucknow University

He returned rather prematurely (*i.e.* without completing DSc) from England and joined Lucknow University as Reader in Botany in 1934. Dr Birbal Sahni, the renowned Palaeobotanist, was the Professor; the other teachers in the department were Mr HP Chowdhury, Dr SK Pande and Dr AR Rao. Sachindra noted with great satisfaction that "it was a pleasure to work with these amiable colleagues". Sachindra was keen to visit Universities in the USA to gain knowledge of latest developments in plant pathology, but his attempts were foiled due to the second world war in 1939.

UNESCO INTERLUDE

In 1946, Sachindra received an invitation from UNESCO. He was offered the position of Counsellor in Agricultural Sciences in the Division of Science in the United Nations Educational, Scientific and Cultural Organisation, which had its seat in Paris. Sir Julian Huxley was the Director General and Joseph Needham (Cambridge) was the Head of the Division of Science. UNESCO was located in the Hotel Majestic, 19 Avenue Kleber, a hotel which was the headquarter of Hitler, while he was in Paris.

Sachindra joined the post at Paris in August, 1946. There his colleagues were, Wang (China), Zhukova (Russia), Malina (USA), Reid (Canada) and Purnell (Australia). He actually replaced Late Bires Chandra Guha, whose term had expired. The only other Indian to hold this high position at UNESCO at that time was Malcolm Adiseshiah, who at a later stage rose to be the Deputy Director General of UNESCO.

Sachindra noted that "the emergence of *Free India* on the 15th August, 1947, an epoch making incident was celebrated by hoisting Indian Tricolour Flag by Malik, the Indian Ambassador in France before a staid small group of Indians. The assassination of Gandhi on January 30, 1948 was mourned by whole UNESCO".

Back to Lucknow University

Prof Birbal Sahni died very suddenly on 10th April, 1949, leaving a void in the botanical world that could never be filled. On the insistence of friends at the University, particularly Acharya Narendra Deo, the then Vice-Chancellor, who made a personal request, Sachindra Nath returned to India to take charge of the department of Botany as the Professor of Botany. He joined the department in December 1949, and was elected as Dean of the Faculty of Science for a short period in 1954.

Member, Public Service Commission, West Bengal

In 1958, Sachindra was invited by the Government of West Bengal offering him membership of the Public Service Commission as a prelude to taking over as



Vice-Chancellor of the proposed Kalyani University. He joined the post in August 1958 and served until November, 1960. Sachindra noted that "...these two years were the most inactive and unproductive period of my life..."

Vice-Chancellor, Kalyani University

Sachindra joined the Kalyani University as its founder Vice-Chancellor. The university started functioning with his assuming duties on November 1, 1960. He had the full support of Dr BC Roy, the Chief Minister, whose brainchild was the Kalyani University. Sachindra has the satisfaction of planning and developing this new University as an ideal residential abode of learning. He watched it making remarkable progress and receive all round approbation. But the death of Dr BC Roy was set back. However, the progress continued as the successor Chief Ministers approved the policies and extended all the support. The Vice-Chancellorship was renewed after first term of four years. Later, with the change in the Government, however, there was obvious shift in the policies, which were not to the liking of Dr Dasgupta, and he noted that "...I had the mortification of seeing the deliberate wrecking activities, emergence of indiscipline and insubordination among the students, employees of all categories and even the teachers, with consequent all round deterioration. I believe, I have the unenviable distinction of being the first Vice-Chancellor to be *Gheraoed* by the students, once for 16 hours." Sachindra was very sad about all this and the fact that in spite of all the efforts he could not develop the University as he liked.

RETIRED LIFE

His second term as Vice-Chancellor ended on October 31, 1968. He then retired fully and never tried and declined all offer of a job or position. He felt fully free and devoted all his time in completing some voluminous unpublished research findings. He read extensively during this period and went very regularly to leading libraries in Calcutta, Lucknow and Delhi. When he expired suddenly and peacefully, he was in the process of writing memoirs of greatmen he met during his life time, a final essay on mango necrosis, a book on non-parasitic diseases of plants in India and research papers on aquatic phycomycetes.

He delivered the first Jeerasannidhi Award Lecture of the Indian Phytopathological Society in 1982 at the age of 80. He considered this "... a tribute to my age..... the invitation came to me at an opportune moment when following a few years of inactivity, after my retirement, I have just made ready for publication the work on aquatic phycomycete.. which was awaiting revision and publication for the last 25 years".

He published a 27 page paper in 1988 (*Indian Phytopath.* 41, 521-547) on the genus *Blastocladia*. This proved his enormous will power, scientific intentions and capacity as well as zeal to work at the age of 86 years. He typed most of the manuscripts himself.



and was extremely particular even for punctuations. He actually worked on the typewriter even under failing eyesight and poor health only to fulfil the mission of his life. Two of his manuscripts have already been published after his death, in *Indian Phytopathology* volume 43, pages 218-222 and pages 564-569. Several other manuscripts are in press or at the preparation stage. It is hoped that these will also be published with the help of his students and colleagues.

In 1986 in the midst of revising one of his major papers he fell seriously ill with little hope of being able to see it through to its completion. But he recovered to resume correspondence with editor of publications and recorded that "...perhaps it was ordained that I shall vindicate our work. I see no other reason for my survival".

TEACHING AND ADMINISTRATION

Sachindra possessed an uncanny vision and perception. He could easily see beyond the mountains. This helped him not only in research planning and execution but also in administration. He seemed to know the difficulties of student/administrative/teaching staff before being told. He was, therefore, prepared in advance. He had definite views, which were difficult to change because they were value based and arrived at after long deliberation. Dr BC Roy, the then Chief Minister of Bengal was highly influenced by the merits of Sachindra Nath and requested him to establish the first agricultural university in the state.

Sachindra was, thus, the founder Vice-Chancellor of Kalyani University, a position which he held with great distinction for 8 years during which he established great traditions of scholarship, justice and initiative. He was able to inspire the young intellectuals and a large number of excellent teachers/research workers from various states joined the Kalyani University. His hard work and organisational ability paid rich dividends and today Kalyani University (along with the Bidhan Chandra Krishi Vishwa Vidyalaya, which was an off shoot of Kalyani University) is one of the most active centres of agricultural research, education and extension.

He maintained very high standards and appointments/promotions were strictly on merits (actually, in the process his own students suffered a little). The 'black day' when he was 'gheraoed' overnight by the students (for passing without examination/less percentage of marks/less attendance), he showed tremendous qualities of courageous leadership, dedication to high academic standards and inspired the teachers to sit with him during the gherao. The demands of students were not met and the academic standards were not diluted. Thus, a tradition was maintained.

Sachindra was highly impressed by the flexibility in the course system followed in the agricultural universities (USA land grant college pattern), particularly because



student, as advised by a teacher, was in a position to take up any course according to the ability as well as needs (this was in contrast to the few combinations available in the biology group/degree courses in the Indian universities). Sachindra was in favour of broad-based course training but he questioned the need for link of Zoology to Botany (at graduate level) and Bryophytes/Pteridophytes etc to Plant Pathology/Plant Physiology at the post-graduate level. He favoured the establishment of microbiology embracing mycology, bacteriology, virology and plant pathology. He was always depressed to learn that the department of Botany laid little stress on mycology and plant pathology, virology and bacteriology were not even considered in various course contents.

It is rather unfortunate that the Kalyani University with strong faculties of Art, Science, Agriculture, etc was within a decade, bifurcated into two universities, one the Kalyani University and second a Bidhan Chandra Krishi Vishwa Vidyalaya, the latter was based on the original Faculty of Agriculture of the Kalyani University (actually the College of Agriculture at Haringhata first became a part of Kalyani University and then later a part of the Bidhan Chandra Krishi Vishwa Vidyalaya).

Sachindra always felt that the sum total knowledge is so great that more careful selection has to be made in the classroom. He emphasised that teaching should not be data based but inquiry-inspiration based. The teaching of plant pathology, in his words "should thus have that orientation and philosophy behind it as would inspire students to learn to gain further insight into the subject and extend its frontiers". In his discourse on teaching of mycology and plant pathology (1967) he emphasised the interdisciplinary approach "to serve the continuing needs of plant health, the science of plant pathology not only has to borrow more and more ideas through interdisciplinary contacts but in order to move forward, the knowledge must be imparted to the rising generations of students and scholars. It is this aspect of science of plant pathology that needs closest attention and the universities have a special role to play."

Sachindra believed that "progress in biological branches of science when plotted against time is not represented by a straight and continuous line. The history of science produces ample evidence of the fact that there are sudden rises of the curves, followed by plateau when no major discoveries are made for some time. The peaks normally coincide with discoveries made in other branches of science which have provided the biologists with new tools of observation and analysis". He used the term 'biochemical anatomy' for the understanding of living system (the fundamental) in terms of interaction between molecules and the known structure. When the post-graduate and school course contents are prepared the syllabus is suitable to the needs of the time; Sachindra stressed the need for a continuous revision of the syllabi so that the school course contents are 10-15 years ahead of time, and the post-graduate syllabus represents the recent advances with some futuristic approaches. The students/scholars must be exposed to the 'possibilities' because it is the potentials that are most inspiring. Overall, the courses must be flexible so that the bright student can have the choice to pursue fundamental biology. The teaching mechanism/machinery should also be overhauled from time to time.



to produce personnels according to the needs of the country. Sachindra concluded that "above all it must be realised that in ultimate analysis it is the man that matters and we need teacher who must be competent, imaginative, inspiring, devoted and productive scientists".

The first final batch MSc students of Prof Dasgupta were, late GS Verma, TS Sadasivan, Anna T Zachariah and Vayusutha. A list of his students who completed their PhD is also given below along with their title of thesis.

GS Verma (*Studies in Plant Diseases*), S Sinha (*On the Diseases of Mango Fruit and Some Related Problems together with a Study of Certain Members of the Choanephorales*), RS Bhatt (*Studies in the Ustilaginales*), SC Agarwala (*Chemical Studies in the Physiology of Mangoes*), Z Maleki (*Studies in the Fungi of Iran and India*), Rachel John (*Studies in Aquatic Fungi*), SK Shome (*Studies in Medical Mycology*), DD Awashi (*Studies in Lichens from India and Nepal*), JN Rai (*Studies in the Diseases of Fruit and Crop Plants*), C Sen (*Studies in Mango Necrosis and Certain Fungal Enzymes*), BB Sharma (*Studies in the Diseases of some Economic Plants*), OP Srivastava (*Studies on some Fungal Diseases of Plants and Man*), and JP Verma (*Fungal Enzymes and Their Activities*).

RESEARCH CONTRIBUTIONS

General

Sachindra was rather critical of the gene-for-gene hypothesis. He believed that "several physiological factors and cell conditions determine the susceptibility of host tissue". Turgidity status and ability of cells to plasmolyse are important. The recognition of the fact that the onset of killing by fungal and bacterial parasite is determined by the failure of cells to plasmolyse leads to the question of interference with permeability regulation in the forefront. It has been known that permeation of hyphal membrane by amino acids/nucleotides is not unidirectional. But the selective leakage of amino acids (from fungal hyphae) emphasises the potential for substrate modification not only by removal of nutrients, but also by the addition of complex nutritive material by the developing mycelium. Sachindra concluded "conceivably the enzymic activities (of nucleic acid metabolism) of a fungal parasite might accelerate the turnover of host cell nucleotide, and at the same time, yield preformed purines and possibly energy to the fungal invader". He went on further to comment that "one would expect that a proteolytic or a lipolytic enzyme, or even a polysaccharide attacking enzyme, would be capable of destroying the permeability regularising mechanism of the protoplast. In addition, macerating enzymes may be directly responsible for the death of plant cells by altering the semi-permeability of their vital membranes. The acceleration of rate of destruction of plant cells may be in some way intimately related to the macerating enzyme." Sachindra felt (1967) that "...most workers... employed crude enzyme..... pectic or other enzymes involved in



pathogenesis have not yet been crystallised..... the final phase of molecular pathology will start with the crystallisation of these enzymes." He also concluded (1967) that "in order to understand the net successful activity of the pathogen, one must consider carefully the naturally occurring or pathogen induced modifiers in the host. The presence of detoxifying agents (anti-toxins) in the host must also be considered, and may have far reaching consequences in determining the resistance of host".

While in Europe Sachindra visited practically all the important laboratories and institutions in England, Scotland and Ireland; in the continent of Europe, France, Germany, Italy, Austria, Holland, Switzerland, Sweden, Norway, etc with a view to study the latest techniques of mycological and plant pathological research and to meet and discuss pathological problems with prominent/eminant men of science.

Sachindra worked on the storage disorders of apples for the Food Investigation Board of Great Britain. He also worked at the Low Temperature Research Station, Cambridge on the problem of storage of apples. The Department of Agriculture, United Provinces, India had entrusted to him (for a period of two years) a scheme on the problem of utilisation of usar (alkali) soils of India. He is one of the few mycologists who have contributed to Medical Mycology and his review in the *Mycopathologia et Mycologia Applicata* (in 1960) still serves as the most important document for planning research projects in medical mycology.

Sachindra's dynamism and flare for critical research are well exhibited in the diverse aspects on which he published and guided research. He was responsible for laying a firm foundation to researches on host-pathogen interaction, leather mycology, paper pulp mycology, predacious fungi, aquatic fungi, deficiency diseases, air pollution, lichenology, virology, medical mycology and reclamation of usar soils. He, thus, established one of the finest schools of Mycology and Plant Pathology at the Botany Department of the Lucknow University, which attracted bright students not only from various parts of India but also from other countries as well. Space does not permit even to comment on all the important contributions made by this celebrated plant pathologist/botanist. I shall, however, mention below some of the outstanding researches in a few areas.

Saltation in Fungi

Phytopathology was at its infancy when Sachindra joined the Imperial College of Science and Technology, London University in 1927 for advanced researches in Mycology and Plant Pathology. The immediate problem was saltation (mutation) in several disease producing fungi (pathogens) of apple fruits namely *Cytosporina*, *Phomopsis* and *Diaporthe*.

Sachindra made wide ranging contribution particularly in those involving commonly observed sectorial saltation, in which the saltants varied in their points of origin, in their shape, size and other morphological characters as well as in their physiological behaviour. Besides sectorial saltation, Sachindra, came across several little known phenomena of outstanding interest; these are listed below :



(i) *Latent (maske) Saltation* : these express their identity only when separately subcultured; these continue to breed true in successive generations.

(ii) *Eversaltating strain* : in which the parent form repeats the phenomenon in every cultural generation as orthogenetic saltation.

(iii) *Cyclic saltation*, in which the saltant at some later generation reverts to the parental form.

(iv) *Conversion* of parental strain in which a strain of *Diaporthe* while retaining its parental character in the hyphae of the advancing region, undergoes conversion into a saltant strain in the older region of the mycelium.

(v) *Faster growth rate* of the saltant hyphae than that of the parental hyphae which may be correlated with greater pathogenic activity.

(vi) *Inhibition* of the parental hyphae caused by the saltant hyphae.

(vii) *Complementary Strain* : A phenomenon of profound interest is the saltation into complementary strains in *Cytosporina*. Such saltants, which are separately infertile when grown in nutritive medium, may form pycnidia along their line of junction, or form scattered pycnidia when the hyphae of the two grow intermingled with each other. This is a form of asexual heterothallism.

(viii) *Origin of Virulent strain* : This is yet another phenomenon of profound interest, particularly from the point of view of plant diseases because here the saltants possess different degree of pathogenicity. Some of the saltants were more virulent than the parent strain, demonstrating that the origin of more virulent strains from weaker strain (parent) may not be so uncommon in nature. This phenomenon poses problems in control of plant diseases.

Prof Blackman remarked on the abilities of Sachindra that "he has made most valuable contribution to mycological knowledge, especially in regard to the saltation of fungi. He has shown that a given species of *Cytosporina* may produce saltants which fall into the genus *Phomopsis* and that such saltants may saltate back into *Cytosporina*. He has studied the infecting power of the saltants of *Cytosporina ludibunda* and has shown that some of them are much more actively pathogenic than others, some of them being even more vigorous than the parent strain". Prof Blackman further commented that "More recently Dr Dasgupta has made a detailed study of two strains of *Diaporthe pernicioso* which show most remarkable relationship. One of them is *ever-sporting*, a type hitherto unknown in fungi. This strain on reaching a certain age in culture changes into a second form; this second form, however, when placed in contact with the first form is converted back to the first form, and the rate of spread of the *conversion* through the mycelium of the second form has been followed. The results obtained are of the greatest mycological interest and importance." Prof Blackman finally concluded that "Dr Dasgupta is thus a man of very high research ability".



Sachindra's monograph on *Saltation in Fungi* (1936) presents a review of the saltation phenomenon from various standpoints, discussing the types of saltation, induction of saltation by different chemicals and physical agents, morphological and physiological differences between the parent and the saltants, variation in the pathogenicity of the saltants, and comparison of saltation in fungi with the phenomenon of bud variation and chimaeras in higher plants.

Mango-necrosis and Air Pollution

The detailed investigations on mango-necrosis-'a boron deficiency disease' formed the presidential address of the section of biological sciences, National Academy of Sciences, Allahabad (1959). The studies covered a period of 20 years. Mango necrosis (also known as black-tip of mango) invariably occurred in orchards situated near operating brick-kilns and was characterised by the necrosis of the tip involving about one third or half of the fruit. The important varieties (e.g. Dasherri and Safada of UP, and Langra of Bihar) were most susceptible. Fungal or bacterial etiology of the disease was eliminated and experimental reproduction of disease was attempted by air pollution by exposing healthy mango fruits to coal fumes (actually miniature brick-kilns/ovens were installed in orchards, using various kinds of fuels). His group of workers could reproduce necrosis, but the distribution of diseased fruits was rather irregular. Further, the symptoms produced by SO₂ in no way resembled the actual necrotic symptoms of the mango fruits. Another brick-kiln fume constituent, ethylene, was also not able to produce the natural symptoms either alone or in combination with SO₂. Careful work showed that at low dose the ethylene caused ripening, but at high dose it caused browning. Many other suspected compounds like carbon monoxide, fluorine, etc were also ruled out as the inducer of disease through careful experimentation. It must be mentioned that although these were rather negative results as far as mango necrosis was concerned, yet these results were laying sound foundation to the various aspects of effect of air pollution on vegetation. Some time was lost at this stage to prove that viruses were not involved either. It was then assumed that mango necrosis was a physiogenic disease caused by the disturbance of the metabolic activity of the healthy mango fruits in an early stage of development leading to deficiency due to the interaction of the brick-kiln fumes with cell metabolites.

The methodology was, therefore, altered to suit the study of deficiency diseases. It was then discovered that administration of boron as spray on trees appeared to check the advance of mango necrosis. The significant accumulation of glucose, sucrose, fructose and total sugars as also of nitrogen in the diseased portion of fruits of Dasherri and Safeda also pointed to the same conclusion (*i.e.* boron deficiency), which was further confirmed by the study of the chemical physiology of healthy mango, healthy/diseased (necrotic) portions of diseased fruits, particularly with regards to the changes in total nitrogen, total acids, carbohydrates, etc. It was finally conclusively proved that *boron* when sprayed adequately at appropriate time prevented the incidence of necrosis. It was also accepted that *the disease once present, however, is checked but not cured by application of borax*. It was suggested that in mango necrosis, boron deficiency was



caused by the fixation of boron in the soil but by the disturbance in boron metabolism due to the interaction of some cell metabolite of mango fruits with the constituents of brick-kiln fumes producing a substance at some stage, this substance (the causal factor) has been obtained in crystalline form. This causal factor (a constituent of gases of brick-kiln fumes) is soluble in ether (the ether soluble fraction of fumes) and chloroform. It crystallises in hexagonal form with a melting point of 110.5°C ; when injected in mango fruits it caused necrosis in 50 per cent of fruits. Because spray of boron prevented the disease it was concluded that the disease producing fraction produced by the absorption of the fumes, translocated into mango fruits, and induced boron deficiency on one hand, while on the other hand, it caused histopathological changes, forming deposits in the vessels and choking/impeding or altogether stopping the translocation of metabolic products that help to develop necrosis from the tip end. The studies demonstrated the multidisciplinary approach to solve a problem in the national interest in an economic way. In the end, however, Sachindra, was not satisfied and wished to pursue the studies further *to unravel the precise steps by which the disturbance in boron deficiency may be brought about and to get a clear picture of the enzymatic systems which are involved in the process*. The investigations of boron deficiency disease of mango ushered in a new era of plant pathology in India focussing attention on deficiency diseases, air pollution and non-parasitic diseases. His presidential address on air pollution to the Botany Section of the Indian Science Congress (1957) reviewed, for the first time from India, the data available from the industrial countries (Germany and Britain in particular). He drew attention, with telling figures, to the human health hazards from air pollution and profound deleterious effect on agriculture (destruction of growing crops, diminished yields, damaged vegetables, etc) besides posing serious national environmental problems.

Sachindra made a serious plea (in 1957) for the scientific studies by the respective disciplines (physics, chemistry, biology) of the polluted atmosphere, evaluation of weather effect on air pollution, epidemiology, human/animal health hazards and damage to vegetation/agriculture. India was then at the threshold of industrial revolution under successive five year plans, and the country was going to face extensive damage through air pollution because new factories were being launched, refineries were started and other industrial plants were being erected. He urged legislative action to control, at the source, the pollutants produced as the bye products of industrial processes and fumes. These could be done, as he concluded *without waiting for indigenous research, by borrowing the design and technology from abroad*. However, all these remained unheeded until in the mid-seventies, the Los Angeles environmentalists paraded the streets with gas masks on, to bring home, the impending dangers to human survival.

Aquatic Phycomycetes

The study of the aquatic phycomycetes in the Lucknow University, which had suffered initial failures, received tremendous impetus from the detection of chytridial parasites in many specifically unidentified algal hosts like *Spirogyra*, *Oedogonium*, *Closterium*, and to a less extent *Cladophora*, *Zygnema*, *Ulothrix*; and among the animalcules



in rotifers, their adults and eggs as well as the appearance of profuse number of members of *Blastocladia* of the order blastocladiales and other orders from appropriate baits.

He (in collaboration with Rachel John) described over 70 species of aquatic phycomycetes; several other species are awaiting identification/publication (the completed manuscripts are at various stages of publication). The identified species have yielded, at least, five orders, chytridiales, blastocladiales, monoblepharidales, lagenidiales and entomophthorales. Three new genera have been proposed to accommodate four new species which could not be placed in any other known genus. *Monophagus* gen. nov. belongs to the suborder polyphagoideae of chytridiales, and is closely related to *Polyphagus*. *Indocytium* gen. nov., belonging to lagenidiaceae, is related and associated with *Myzocytiium megastomum*. *Sparrowmyces* gen. nov. is parasitic in *Ulothrix* species and possesses epibiotic sporangium, endobiotic apophysis and extracellular free floating copiously branched rhizoids arising from apophysis penetrating through the lower cell wall of the host *Ulothrix*; this type is wholly unknown in any other aquatic chytrid. The validity of these new genera has yet to be established.

A large number of manuscripts are ready for publication; these deal with the revision of the following genera, *Olpidium*, *Rozella*, *Phlyctidium*, *Rhizophyidium*, *Blyttomyces*, *Entophlyctis* and *Rhizidia* (inoperculate chytridiales), *Chytridium*, *Macrochytridium* and a proposed new genus *Sparrowmyces* (operculate chytridiales); *Catenaria*, *Allomyces* and *Blastocladia* (blastocladiales); *Gonapodya* (monoblepharidales); *Olpidiopsis*, *Myzocytiium* and *Lagenidium* (lagenidiales), *Ancylistes* (entomophthorales). Such a huge collection from a single laboratory within a short span of 5 years is indeed phenomenal, and is surpassed only by Sparrow, Karling and perhaps Scherffel.

A comprehensive account of the status of aquatic phycomycetes was presented in 1982 in his Jeerasannidhi Lecture (*Indian Phytopath.* 35: 193-216) where he remarked that "Discovering new and less known genera is both exciting as well as encouraging and must be pursued with all earnestness. Besides, these form the foundation of phylogenetic work, providing in many cases link species. But equally, if not more demanding, is the thorough study of the different phases of the life cycle of marginally placed newly found species with special emphasis on the characters which are known to be of importance from the classificatory point of view".

He went on further to advise that *our maturity demands that not resting content with survey alone, the taxonomists take up the critical study of the individuals of those areas which are unsettled and speculative, besides the monographic studies of such groups which are well represented in India. The literature abounds in cases where the critical developmental stages of species are unknown or imperfectly known, where the limits of genera, families are not well delineated, where opinion differs as to their taxonomic status. Contributions in these areas may lead to the emergence of new facts, conduce new concepts, invalidate some which are now extant, solve many problems confronting the present day myco* and throw up other problems to be solved in their turn, gradually moving towards possi



phylogenetic classification. Finally he concluded that there remains a vast field to explore in India, elsewhere as well, only a fringe has been touched.

HOBBIES

Sports

Sachindra Nath was a man of varied interest. He possessed a good physique and maintained a sound health throughout his life. He was highly proficient in most of the outdoor games, but excelled in tennis. He disliked indoor sports like chess or cards. He was a keen footballer. He used to say that, at school after a game of football in the evening, when he got back home (tired and exhausted) his mother would rebuke him daily for being so unmindful of his studies. He carried this interest in outdoor sports to Calcutta where in the YMCA, he participated fully in all games.

In London he earned a University Blue in tennis. In Lucknow he became the president of the University Lawn Tennis Club. He was so fond of tennis that he could be often seen playing with great vigour and swiftness (so characteristic of him) in the staff courts of Lucknow University. With age, he later switched to badminton.

Music/Painting/Languages

He would often refer to his lack of ear for music very apologetically, because Lucknow during his time, was the acknowledged centre of Hindustani music. But this lack of interest in music was true only of the vocal side. In London, he did a full course at the Putney School of Art, and his surviving pencil portrait sketches are perfect. He was not a great social mixer but he developed abiding friendship with individuals among whom were the sculptor Hiranmoy Roy Chaudhuri (who also did a marble bust of Sachindra) and the painter Lalit Mohan Sen, both of the Lucknow School of Art.

Foreign languages fascinated him and he dabbled in many but was particularly fond of German poetry. A framed German hymn always stood besides his writing desk. It said (translated) "When you have the sun in your heart then come what may your darkest day will be full of light. Have a word for others in sorrow and in pain and that will make you feel glad too". He had a profound admiration for Germany and German Culture. For Lucknow, he continued to have an affection which made him visit it twice every year until his last days. Like many of his generation, he had a good grounding in Sanskrit language and literature. After retirement, he wrote half a dozen short stories in Bengali, which, however, never got published, more as social romances than a depiction of society. His reading habit curiously included a heavy doze of thrills.

Trekking/Mountaineering

He was very fond of travels in the Himalayas. The summer vacations in the Lucknow University were often spent by him in travelling through different parts of Sikkim, just with one porter. He maintained details of his day to day journey in the diary, mentioning



the type of route, miles traversed, people with whom he came in contact, the vegetation and the food he was able to get. He relished the simple food items like 'dal' and 'roti' or dal and rice only. His nature to adjust and be happy with diverse inconveniences of shelter, food, etc. was marvellous. It is fortunate that I have a write-up in Sachindra's own typed manuscript on interest in mountaineering. I reproduce that to demonstrate his tremendous interest in trekking as well as his adventurous nature.

"Trekking has been my hobby and pleasure. Adventure is in my blood. Leaving aside juvenile excursions to the forests of Dooars, ruins and temples, the first initiation in adventure was in 1919, at the age of 16, immediately after matriculation, along with two friends of like mentality, we trekked from Siliguri to Kurseong (5000 ft), a distance of 25 miles through the dense Sal forest and mountain stream (now practically non-existent). Starting at the very small hours of the dawn with lighted torch to scare away wild elephants and animals following uphill tracks we reached Kurseong near about midday. Resting the night we walked along the cart road (taking short cuts wherever possible) to Darjeeling (8500 ft), another 25 miles. Much later in England I was initiated in mountaineering in Snowdon (Wales) by Sir John Farmer. Further mountaineering and trekking were done in Germany (Black Forest) and Switzerland, notably Junge-Frau, with the help of professional guide".

"Further opportunities came in the way at Lucknow University. There my most valued friend and colleague, Dr SK Pande, of Bryology fame, a trekking enthusiast, no doubt inspired by his teacher Prof. Kashyap, became my constant companion. With our combined enthusiasm, between 1935-1945 we took a series of excursions systematically from Kashmir to Cape Comorin and Ceylone (now Sri Lanka), to areas important from botanical, geological and religious point of view. Among these trekkings the most rewarding were the trekkings in the Western Himalayas. Starting with Pindari Glaciers (13,500 ft) we visited many other Himalayan resorts like Milam Pass (14,500 ft), Kedarnath, Badrinath, Yamnotri, Gomukh etc".

Solo Mountaineering in Sikkim

"My solo venture in trekking/mountaineering was the land of Sikkim. It was my favourite haunt for three successive seasons from 1939, terminating with the bombing of Calcutta by the Japanese in 1942. The first trek was the round trip from Gangtok to the South-East region of Sikkim. From Gangtok I trekked to Karponang (Possum), along a narrow mountain track, skirting an awesome abyss, the both faces of which were covered by Rhododendron plants, and in the season I visited, it was an unbroken view of a riot of gorgeous red flowers as far as eyes could travel. From Karponang I trekked to Changu Lake (12,500 ft) which is about a mile long glorious expanse of water, when viewed from a cabin at the western end. I then proceeded on to Nathu La (14,000 ft), then to Jelep La (13,500 ft), over which passes the Kalimpong-Lahsa trade route, the gateway to Tibet; from there to Kapup, Sedonchen (6,500 ft), to Rhonak and up towards Pakhyong and finally back to Gangtok".



"The next trip, with a Lopcha guide, was to Donkhya La (18,100 ft). From Gangtok, following the same route as for Sebu La (*infra*) we came to Chungthang, crossed over to Lachung Valley, to Lachung, then to Yumtang, to Mome Samdang, and from there to Donkhya La. I retraced my foot steps, instead of crossing over the fairly easy pass. There at the foot of the hill I had the temerity to take bath in the ice-filled mountain stream at a height of over 17,500 ft. Almost frozen blue and paralysed, I was warmed and revived by the Yak dung fire prepared and kept ready by the guide. I returned back to Gangtok by the same route".

"The acme of my Sikkim mountaineering was when I crossed Sabu La (17,500 ft) from Lachen Valley to Lachung Valley. I started from Gangtok with the same Lepcha guide, with Ice Axe and a few other accessories, taken on loan from the Himalayan Club, Calcutta. Down we went meeting the river Tista at Dikchu, our first *Parao* (stage). Our wooden shelter, where we passed our night, was practically over the awesome, deafening roaring torrents hurtling down its course. Next morning we trekked up to Mangen and continued upto Singhik (4,600 ft). Rested the night. In the morning Singhik presented a most magnificent, exalting, panoramic view of the Kanchanjangha range, that appeared to dominate Sikkim. Face to face with Kanchanjangha, adjudged as the most beautiful and symmetrical peak of the world, the eastern face of which shimmered and glittered as a sheet of gold in the morning sun, true to its name, a sight that fascinated me even as a child, while watching the peak from the iron bridge that spanned the Karala river (Jalpaiguri) on my way to morning school. The glory of the vast, massive, pinnacle of Kanchanjangha range left me spell bound. We proceeded onward to Toong and from there to Chungthang (5,350 ft)".

"Chungthang is in the confluence of two rivers, Lachen Chu and Lachung Chu, mingling their waters to form Tista. We passed on along Lachen Valley to Lachen (8,800 ft, then to Thangu (12,800 ft). From there, the path lay over Sebu La to Lachung Valley. Starting early, trekking, which involved occasional cutting steps with ice axe, alternatingly the guide and myself, again at some stages crossing dried-up river beds, skirting, avoiding, treacherous possible quick sand, and fallen trees and boulders. We hurried on, as best as we could, afraid to be engulfed by sudden onset of darkness, in that mountainous forest region, which would spell disaster. It was just in fading evening light that we reached Mome Samdong (15,000 ft) in Lachung Valley. There we took shelter in the Himalyan hut. We had traversed, in one day, what normally, enjoyable, should be done in two stages with proper equipment. There, for the first time, I experienced mountain sickness. Food cooked by solicitous guide remained untouched. Nausea, high fever and fearful dreams gave a disturbed night. Gradually all these passed off and I slept soundly into the morning. Next day was a day of repose. The day following weary limbs rested, revived and refreshed, we embarked on return journey, following the trek along the Lachung river, arriving at Yumtang, Lachung, back to Chungthang, finally to Gangtok, following the same route as on our onward journey to Sebu La. At Gangtok, after



day's rest I bade farewell to my amiable, companion and guide. Thus ended my Sikkim odyssey".

FELLOWSHIPS, AWARDS, HONOURS AND DISTINCTIONS

Sachindra Nath was honoured by various societies and was elected as the President, Indian Botanical Society (1947), President of the Indian Phytopathological Society (1954) and President, Botany Section of the Indian Science Congress Association (1957). He was Honorary Fellow of the Indian Phytopathological Society, Honorary Fellow of the Indian Botanical Society, and Foundation Fellow of Indian Academy of Sciences, Bangalore. He was also a Fellow of the National Academy of Sciences, Allahabad, Emeritus Member of the American Phytopathological Society, Member Societe Botanique de France, Member Editorial Board of Mycopathologia et Mycologia Applicata and Member, Indian delegation at FAO conference on Freedom from Hunger at Washington (1963).

The famous Italian Naturalist O Campese dedicated his monumental work on Culture Tropicali, Volume-VI to Prof SN Dasgupta as a token of esteem and appreciation. A special volume entitled "*Current trends in Plant Pathology*" edited by SP Raychaudhuri and Jeevan P Verma, was dedicated to him on the occasion of his 70th birthday in 1974 during the Indian Science Session held at Nagpur. He was awarded DSc (*Honoris causa*) in 1979, as the founder father by the University of Kalyani, West Bengal. The citation described him as *an eminent scientist and a distinguished academician who combines in his gentle personality the noblest traditions of learning, the challenging spirit of the scientific explorer and the inspiring vision of the creative genius.*

He was also Member, Governing Body, Birbal Sahni Palaeobotanical Institute, Lucknow, Member, Advisory Council, National Botanical Research Institute, Lucknow; and held important positions in various societies/academies.

THE KARMAYOGI

Sachindra Nath had a deep faith in God, but an equally great contempt for religious rituals. He believed in the goodness of his actions. In 1986 while revising one of his major papers for publication he fell seriously ill with little hope of survival. When he recovered and completed the manuscript he wrote to the editor *perhaps it was ordained that I shall vindicate our work. I see no other reason for my survival.* Sachindra was research minded and felt *guilty for shifting to administration*, but even this he accepted as the act of God when he said that ... *but it is fate.*



When he started working on the publications of old manuscripts in the seventies, he faced acute problem in obtaining the recent number of journals. As the IARI library is very good, he wrote to me very often for Xerox, books, photos, etc. He took help from very few, and only willing workers. He wrote to me ultimately on 1-9-89 that *excepting you and one or two others there is none to help. They think perhaps it is futile to pretend research at this old age.* His health was particularly poor during the last 5-6 years, but this never stopped him from working. He wrote on 1-1-88 that *now that I am better I am going to trouble you again.* He used to write even upto ten items to be done in a single letter. But he was aware of others problems and admitted that *I have worried you with many trivial matters in the midst of your multifarious more important activities, academic and otherwise.* When I was the President of the Section of Agricultural Sciences (Indian Science Congress) and preparing my presidential address he wrote *you are surely concentrating on your presidential address... Let not these paltry matters divert your attention.* Once he wrote *I was feeling too diffident to continue to trouble you.* After the address he had the kindness to congratulate me and say *this is just to congratulate you on your penetrating, thought provoking address, rational in its approach and bearing a stamp of erudition. God bless.* He not only cared but also encouraged and inspired his students with similar remarks.

Once when he was very sick he wrote on 4-1-90 that *when your last letter arrived I was fighting for my life in a nursing home. Unfortunately I won. A further step, I would have merged with eternity. What a relief it would have been.* He, however, was true Karmayogi and advised that *Man can only try-the success is in the hands of God. Let not spurious ambitions deviate you from the main purpose of life.*

On April 14, 1990 he wrote *I write as I feel coming to the end of the journey. I hesitate not to express myself as I feel. My health is failing. But I keep on working while I may. I shall be happy if the end comes suddenly without notice.* True to his desires his end was sudden and peaceful on the night of 11/12 September, 1990.

His life was so honest, straight forward, truthful, sincere and disciplined that one would like to imbibe something from it. He was always full of new ideas and generous in sharing them with his colleagues and students, often allowing them to take much of the credit. He was held in awe for his dynamic personality and simultaneously respected for his humanitarian views. He was Godfather to three children's institutions; this became known only after his death. He donated his large and magnificent personal library to the University of Kalyani. He lived in a shell, and only the few who could penetrate this hard shell became aware of his softness and love for the weak as well as respect for the outstanding. He liked to help the deserving ones, but without being known as the helper, and the help was always in plenty, with modesty and with sympathy. His kindness and warmth of personality made him many friends, more admirers. Sachindra was a bachelor. But he has left behind a large family of mourners, which include his near relatives, students, colleagues and admirers.



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