JEEVAN PRAKASH VERMA

(6 May 1939 - 4 September 2005)

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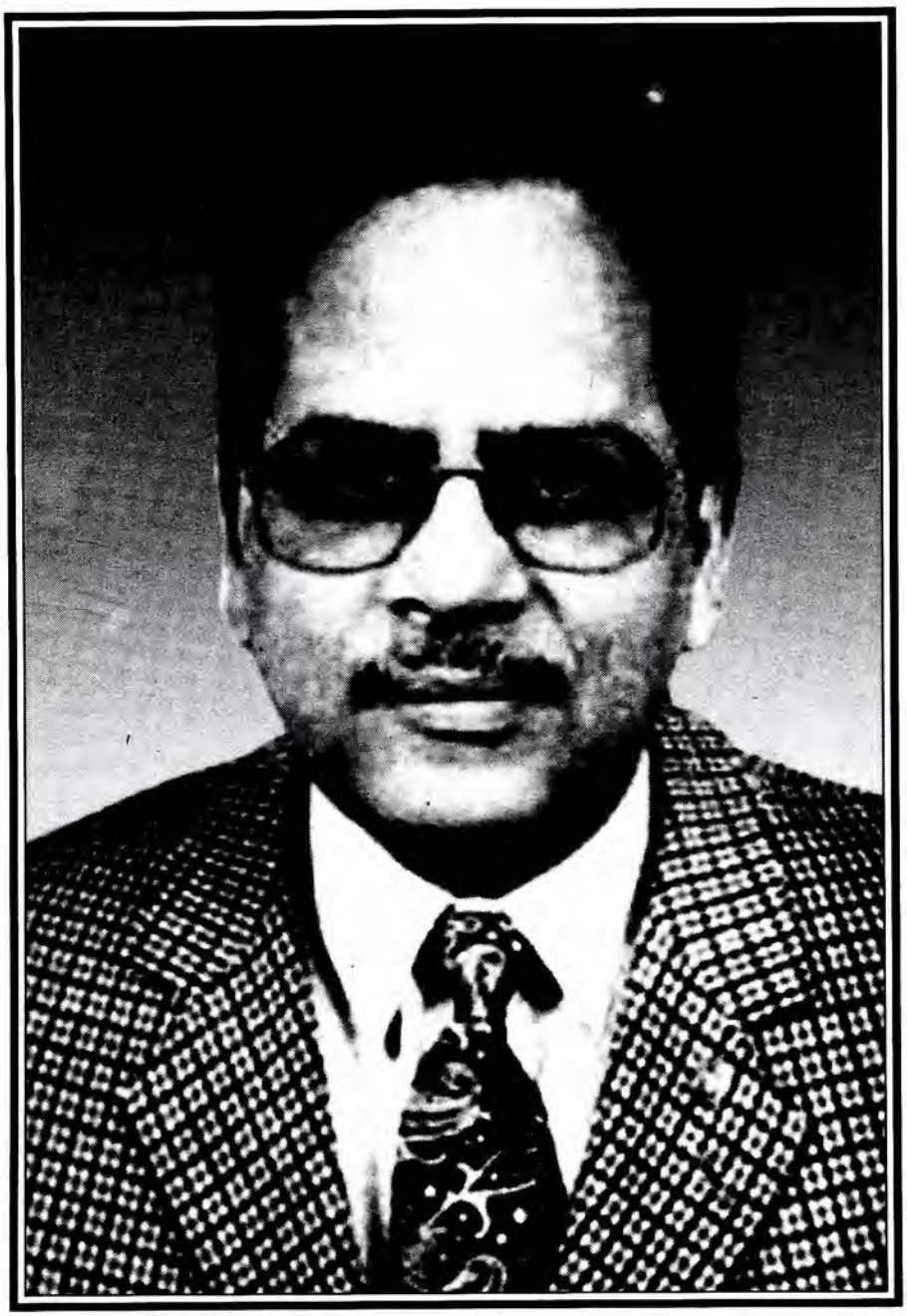

JEEVAN PRAKASH VERMA

(1939-2005)

Elected Fellow 1990

EARLY LIFE AND EDUCATION

JEEVAN PRAKASH VERMA was born on the 6th of May 1939 in Kauraha Village, Jaunpur District of Uttar Pradesh. His father Late GS Lal Shrivastava retired as Chief Engineer in Birla's Sugar Mills at Hasanpur Road, Bihar. His mother Mrs. Shanti Devi was a housewife. Dr. Verma was eldest in the family with four brothers and two sisters.

Dr. Verma studied at the National Higher Secondary School, Lucknow and passed the High School Examination in 1952. In 1954, he passed the Intermediate Examination (Biology) with distinction securing highest percentage of marks in the biology section. He got merit scholarship for doing his MSc and completed it in 1958.

Dr. Verma married Mrs. Rekha in 1963. She worked as a Hindi Teacher in St Michael Junior School, New Delhi. Vermas had two children. Eldest was a daughter Shakuntala (1964) who did MBBS and is now working as a Medical Officer in NDMC, New Delhi. The second was a son, Mr. Sudhansu (1966) working in North Indian Petrochemicals, Nehru Place, New Delhi.

During his school days Verma was an excellent cricket player besides being proficient in 100 meters race and long jump. He had played against Ranji Trophy Cricket players. Once during his visit to Bombay along with his classmates for collecting specimens, he took special permission from his teacher to watch the test match played between India and Australia. He had to rush to the Railway station half way through the match to catch the train. His passion for cricket was always with him. But his elders persuaded him not to play cricket during his college days and to concentrate only on studies. He gave up cricket since then.

HIGHER EDUCATION

Dr. Verma joined the PhD programme in Lucknow University under Professor SN Das Gupta to work on physiology of host pathogen interaction, but realized it was a difficult subject to master. He switched over to fungal enzymes and their activities. The topic selected was genus *Alternaria* since it possessed highly pathogenic (even host specific) to weakly pathogenic stains. His colleagues at that time were SK Shome, C Sen, KG Mukherji and JP Tiwari. Unfortunately, Dr. Das Gupta shifted to Calcutta in 1958 to become a Member of West Bengal Public Service Commission. However he agreed to supervise by periodically visiting Lucknow. Professor Jeevan prepared two papers on his research work submitted them to his supervisor for scrutiny in ten months time. His supervisor was very much impressed with his progress. In the meantime Professor

Jeevan came in contact with Dr. S Ghatak of CDRI, Lucknow who had tremendous knowledge of enzymes. The other person from CDRI who helped him in his research work was Dr. Krishnan of Biochemistry Division. The schedule of work was hectic, German language course in the morning, enzyme reaction studies in CDRI till the evening and to get back to the University late in the evenings. Dr. Krishnan had very fruitful discussions with Dr. Verma and Dr. Sen regularly and sorted out all his academic and administrative problems. His knowledge helped him during his stay at Lucknow and also in his professional career later on. His research work progressed quite well. He was permitted to submit his PhD thesis within two years as an exception. Professor Verma got Ruchi Ram Sahni Research Award for his PhD. His examiners were Dr. W Snyder and Dr. JC Walker. He got his PhD in 1961 at the age of 22.

RESEARCH WORK

Around this time, Dr. Das Gupta had joined the newly established Kalyani University as its first Vice Chancellor. Dr. Verma and Dr. Sen were persuaded to join this University as faculty, Verma in Botany and Sen in Agriculture. Professor Verma had a strong urge to go abroad and get exposed to the facilities available. He succeeded in getting Royal Commission Scholarship and DAAD (German Academic Exchange Service) scholarship. He preferred to go to Germany even though monetarily Royal Commission Scholarship was more remunerative. In West Germany he had the choice to work with Professor Lynen (who got the Nobel Prize in 1966) and Professor Kandler. He opted for Kandler who was working on fundamentals of bacteriology. Professor Verma worked on cell walls of myxcobacteria, the genera cytophaga and Sprorocytophaga. He worked with Professor Martin who was one of the world experts on gram negative bacterial cell walls. Professor Martin had a small but well equipped laboratory including a Beckman spectrophometer, an automatic amino acid analyzer and an ultracentrifuge. He had the opportunity to listen to the lectures of stalwarts in the field like Professors Lipman, Lynen, Crick, Nirenberg and Ochoa.

To start his research Professor Martin gave Dr. Verma a couple of samples of amino acids to dinitrophenylate and estimate the yellow products. The weighing of amino acid was done by Martin himself. Verma had never done such experiments in Biochemistry. Martin was surprised at his results. His first assignment was on Myxobacteria. The first task was to obtain mass culture. First mass culture took 7 days and subsequently it got standardized to 24 hours. Professor Martin was so much impressed with the progress of his work that he started discussing research projects on daily basis.

Purification of mureins was creating lot of problems. At that time (1964-65) pronase (a proteinase) was frequently used for removing protein contaminants from cell wall. But when Verma used pronase at slightly higher temperatures he could not isolate mureins. In three months he proved that pronase possesses lysozyme or similar activity at higher temperatures and digested the linkage of mureins. He analysed all the fractions chemically as well as electromicroscopically. Very soon he became a source of help to all the research scholars in the laboratory.

Professor Martin was a tough man. It was very difficult to convince him when his views were wrong. His one year stay was coming to a close. He was requested to continue working in the laboratory for one more year which could fetch him a doctorate. As soon as substantial results were obtained Professor Verma was allowed to submit his thesis within a period of two years, a rare exception given to students. This was partly due to his proficiency in German. In the meantime, Professor Martin got a Chair in Darmstadt. Professor Verma had to shift his place of work to fulfill his thesis requirements. He obtained Doctorate in two years from the Technical University, Munich in the year 1966.

While in Europe, he was on a study tour to Germany and Switzerland and visited various laboratories. This included Sandows, CIBA, Hoffmann-La-Roche. He attended an important seminar in old castle near Prague.

POSITIONS HELD

Professor Jeevan Prakash started his professional career as a Lecturer in Kalyani University, Calcutta in 1961. He continued in this position till 1969. He was also an Instructor in German for part-time students. He shifted to the Indian Agricultural Research Institute, New Delhi as a Scientist S2 and continued in that position till 1976. He was Scientist S3 between 1976 and 1982. He was Principal Scientist (S4) between 1982 and 1988. He became a Professor of Plant Pathology in 1988. He served as the Head of Plant Pathology Division from 1995 till his retirement.

MAJOR ACHIEVEMENTS

Bacterial blight of cotton induced by *Xanthamos axonopodis* pv. *Malvacearum* is the most destructive disease for good quality tetrapoloid cottons under irrigated and productive/intensive agricultural conditions and losses upto 50 per cent (generally 10 to 30 %) have been frequently observed. In India, not only all cultivated CVS were susceptible to Xam but even the CVS resistant in the country of origin were devastated.

Professor Jeevan Prakash has generated both basic and applied data which have been used for the strategic management of this disease. First he developed the technique of detection/identification of bacterial blight of cotton, on the sound basis of virulence factors which neutralize individual B genes (blight resistant host genes), plasmid profile and bacteriophages. Race 32 with virulence factors to five B genes (B7, B4, B2, B In and B-N) was pathogenic to all tetraploid cottons cultivated in India and was present in 80 per cent of locations. But a B-2 + B-3 combination in Acala background was resistant to this race. This gene combination was transferred to *G. hirsutum* to generate a CV. BJR (bacterial blight jassid resistant). Race mixtures occurred in single lesions and the phenomena of cross protection as well as generation of more virulent genotypes through process similar to recombination were demonstrated in nature.

Two groups of phages lysing lactose non utilizing (lac-) isolates of Xcm (group I phages) or lactose utilizing (lac+) isolates of Xam (group II phages) were established. Lysogeny was demonstrated in several strains, but the lysogenic phage 352 T (group II phage) could also lyse lac isolates. Group II phage possessed a hexagonal head (0.625nm in dia) and a non contractible but flexuous tail (1450 A long), which was unique since it

was more the twice the length of the head and coiled to form a loop. Such a long tail is needed to penetrate the thick slime layer enveloping Xam and reach the phage receptors located lower down in the cell wall. A highly sensitive and specific phage technique was standardized to detect the presence of Xam in seeds, soil, water etc.

In addition to seed transmission Professor Verma demonstrated that cotton pests (*Earias* spp. and *Dysdercus koenigil*) also transmitted Xam. Further the relative role of trash, soil, self sown seeds and latent phase in the disease cycle was demonstrated. Symptoms were produced only at Xam population of 1-5 X 10^{10} per gram fresh weight of leaves.

Virulent genotypes of Xam secreted copious exopolysaccharides (EPS) by force, thereby creating water soaking in advance which helped in the rapid multiplication and spread of pathogen. A water soaking inhibiting factors was isolated from CF by ether extraction. This inhibitor was useful in the management of the disease. Plasmid cured isolates were avirulent and defective for EPS production indicating the role of plasmid and EPS in virulence. Virulence also depended on protease endo PG and endoglucanase. PMSF (phenyl methyl sulphonyl fluoride), a specific protease inhibitor, also inhibited susceptible disease reactions.

The cell wall of Xam contained a manolayered murein sacculus of the type A1 (direct cross linked) emphasizing that phytopathogenic bacteria are one of the most evolved prokaryotes. Cellulolytic gram negative bacteria (myxobacteria) produced manolayered mureins (25A thick) in vegetative cells but in microcysts the murein was multilayered (more than 80 A thick) and strained gram positive, this established that the thickness of mureins played a significant role in gram straining. B lactums (specific prokaryotic inhibitors) were however, not effective in disease management since they were degraded by B lactomase produced by more than 50% of the phyllopane bacteria. Several phylloplane bacteria have been used successfully in the biocontrol of bacterial light of cotton. Antibacterial propereties of plantvax, vitavax and busan 72 were demonstrated and data on their apoplastic movement generated. Ecofriendly neem based products have also been demonstrated to be effective as well as compatible with chemical control. A few bacteriocin producing fluorescent pseudomonads have been developed which on seed bacterisation improved seed germinability by more than 80%. Professor Verma has also generated significant data on other bacterial diseases of crop plants, role of enzymes in pathogenicity and biocontrol agents including plant growth promoting rhizobacteria.

MEASURABLE IMPACT

In 1969, around the time when Professor joined IARI, a policy decision was taken by the Government of India to replace large areas of diploid indigenous cotton with tetraploid American and Egyptian cottons. But these varieties could not be successfully cultivated due to their extreme susceptibility to bacterial blight. The problem was complicated because all cultivated tetraploid cottons including varieties resistant in countries of their origin were susceptible to Indian races of Xam. Professor Verma identified host resistant gene combinations and transferred these genes to suitable cotton CVS. BJR variety was

developed through triple cross. Besides, Professor Verma developed suitable chemical control which enabled the cultivation of *G. barbadense* under North Indian conditions.

In summary, work of Professor and his group made it possible to cultivate good quality tetraploid cottons which were highly susceptible to bacterial blight of cotton caused by *Xanthamos axonopodis* pv. *Malvacearum* (Xam).

Professor Verma identified genotypes of Xam in large number of locations in India and the data was used in the strategic deployment of host resistant genes in the management of bacterial blight of cotton. He demonstated the negative effect of race mixtures. He suggested the use of pure race 32 of Xam which neutralized five B genes.

Professor Verma developed a technique for the identification of races of Xam on the basis of gene interaction. Work on plasmid biology confirmed the role of plasmids in virulence. A nucleic acid probe was developed which was useful in detection of virulent races of Xam.

Work on cell walls and prokaryotic inhibitors have established biodegradation of antibiotics in nature.

Professor Jeevan Prakash developed fluorescent pseudomonades which on seed bacterisation increased the germiability of seeds of genetic stocks from 0 to 80 %; thus the valuable genetic stock was saved.

Phylloplane bacteria have been developed for biocontrol; these were tested in four locations in India and proved successful in the management of bacterial blight. They have been shown to control root rot and seedling rot diseases.

AWARDS AND HONOURS

The following are the awards received by Professor Verma.

- Birbal Sahni Gold Medal (1958) of Lucknow University
- Ruchi Ram Sahni Research Prize (1961) of Lucknow University
- Hexamar Award (1981) jointly with RP Singh for cotton improvement
- Hexamar Award (1991) for outstanding contribution in cotton pathology
- ICAR Gold Medal (1992) for evolving appropriate technology for increasing cotton production
- MJ Narasimhan Medal (1993) for best paper in *Indian phytopathology* **44**, 1991
- Best Teacher Award (1996) IARI, New Delhi

Professor Verma was elected a Fellow of the Indian National Science Academy; National Academy of Sciences, India; National Academy of Agricultural Sciences, India; Indian Phytopathalogical Society and Indian Botanical Society. He has been the President Agricultural Sciences Section, Indian Science Congress 1990. Professor Verma was the President of the Indian Phytopathological Society 1994. He was also the Chief Editor of the *Journal of Phytopathology*.

AS A PERSON

Jeevan Prakash, as a student, was very good in sports. He did exceedingly well in cricket, long jump and ball badminton. He was highly religious and God fearing. He was unassuming. His motto was 'my wealth lies in fewness of my wants.' He believed in

simple living and high thinking. He was never after short term gains and cheap popularity. Professor Verma had worked for more than 20 years in cotton research. He breathed his last on the 4th of September 2005. In him the academy has lost an agricultural botanist of repute.

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