

M. Udayakumar (1946–2021)

King Bhartrihari, a renowned Sanskrit scholar of the 5th century AD wrote in his *Niti Shatakam*,

परिवर्तिसंसारमृतः कोवानजायते।

सजातोयेनजातेनयातिवंशः समुन्नतिम्।

‘in a constantly changing world, everyone born would die. But we regard and celebrate the life of a person because of whom an entire generation gets benefited’. Professor M. Udayakumar who passed away on 26 June 2021 was one such person who deeply influenced and illuminated the lives of scores of his students and colleagues over the last 40 years of his life. An astute intellectual, he was a mountain of patience and perseverance. Udayakumar’s thoughts and advice have impacted fields as wide apart as plant physiology, plant molecular biology, molecular plant breeding and many more.

Makarla Udayakumar was born on 15 September 1946 in Guntur town of erstwhile Andhra Pradesh, India. He studied in Majeti Guravaiah High School (Guntur) and graduated with a B.Sc. degree from Andhra University. Next he went to the then Soviet Union for higher studies and completed his Master’s degree at Moscow University, subsequently obtaining his Ph.D. in 1971 from the Academy of Sciences, USSR. Armed with vast knowledge and experience on various aspects of plant physiology and biochemistry, Udayakumar returned to India and joined the University of Agricultural Sciences, Bangalore (UASB) as a CSIR Pool Officer in 1973. This heralded the beginning of a golden era for plant physiology at UASB, in particular and India in general. As destiny would have it, Udayakumar met his mentor and match in K. S. Krishna Sastry, then Head of the Department of Crop Physiology at UASB. Their close association and shared passion for excellence in science led to the evolution of one of the country’s most vibrant and successful groups of plant physiologists at UASB. As one of the youngest professors at UASB, Udayakumar succeeded Sastry and served as Head of the Department for around 17 years.

Undergraduate days for many of us were more filled with mischief and sports than studies. But as some excellent teachers taught us their subjects passionately,

we were constantly in a dilemma to decide on an appropriate subject for a career in academics. Genetics and breeding was the most sought after subject then (even now) as it would guarantee jobs. One of our senior friends who used to coach us to prepare for the Indian Council for Agricultural Research (ICAR) competitive exam took one of us (M.S.S.) to Udayakumar and requested him to teach nitrogen fixation. He asked us to come after an hour. What surprised M.S.S. the most was to see Udayakumar preparing earnestly to teach him. The hour and a half class changed the life of M.S.S. He was elated to join crop physiology as a Master’s student with an ICAR fellowship in 1985, and his journey with Udayakumar and science began at that instant.



Udayakumar taught us plant metabolism, especially photosynthesis with an infectious passion. He made an excellent impression on all his students through his teaching and we affectionately called him ‘Profy’. He used to teach with absolute seriousness even after his superannuation in 2006. Here we narrate two events that are fresh in our memory. One day in 2007, Udayakumar was caught in one of those notorious traffic jams in Bengaluru and was late for his class. M.S.S. an assistant professor then, and eager to teach, took the class. On his reaching the campus Udayakumar hurried to the classroom, chased M.S.S. out and continued the class. The second time was at a review meeting of a Department of Biotechnology-funded programme that Udayakumar was coordinating. We could see how restless and impatient he was while M.S.S. was making his part of the presentation.

Udayakumar was so eager for his turn, just like a beginner, waiting to talk about his work to the reviewers. We can narrate innumerable such instances that illustrate his passion for teaching and commitment to research.

Executing a plan for higher learning and excellence in research *de novo* must have been a formidable challenge, especially in agricultural research which is heavily inclined towards translating leads to improve crop productivity. The question was whether plant physiology had any relevance at all. The vision of Sastry coupled with the incisive acumen of Udayakumar unleashed a plan that looked far into the future. Way back in the late seventies, when hardly anything about global warming was discussed, Udayakumar envisioned a programme to understand the physiological responses of plants to drought stress. The meticulous segregation of physiological subcomponents of drought adaptation paved the way for understanding plant responses at different levels – whole plant to single leaf to the cellular level. He established strong and decisive associations with several laboratories across the country and most of these collaborations are active till date. Further, with his vast knowledge of stress physiology, he standardized temperature induction response technique, a novel way of screening a large number of genotypes at seedling stage for acquired tolerance at the cellular level. With his foresight, Udayakumar realized the importance of molecular biology in agricultural research and, accordingly, set-up facilities and sent Ph.D. students out for advanced training. He ardently encouraged Ph.D. students to work closely with younger graduate students, which created a cordial working environment in the Department and made us better supervisors later in our lives.

Udayakumar made significant efforts to develop novel techniques and approaches to determine genetic variability in important physiological traits. Water-use efficiency was one of the chosen traits and analysis of subcomponents of this parameter was an excellent novelty for that time. Tremendous global emphasis is being given to this trait now. Measuring water use through gravimetry was the only option available and we weighed hundreds of pot-grown plants daily. Though the exercise

was back-breaking, the results were exciting. The laboratory has pioneered measurement of water-use efficiency at the single leaf level using gas exchange systems. Through collaborations with Australian scientists, we established India's first National facility for stable isotopes research to understand plant physiological processes.

The visionary that he was, Udayakumar clearly realized that the success of improving physiological traits depends on methods for introgressing them into an elite background. His amazing perseverance made him learn both forward and reverse genetic approaches. He developed strong groups of colleagues and students to work on cloning genes and identify quantitative trait loci (QTL) and devised methods to transfer these genes and QTL through transgenic and molecular breeding approaches. One of the testimonies for this 'out-of-the-box' thinking was the development of an image-based method to assess the canopy health of a plant. For this, he was bestowed with the 'Merito-

rious Invention Award' by ISRO, way back in 1985. Image-based phenotyping is now being considered as one of the most precise approaches, which he had envisioned more than three decades ago.

Udayakumar was a guiding force for revising plant physiology syllabi at the postgraduate level and set a high standard of teaching and research in India. He spearheaded efforts of establishing high-end phenotyping facilities in the country, including the mini lysimeter-based drought simulator phenomics facility at UASB. This facility is an illustration of his consistent perseverance to automate the gravimetric methods of measuring water use by plants in real time. To the best of our knowledge, the drought simulator facility is the largest outdoor phenotyping platform. Udayakumar was instrumental in mentoring several laboratories in India and helped them establish state-of-the-art facilities, including advising private seed companies.

He was conferred with the Lifetime Achievement Award by ITC Ltd (1997)

and the Indian Society for Plant Physiology (2016), and was an elected Fellow of all three major Science Academies in India and the National Academy for Agricultural Science (NAAS).

Till the last minute, Udayakumar was thinking only of science and according to him, 'learning is interesting'. Persons like Udayakumar traverse this universe once in a millennium. Fortunate are we, his students, who walked this earth at the same time as him.

M. S. SHESHSHAYEE^{1,*}
K. V. RAVISHANKAR²
M. G. PURUSHOTHAMA³

¹*Crop Physiology,
University of Agricultural Sciences, GKVK,
Bengaluru 560 065, India*

²*Division of Biotechnology,
Indian Institute of Horticultural Research,
Bengaluru 560 089, India*

³*I&B Seeds Pvt Ltd,
Bengaluru 560 060, India*

*e-mail: msshesh1@uasbangalore.edu.in

Hare Krishna Pradhan (1945–2020)

Bird flu or avian influenza is considered as one of the dreaded diseases with certain virulent strains like H5N1 or H7N7, which caused epidemics in about 39 countries of the world with high public health significance. More than the disease itself, the panic causes loss of thousands of crores of rupees through various means and is the main cause of concern. The chickens of the area under certain radius are culled to contain the disease as a first hand measure. In this process, the contribution of National Institute of High Security Animal Diseases (NIHSAD) is truly remarkable for successfully diagnosing the viral strains. It is helping to control and prevent the disease from spreading further. The man behind the creation of the world-class laboratory was Dr Hare Krishna Pradhan, popularly known as the 'Bird-Flu Man of India' due to his immense contribution in this field. According to him, 'bird flu has the potential to spread very fast, it has no treatment, and could cause major epidemics'. In India, this epidemic was first surfaced in 2006, and even at present day also, it is being reported at several isolated places across India.

Pradhan was born in a poor teacher's family in Khajuripada village in Khand-

amal district (a remote area) of Odisha on 1 April 1945. Being one of the nine siblings to his parents, he has undergone



rigorous challenges for completing his studies with fellowships throughout his career. He was deeply inspired by his father to move ahead through honesty and discipline along with continuous perseverance. His teacher, G. C. Mohanty, inspired him to continue career in veterinary science as it is not the subject, but the perseverance, love and interest in the subject matters. Pradhan completed his Bachelors in Veterinary Science and Ani-

mal Husbandry and Masters in Veterinary Pathology from Orissa Veterinary College, Orissa University of Agriculture and Technology in 1969 and 1971 respectively. He subsequently moved to Indian Veterinary Research Institute (IVRI) and received the doctoral degree in Pathology in April 1976.

After obtaining Ph.D., he joined IVRI as a scientist in the Division of Avian Diseases. Considerably, the poultry industry – representing meat and egg-producing birds – had started flourishing with the improved genetics and efficient strains. Simultaneously, the demand on avian disease diagnostics and investigation was also increasing. Pradhan devoted his attention to a variety of prominent poultry diseases like infectious bronchitis, herpes virus-induced cancer, egg drop syndrome, duck plague, etc. from 1977 to 1990. Since then, many of the novel findings of his team are referred in standard textbooks even abroad as well. He successfully developed new *in vitro* and *in vivo* models to study infectious bronchitis and Marek's disease¹. Pradhan was deputed to Holland, England and Switzerland for four months for a training on biosafety during 1988–89. His career got a new turn after this training as he shifted to