

Jalal A. Aliyev (1928–2016): A Great Scientist, A Great Teacher and A Great Human Being

I.M. Huseynova¹, S.I. Allakhverdiev^{1,2,3,4}, Govindjee^{5,6,7}

¹*Institute of Molecular Biology & Biotechnologies, Azerbaijan National Academy of Sciences, 2A Matbuat Ave., Baku AZ1073, Azerbaijan; E-mailimbb@science.az*

²*Institute of Plant Physiology, Russian Academy of Sciences, 35 Botanicheskaya Str., Moscow 127276, Russia; E-mail: suleyman.allakhverdiev@gmail.com*

³*Institute of Basic Biological Problems, Russian Academy of Sciences, Pushchino 142290, Moscow Region, Russia*

⁴*Faculty of Biology, M.V. Lomonosov Moscow State University, 1-12 Leninskie Gory, Moscow 119991, Russia*

⁵*Department of Plant Biology, University of Illinois at Urbana-Champaign, Urbana IL 61801, USA; E-mail: gov@illinois.edu*

⁶*Department of Biochemistry, University of Illinois at Urbana-Champaign, Urbana IL 61801, USA*

⁷*Center of Biophysics & Quantitative Biology, University of Illinois at Urbana-Champaign, Urbana IL 61801, USA*

Jalal A. Aliyev was a distinguished and respected plant biologist of our time, a great teacher, and great human being. He was a pioneer of photosynthesis research in Azerbaijan. Almost up to the end of his life, he was deeply engaged in research. He left us on February 1, 2016, but many around the world remember him as he was engaged in international dialog on solving global issues, and in supporting international conferences on “Photosynthesis Research for Sustainability” in 2011 and 2013.

Jalal Alirza Aliyev was born on June 30, 1928, in Nakhchivan, a city with a 5000-year old history. After receiving primary school education, he graduated, in 1946, from the Faculty of Natural Sciences of Nakhchivan Pedagogical College. In June 1946, he went by train to Baku, the capital city of Azerbaijan for further studies. There, he attended the Azerbaijan (now Baku) State University; as a student he worked as a laboratory assistant in the Department of Plant Physiology. In 1951, he graduated from the Biological Faculty of Azerbaijan State University, receiving a diploma with honors.

During 1951–1954, Jalal Aliyev was a graduate student in the Plant Physiology Laboratory of the Azerbaijan Academy of Sciences, working under the supervision of academician Muzaffar Abutalubov, who had many graduate students and technical personnel. Jalal Aliyev's PhD thesis, in 1955, was on “The effects of microelements on the growth and productivity of wheat”.

After graduation Jalal Aliyev worked as a junior researcher, head of a group, and then head of a laboratory at the Research Institute of Crop Husbandry, Ministry of Agriculture.

Young Jalal entered the world of photosynthesis research and, in 1971, received a “Doctor of Biological Sciences” degree with a thesis on “Photosynthetic activity, mineral nutrition and productivity of plants”.

In the 1970s, Jalal Aliyev was a group leader

in the Institute of Botany. In 1974, his creative group became the Laboratory of Molecular Basis of Bioenergetics, under the broader umbrella of Physicochemical Biology. In 1983, a Laboratory of Molecular-Genetic Basis of Production Processes was created, which at the end of 1988 became a full-fledged department by the same name. In 2010, this department became the Department of Fundamental Problems of Biological Productivity. Currently, fifteen laboratories are housed in the new Institute of Molecular Biology and Biotechnology, ANAS, created, in 2015, on the basis of the earlier department. In addition, Professor Jalal Aliyev served as the Head of the Department of Plant Physiology and Biotechnology at the Research Institute of Crop Husbandry as well as the Head of the Department of Fundamental Problems of Biological Productivity in the Institute of Botany.

Jalal Aliyev was much loved and respected by students and staff throughout Azerbaijan. He had been a long-time member of the Azerbaijan Academy of Sciences, had served as Academician-Secretary in the Department of Biological Sciences, and had been a member of the Presidium of the National Academy of Sciences of Azerbaijan.

Professor Jalal Aliyev was deeply involved in dynamic research on several aspects of photosynthesis for 65 years; he focused mainly on an important crop wheat; this research was

integrative in its approach, involving physiological, biophysical, biochemical, and molecular-genetic basis of plant productivity. Further, it dealt with production processes, and structural-functional organization of plants – from the molecular level to the whole plant. Under Jalal's leadership, the main principles determining productivity and high-yield capacity of an "ideal" type of wheat was made available to all of Azerbaijan and neighboring countries (see Aliyev, 1974).

Delving deeper into CO₂ exchange, carbon metabolism, transport and distribution of assimilates in the leaves and ear elements of contrasting genotypes, (through the use of ¹⁴CO₂), he revealed the role of separate organs in grain filling (Aliyev et al., 1996). Jalal's team also continued their detailed studies on structural and functional organization of carbonic anhydrase; this enzyme was isolated and crystallized from *Cicer arietinum* leaves for the first time and a molecular model of its quaternary structure was proposed (see Aliyev et al., 1985).

Jalal Aliyev's team went further into illuminating the structural molecular organization of the two photosystems and presented a model for the topography of pigment-protein complexes in thylakoid membranes (Asadov et al., 1987). These studies included biosynthesis, molecular biology and genetics of the system. His team elucidated the general mechanisms of drought response and their application in drought-resistance improvement in wheat genotypes (Huseynova et al., 2007).

Under his leadership, the distribution of ⁹⁰Sr and ¹³⁷Cs in a soil-vegetative cover was studied (Aliyev et al., 1991); in addition, the group promoted research to obtain a data-base of plant promoters, development of computer programs for the prediction of RNA polymerase II promoters, as well as potential regulatory elements of transcription. Jalal's research group revealed some peculiarities of organelle-to-nucleus DNA transfers and of the organization and expression of genes in nuclear genomes of rice and *Arabidopsis* (Shahmuradov et al., 2003).

A major point that emerged from his research team was that, under field conditions, photorespiration is one of the vital metabolic processes in plants, and attempts to reduce this process by various ways with the purpose of increasing the crop productivity is not viable (see Aliyev, 2012).

Professor Jalal Aliyev instigated the development of new directions of research, namely molecular biology, molecular genetics, gene and cellular biotechnology, mathematical and computational biology, and bioinformatics as applied to crop productivity in Azerbaijan. Under

his initiative, about 300 doctoral students were trained; further, under his personal supervision, 85 Ph.D. and 12 Doctor of Science (Dr. Sci) students successfully defended their theses. At present, these former students are leading scientists in research centers and universities of Azerbaijan and many others around the world (e.g., Australia, Canada, France, Israel, Japan, South Korea, Russia, the UK, and the USA).

As chairman of the Problem Council on Biological Sciences of the Scientific Research Management and Coordination Council of the Azerbaijan Republic and member of many scientific and academic councils, Jalal promoted development of photosynthesis research in Azerbaijan and elsewhere.

Jalal Aliyev served as an editor-in-chief of the "Proceedings of Azerbaijan National Academy of Sciences (Biological and Medical Sciences)", a member of the Editorial Board of "Reports of Azerbaijan National Academy of Sciences", and a scientific editor of a number of books and proceedings. He was elected an honorary member of the editorial board of "Bioinformatics and Comparative Genomics", "Plant Biochemistry and Physiology", "Computational Biology and Bioinformatics", and "The Infectious and Non-infectious Diseases".

A major contribution of Jalal Aliyev was in the development of high-yielding wheat *Triticum durum* Desf. (durum) and *Triticum aestivum* L. (bread) with a productivity of 7–8 tons per hectare. These wheat lines have excellent grain quality, and are being cultivated widely in Azerbaijan. In acknowledgment of his success in the field of fundamental and agricultural sciences, Professor Jalal Aliyev was elected as a foreign member of the Russian Academy of Agricultural Sciences (1995), the Ukrainian Academy of Agrarian Sciences (1996) and the Academy of Agrarian Sciences of Belarus (1996).

As a research scientist, Jalal Aliyev was highly prolific. He authored or coauthored more than 800 scientific publications including 25 monographs and books, and 10 book chapters.

The National Plant Genetic Resource Program was created, a strategy on preservation and rational use of biodiversity was developed, and the Plant Gene Pool of Azerbaijan was created under his leadership.

Bioethical problems of research in modern biology, agriculture and medicine were also of great interest to him, and ways of tackling these issues were established under his leadership.

Professor Jalal Aliyev received many distinguished honors in Azerbaijan: Order of Independence of Azerbaijan (1998); the Order of

Glory of the Republic of Georgia (2003); the Honorary diploma from the President of the Republic of Azerbaijan (2008); the Order of Glory of the Republic of Azerbaijan (2013), and, together with Irada Huseynova, Hasan Bey Zardabi Prize of the Azerbaijan National Academy of Sciences (2014). In addition, he was elected as a Member of Parliament of the Republic of Azerbaijan four times (1995, 2000, 2005, and 2010), a rare honor, especially for a scientist.

In 2011 and 2013, the meetings on “Photosynthesis Research for Sustainability”, held in Baku, Azerbaijan, were highly successful, attracting outstanding scientists from around the world. The 2013 meeting celebrated his 85th birthday and honored him for his outstanding contributions to Plant Science in general and Photosynthesis in particular, with a significant impact on improving crop productivity. His leadership support and, at the same time, his outstanding contributions were highly appreciated by the International Photosynthesis Community (see Allakhverdiev et al., 2013).

Professor Jalal Aliyev left us on February 1, 2016, but many around the world remember him as he was engaged in international dialog on solving global issues, and in supporting international conferences on “Photosynthesis Research for Sustainability” in 2011 and 2013.

REFERENCES

- Aliyev J.A. (1974) Photosynthetic activity, mineral nutrition and plant productivity. Baku: Elm, 335 p. (in Russian).
- Aliyev J.A. (2012) Photosynthesis, photorespiration and productivity of wheat and soybean genotypes. *Physiol. Plant.*, **145(3)**: 369-383 (in Russian).
- Aliyev J.A., Suprun V.L., Guliyev N.M., Mamedov T.G. (1985) Quaternary structure of carbonic anhydrase in leaves of a dicot plant *Cicer arietinum*. *Rep. Acad. Sci. USSR*, **285(6)**: 1472-1475 (in Russian).
- Aliyev J.A., Gulaliyev T.D., Aleksakhin R.M. (1991) Distribution of ⁹⁰Sr and ¹³⁷Cs in Azerbaijan soils and accumulation of these radionuclides by agricultural plants. *Russ. J. Agrochem.*, **11**: 89-95 (in Russian).
- Aliyev J.A., Rerimov S.K., Guliyev N.M., Akhmedov A.A. (1996) Carbon metabolism in wheat genotypes with contrasting photosynthetic characteristics. *Russ. J. Plant Physiol.*, **43(1)**: 42-48 (in Russian).
- Allakhverdiev S.I., Huseynova I.M., Govindjee (2013) International conference on Photosynthesis research for sustainability-2013. In: *Honor of Jalal A. Aliyev*, held during June 5–9, 2013, Baku, Azerbaijan. *Photosynth. Res.*, **118**: 297-307.
- Asadov A.A., Zulfugarov I.S., Suleymanov S.Y., Aliyev J.A. (1987) The study of the topography of pigment-protein complexes in thylakoid membranes of chloroplasts. *Rep. Acad. Sci. USSR*. **294(3)**: 703-707.
- Huseynova I.M., Suleymanov S.Y., Aliyev J.A. (2007) Structural-functional state of thylakoid membranes of wheat genotypes under water stress. *Biochim. Biophys. Acta*, **1767(6)**: 869-875.
- Shahmuradov I.A., Akberova Y.Y., Solovyev V.V., Aliyev J.A. (2003) Abundance of plastid DNA insertions in nuclear genomes of rice and Arabidopsis. *Plant Mol. Biol.*, **52**: 923-934.