

## OBITUARY

**Zahir Eyal**  
1936–1999



*IN MEMORIAM*

On July 30, 1999, at the age of 62, Zahir Eyal lost his battle against cancer and died at his home in Hod haSharon, Israel. Zahir was born on October 5, 1936, in Qiryat Hayyim, a working-class suburb of Haifa. His parents, Bella and Ephraim, had immigrated to Israel from Poland a few years earlier. They arrived as pioneers, already speaking Hebrew and filled with unconditional love for the Land of Israel. Zahir's course in life was influenced by his home, the environment, his school, the youth movement he attended, and his friends. The foundations for the path he would tread were thus established in his early youth. It was therefore only natural that as a youngster he joined the pioneering youth movement 'HaTnuah Hameuchedet', which saw settling the land as its main goal. As a member of the generation that drew its values from that particular era, especially from its people who had taken part in settling the land, Zahir chose to study at the Miqwe Yisra'el Agricultural School in preparation for realization of his pioneering dreams.

Miqwe Yisra'el symbolized a turning point. It was here that Zahir discovered his great love for agriculture, the land and its flora and fauna. And it was here that all the values he had brought with him from home came together as one with the discovery of how to achieve his purpose. It was only natural for him to carry out his army service in the Nahal Unit, with its combination of the 'plowshare and the sword'. Zahir fought as a paratrooper in reprisal actions and in the Sinai Campaign. His generation too, the generation that followed the War of Independence, was forced to pay a heavy price, and Zahir lost several of his closest friends. The practical realization of Zahir's pioneering dreams took place at Kibbutz Urim in the Negev, which was the next station along his path. There, in the far south, seated on a tractor, Zahir turned the stubborn clods of earth into fields of wheat, that same wheat to which he dedicated his life.

After a few years on the Kibbutz, Zahir went to the USA, earning a B.Sc. degree in agronomy and plant pathology from Oklahoma State University, Stillwater, OK, in 1963. This was followed by graduate school at Rutgers – The State University, New Brunswick, NJ, where he was awarded a Ph.D. degree in plant pathology in 1966. Zahir's research into cereal diseases and breeding for resistance continued throughout his career, beginning with his doctoral dissertation on "The production and protein content of uredospores of *Puccinia recondita* as affected by light and temperature". He next joined the group headed by Prof. R. M. Caldwell at the Department of Botany and Plant Pathology at Purdue University, West Lafayette, IN, as a Post-doctoral Fellow, investigating slow rusting of wheat due to the fungus *P. recondita*, including non-specific resistance

to wheat leaf rust. His assignment to the Small Grains Improvement Program at Purdue played a key role in preparing him for a career in diseases and breeding for resistance in barley, oats and wheat.

In 1967 Zahir joined the Department of Plant Sciences at Tel-Aviv University, in Israel, attaining the rank of Professor in 1984. He served as head of the department for two separate terms (1984–86 and 1993–95). In 1994 he was appointed Director of the Institute for Cereal Crops Improvement at Tel-Aviv University, where the germplasm of wild ancestors of cultivated small grains is being preserved and characterized as a breeding source.

The beginning of Zahir's academic activity in Israel corresponded with CIMMYT's introduction of high-yielding, susceptible semi-dwarf spring wheat cultivars into breeding programs and their cultivation in Israel as well as many other countries. These cultivar changes were often accompanied by alterations in crop management, such as a higher frequency of wheat in the rotations, less management of crop residues, and an increase in the application of nitrogen fertilizers. The change in plant stature and cultural practices of cultivars susceptible to *Septoria tritici* also enhanced the pathogen's adverse effects on productivity. To cope with this new situation Zahir initiated a multifaceted program of integrated basic and applied approaches aiming at minimizing the economic impact of the pathogen on yield. He analyzed yield loss data and designed chemical control strategies that provided Israeli growers with control alternatives.

Prof. Eyal was the first to demonstrate the presence of physiologic specialization in *S. tritici* on cultivated bread and durum wheat and on their wild relatives. He identified resistance sources, developed wheat differential sets, and investigated national and global virulence patterns. Using quantitative and statistical procedures he was able to demonstrate gene-for-gene interactions in the wheat – *S. tritici* pathosystem. Prof. Eyal and his students conducted a series of studies on the divergence from the expected host response upon inoculation of seedlings and adult plants of specific genotypes with a mixture of virulent and avirulent *S. tritici* isolates. The reduction in disease severity following inoculation with this mixture was attributed to the induction of a host defense mechanism by the avirulent isolate. Zahir and his group also isolated from wheat canopy antagonistic bacteria capable of controlling Septoria blotch, and issued a related patent. Chemical, biochemical and molecular approaches were undertaken to study the mechanisms associated with biocontrol of Septoria blotch.

Throughout his career Prof. Eyal always kept abreast of the innovative concepts and technologies emerging from the contemporary revolution in biological sciences, and he consistently and forcefully incorporated cutting-edge biotechnological approaches into his holistic program. PCR primers that specifically identified different isolates of *S. tritici* were developed, enabling monitoring of the progression of each of the diverse isolates within the host tissues. This approach paved the way to evaluating the contributions of wheat genotypes (resistant and susceptible), the effect of different environmental regimes (various locations), the interrelation between isolates (*e.g.* competition), and cultivar × isolate interactions (*e.g.* induced resistance). To gain more knowledge about the fungal virulence genes, a knockout approach, based on genetic transformation of *S. tritici* isolates, was developed. The bacterial *hph* gene conferring resistance to hygromycin B and the *uidA* reporter gene encoding beta-glucuronidase (GUS), carried on two different plasmid vectors, were co-introduced into the genome of *S. tritici* isolates varying in virulence on spring wheat cultivars. The alien GUS reporter gene facilitated the analysis and quantification of events associated with the pathogen progression in planta. Tagged mutants resulting from insertional inactivation of putative virulent genes were identified. Complementation studies of such mutants with genomic DNA fragments were initiated in order to verify the function of the isolate gene.

The integration of biological and genetic parameters together with epidemiological aspects enabled Zahir to establish guidelines for resistance breeding. Its practical implications were one of his major goals. Throughout his career he was engaged in the establishment of national and international virulence/resistance monitoring nurseries, comprising identified resistance sources and tested together with accessions of special interest (*e.g.* promising breeding lines). He also strongly

supported the International Monitoring *Septoria/Stagonospora* Nurseries philosophy executed by CIMMYT and was instrumental in their operation.

Prof. Eyal believed in the approach of incorporating multiple resistance qualities into wheat either by breeding or by overcoming genetic barriers and introducing alien genes into the wheat nuclear genome. Based on newly developed biotechnological strategies, and together with colleagues at home and at the Max-Planck Institute in Cologne, Germany, three different wheat transformation methods were employed by his group. One of these transformation methods, originally developed and patented by the group, appeared to be independent of wheat cultivars and was thus considered as highly compatible with pathology/breeding programs.

Prof. Eyal was one of the most outstanding internationally oriented cereal pathologists of his generation. He focused his research on an economically important group of wheat diseases in Israel, which are also of worldwide significance. To achieve his goals, he drew from research throughout the world for the background and enhancement of his own program. He contributed greatly to the international arena in bringing together research from diverse parts of the world, strengthening ties among scientists working on plant pathology. His accumulated knowledge, research output and publications, including significant review articles, provide a major contribution to the understanding of *Septoria* leaf blotch and other wheat leaf diseases. His life work and views on the biology and control of *Septoria* diseases culminated in three recent reviews published in 1999 [*Septoria* and *Stagonospora* diseases of cereals: a comparative perspective. *in*: Lucas, J.A., Bowyer, P. and Anderson, H.M. [Eds.] *Septoria on Cereals: A Study of Pathosystems*. CABI Publishing, Oxon, UK. pp. 1-25; Breeding for resistance to *Septoria* and *Stagonospora* diseases of wheat. *in*: Lucas, J.A., Bowyer, P. and Anderson, H.M. [Eds.] *Septoria on Cereals: A Study of Pathosystems*. CABI Publishing, Oxon, UK. pp. 332-344; The *Septoria tritici* and *Stagonospora nodorum* blotch diseases. *Eur. J. Plant Pathol.* (in press)]. Few people have had as great an impact on wheat leaf diseases as Zahir.

Prof. Zahir Eyal was President of the Israeli Phytopathological Society from 1979 to 1982 and Vice-President of the Mediterranean Phytopathological Union from 1998. He served as a member of the Editorial Board of *Phytoparasitica* during the years 1979–82 and 1990–94. He taught undergraduate and graduate courses and supervised many M.Sc. and Ph.D. students. He was a member of numerous university, national and international committees, frequently serving as chairman, as well as one of the leaders of the Faculty of Life Sciences at Tel-Aviv University. His active involvement in teaching and training programs in Israel and developing countries exposed scientists and growers to the concepts, methods and strategies generated by his group. He strongly advocated, initiated and implemented close associations between plant pathologists and breeders, in joint efforts to increase both yield and quality potential.

Prof. Eyal launched a research and outreach program new to Israel, grounded it in basic science, maintained it state-of-the-art, and witnessed its positive impact on wheat management and improvement in Israel and throughout the world. For his many contributions to research, education, university, national, and international activities he was honored by the national and international communities and was granted the Hazera Seed Co.-Melamed Award and the A.Z. Cohen Award, and was elected a Fellow of the American Phytopathological Society.

Zahir was a remarkable person whose interaction and cooperation gained him numerous friends in Israel and around the world. All of his friends in the scientific world, who so greatly esteemed his forceful and encompassing research program, will keep fond memories of the time they spent with him. Zahir is survived by his wife Yona, son Ephraim, daughter Tal, mother Bella, and brothers Yigal and Avraham.

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