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OBITUARY FOR DR. RALPH HAROLD KURTZMAN, JR.*

D. Martínez-Carrera

College of Postgraduates in Agricultural Sciences (CP), Campus Puebla, Biotechnology of Edible,
Functional and Medicinal Mushrooms, Apartado Postal 129, Puebla 72001, Puebla, Mexico.
E-mail: dcarrera@colpos.mx

Dr. Ralph H. Kurtzman, Jr., age 82, passed away unexpectedly on Tuesday, October 20, 2015. He was born on February 21, 1933, in Minneapolis, Minnesota, U.S.A., to Ralph H. Kurtzman, Sr. and Suzie (Elwell) Kurtzman. Ralph attended the University of Minnesota – Twin Cities (1955), earning his B.S. in Biochemistry, and the University of Wisconsin – Madison (1959), earning a Ph.D. in Plant Pathology & Biochemistry. He married Nancy Virginia Leussler in August, 1955. In June of 1965, they moved to Berkeley, California, U.S.A., where Ralph worked as a Research Biologist for the U.S. Department of Agriculture, ARS, for over 31 years.

Dr. Ralph H. Kurtzman, Jr., made important and recognized contributions in the field of edible mushrooms and their cultivation, not only in basic and applied research but also in teaching and dissemination of knowledge worldwide. Some of his many achievements were:

1) There has been considerable interest in induction of mushroom (basidiocarp) production. Many publications have suggested, but not proven plant hormones. Ethylene had been among those. Cobalt chloride is known to inhibit biological production of ethylene. He "poisoned" mushrooms with cobalt chloride, got reduced

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* Dr. R. H. Kurtzman, Jr. (1933-2015) was Co-Editor of *Micol. Apl. Int.*, 2001-2015.

mushrooms (control); added exogenous ethylene to poisoned beds and obtained a recovery of production compared to poisoned beds with no ethylene. *Mycologia* 87: 366-369 (1995).

2) Dolomite has been known to reduce mushroom production, as opposed to calcium-only lime stone. He showed that magnesium upset the carbon dioxide balance. Behaving very differently when excess carbon dioxide was added. *Mushroom Science* 13: 747-751 (1991). He "titrated" calcium carbonate, magnesium carbonate, dolomite and other alkali metal carbonate solutions with carbon dioxide. The pH of the magnesium carbonate and the dolomite actually increased with added (bubbling) carbon dioxide, all others decreased, until they reached a constant pH.
3) He demonstrated that bacterial spores could be ruptured with ammonium bicarbonate, then the salt was removed by sublimation. *Letters Appl. Bacteriol*. 5: 111-113 (1987). His colleagues needed a useful technique to release salt-free spore enzymes for their studies. They were using sodium chloride in a dental amalgamater to grind the spores. He learned that ammonium bicarbonate, is often used, instead of baking powder, in Germany. Ammonium bicarbonate is crystalline at room temperature, but vaporizes at oven temperatures. He found that it also vaporized at room temperature under vacuum. So he substituted the ammonium bicarbonate and was able to produce crude enzymes with greater enzymatic activity.
4) He developed an alternative to compost for mushroom growing. He used liquid fermentation to make a treatment for straw that became the substrate. U.S. Patent 4,333,757, June 8, 1982. Water, after it is used to pasteurize straw for oyster mushrooms, presents a disposal problem, but the common commercial mushroom substrate also includes straw that must be wet and eventually pasteurized. He added other sources of carbohydrates and nitrogen to the waste water, then fermented it at 55 C, diluted it, and heated it to pasteurization temperature for adding straw. The result was a good quality mushroom substrate, *i.e.* "compost". The process controls odor, requires less heat, less water and less time than traditional composting.
5) With two authors from Pakistan, he demonstrated why the desert mushroom, *Podaxis pistillaris*, while often considered inedible, is edible in Punjab weather. *Mycologia* 71: 861-867 (1979). While in Pakistan his hosts showed him *Podaxis* and told how it was used for food and the spores are used to promote blood clotting at wounds. The Pakistani authors asked him to help them publish their work on *Podaxis*. He assumed that it would be just a question of writing and formatting their data. When he looked carefully he found that they had done only simple growth-temperature studies. Rather than panic, he studied the literature and found that there were old, but good studies of *Podaxis* from California deserts and good weather data for both California deserts and the Punjab. He learned that in California and from less data in other locales that there was rain followed by very hot weather, when the mushrooms were found. However, in the Punjab there was very hot weather, then rain

when the mushrooms were found. The laboratory growth- temperature studies correlated with the temperatures when the mushrooms were found in nature. While the original experimental design was not ideal, the results were very useful in understanding the human interaction with the mushroom.

6) He demonstrated production of mushroom fruiting bodies on the surface of submerged cultures. *Mycologia* 70: 179-184 (1978). This was particularly significant because it also showed that mycelium that had lost its clamp connections from shaking were not de-dikaryotized as others had claimed. He made shake cultures of oyster mushrooms in 250 ml flasks. In a few weeks they were well grown, he examined them microscopically and as others had seen, there were no clamp connections. He set them aside, allowing them to grow further without shaking. After several more weeks, tiny mushrooms appeared in the flasks. He examined the mycelium again and found many clamp connections.
7) Invited to write: Mushrooms as a source of food protein. *In*: Ed. M. Friedman. *Protein Nutritional Quality of Foods and Feeds*, Part 2. Marcel Dekker, Inc. (1975). Pp. 305-318. (A published ACS symposium). It was quickly translated to Chinese: *J. Chinese Hort. Soc.* 21: 249-254 (1975). Dr. Kurtzman made some informal remarks about the protein content of mushrooms in a seminar. Dr. Friedman was in the initial stages of organizing the book and asked for a formal review of the subject. Dr. Kurtzman sent his manuscript to a friend who was a professor at the Chinese University of Hong Kong, the friend had his student translate and publish the translation.
8) He developed a simple, effective way to wet and pasteurize straw and other dry field wastes by submerging them in water at approximately 60 C. The method has become widely accepted for oyster mushroom cultivation – particularly in developing countries with limited fuel. Initially, this was done with a large stainless steel tank, a gantry crane and live steam to heat water in the tank. The equipment was readily available in the Western Regional Research Laboratory pilot plant. It was, of course, overkill for practical application. The steam was used to heat water and then the crane dropped a *ca.* 90 lb. bale of straw into the hot water, hold it down and pull out the 300+ lb. dripping bale. This translated first into lose straw put into farm sugar evaporator pans on an open fire in Pakistan, then steel drums with the straw in woven bags or wire baskets.
9) He was invited by the Agricultural Research Council, Karachi, Pakistan, to present and write four of five seminars: *Proceedings of Seminar on Mushroom Research and Production*. 52 pp. (1975). First, Dr. Kurtzman was asked and did review research proposals, the Foreign Agricultural Service asked him to visit, examine and consult with one proposal author at the faculty of the University of Agriculture, Lyallapur/ Faisalabad. The Pakistan Agricultural Research Council asked that lectures be written so they could publish them, to reach those who could not attend.
10) Patent, coauthor, on decaffeination of coffee with fungi. U.S. Patent 3,749,584, July 31, 1973. Agar plates with caffeine, as the sole source of

carbon, were exposed, fungi which grew on them were cultivated and grown in brewed coffee, caffeine was monitored.

11) Along with two colleagues, he demonstrated a distinct outer layer on starch granules from several species: *Cereal Chem*. 50: 312-322 (1973). The discovery sharply contrasted with previous knowledge of starch structure. The layer was visible with microscopic and spectrophotometric examination during starch dissolution in dimethylsulfoxide.
12) He showed that various metabolic poisons and radical girdling stopped the flow of water in trees before the poisons could reached the transpiring surfaces – substantial evidence for xylem-based metabolic activity in water movement in trees. *Plant Physiology* 41: 641-646 (1966). The work was done, while on the University of Minnesota, Morris faculty with the support of the Minnesota Institute of Research, using trees on the Cloquet Forest Experimental Station. The flow meter was thermocouples stuck into the xylem and a hot wire thrust in a hole between them. The thermocouples were attached to a strip-chart recorder, to record the movement of the heated xylem water.

Other achievements included:

1) In 2004, Dr. Kurtzman and his wife established junior and senior division prizes for environmental history projects for Minnesota History Day. Environment is understood to include all aspects and prizes have been awarded for projects that dealt with agriculture. Then in 2012, they added junior and senior division prizes for educational history projects.
2) He helped people in developing countries from Asia, East Europe, Africa, and Latin America to grow mushrooms; a total of 14 countries on five continents. The work performed by the USDA, Foreign Agricultural Service, USAID contractors, and local organizations represented the primary effort. However, he made extensive preparation including growing seed material, presentations and written hand-outs. In several cases, he wrote information for publication. He has maintained e-mail friendships with many of the people he worked with.
3) At the request of a librarian, he wrote a small book on cultivating oyster mushrooms, which was translated into Russian by USAID contractor's employees while he was writing. He placed both the English and Russian version on the internet (www.oystermushrooms.net), and distributed a few hundred computer-printed copies to people he has worked with. His hope was to help as many interested people as possible, throughout the world.
4) He established the first refereed journal devoted to mushroom cultivation and associated studies in 1995. He first searched for others who were interested. Assembling a list of prospective subscribers, performing all functions of editor and publisher were most important for the first issue.
5) He organized a symposium on mushroom cultivation in the American Tropics for the 1997 national meeting of the Mycological Society of America in San Juan, Puerto Rico.
6) By using biologically inert materials, *i.e.* pea gravel, and fired-clay chips, he established that the primary function of the casing layer used in growing

> common commercial mushrooms, is to provide a gas porous layer and that other factors attributed to it are of secondary or of no importance. *Mushroom Biology and Mushroom Products*. Pennsylvania State University, University Park. (1996). pp. 259-264, and other publications. Mushrooms were grown with peat-casing controls, gravel casing, clay chip casing, Fargo soil casing, showing that when kept wet the gravel and clay chips gave only slightly lower yields than the peat-casing, and better than the high-ion exchange Fargo soil. Other ion exchange and water holding materials were added to the gravel and to the clay chips to check the importance of water-holding and ion exchange capacities. While it was very important to keep the casing wet, enhanced holding capacity always reduced yields. However, it should be understood that more water conversely meant less gas porosity. Ion exchange, seemed to have a small positive effect, yet it also resulted in less gas porosity.

After retirement, he continued not only to write, teach and think of new questions about the best techniques and materials for growing mushrooms, but also to travel to far and exotic developing countries for sharing his knowledge. He also performed a tireless editorial work. Dr. Kurtzman certainly performed a distinguished scientific and technological career, and he actually had a bright and creative mind. It was a great honor to have worked with such a great scientist and friend.

Ralph is survived by his wife of 60 years, Virginia, his son Steven Paul Kurtzman (Bokki), daughter Sue Kurtzman Anderson (Kevin), and grandson, Douglas Anderson, his brother Hugh Kurtzman, and his sister Joan Hofer (John) and their children.