Paulo de Tarso Alvim (1919-2011) and Moacyr Maestri (1925-2011)

The Master and the Pupil: Two close friends, two great plant physiologists

With great sadness we inform the scientific community of the deaths of Dr. Paulo de Tarso Alvim, on February 18 from nephrological problems, and Prof. Moacyr Maestri, two days later, from cardiological complications. Master and pupil at the College of Agriculture and Veterinary Studies (ESAV, currently Federal University of Viçosa - UFV, Brazil), where they graduated in Agricultural Sciences in 1940 and 1948 respectively, Alvim was born in Ubá (MG) and Maestri in Santa Teresa (ES). During this time they became close friends, notwithstanding their opposite personalities: Alvim, quite expansive and warm whilst Maestri timid or even shy. This friendship lasted until the end of their lives. Alvim completed his PhD in 1948 at Cornell University, NY, when he presented the thesis "Studies on mechanisms of stomatal behavior", an outstanding contribution for the time. With the thesis "Structural and functional effects of endothall on plants", Maestri concluded his PhD in 1967 at the University of California, Davis. According to contacts between Alvim and Davis' lecturer-friends, Maestri was considered bright during his course, a condition which persisted for life. He then became, in Alvim's words "the best scholar of Plant Physiology in all Latin America, in the decades 70 and 80 of the last century".

Alvim was admitted to Viçosa University to teach Plant Taxonomy, which impressed upon him a holistic view of Plant Science. In 1943 he started teaching Plant Physiology, which became an official discipline of the course of Agricultural Sciences. In a scientific tour to the arid zone of Northeastern Brazil with undergraduate students Alvim concluded that the drought condition of the "Caatinga" ecosystem was a natural phenomenon and not a result of human activities. Later on he postulated that the "Cerrado" ecosystem was a consequence of soil mineral deficiencies and not a result of the periodic burnings thatwhich affect that ecosystem.

In 1951, Alvim was admitted to the Interamerican Institute of Agricultural Sciences (IICA), of the Organization of American States (OAS) in Costa Rica, which represented a turning point in his scientific career. There, he had the chance to see a cocoa tree for the first time. As a member of the Graduate School he supervised 30 MSc(s) students, whose theses were devoted to tropical crops. His concerns with the welfare of mankind led him to dedicate himself to Applied Physiology, always employing the principles of Crop Physiology.

In a patient work, Maestri, upon his return from his PhD training, was faced with poor working conditions in Viçosa. He began to form a small research group, and in 1970 succeeded in establishing the first MSc Program in Plant Physiology in South America. Another pioneering initiative of his began in 1988 when he created the PhD Program. As of December 2010, the Program has already graduated 249 MSc(s) and 85 PhD(s), who are engaged in research and teaching throughout Latin America. The scientific production of the Program in high impact journals has been significant, which in 2010 led CAPES (Governmental Agency of classification of programs) to attribute to it its maximum score comparable to the Graduate Programs of the First World. The devotion of Maestri to the training of plant physiologists did not lead to neglect of his scientific career. In addition to articles in scientific journals, several of his works appeared in books published by the Academic Press, CRC Press, Elsevier and others.

Whilst at the IICA Alvim also worked at La Molina (Peru) between 1955 and 1963, when he succeeded in noting that in continuously irrigated coffee trees flower buds were kept dormant. If watering was withheld and plants later irrigated again, dormancy was broken. In other words drought induced dormancy breakage and reirrigation was required for bud growth. To this phenomenon Alvim applied the term "hydroperiodism", which occurs under natural conditions when several developmental and growth phenomena are observed after rains anteceded by a dry period. Ever interested in Tropical Ecology, Alvim took part in the Alpha Helix Expedition in 1967, in the company, among others, of Loomis, Williams and Scholander, when they stayed for a while at the Upper Negro River Basin in the Amazonian rainforest. During the 1960s it was believed that the Amazonian forests were the World's "lungs", a point demystified by Alvim on the grounds that the Amazonian forests were in climax, and thus the amounts of O_2 produced by the forests were similar to the amounts consumed. The fragility of Amazonian ecosystems should thus be due to other causes. He always argued that with six billion

souls on Earth to be fed, and with their ever-increasing demands, the Amazonian ecosystems should be used for sustainable agriculture under a rational exploitation (timber, typical fruits etc.); grains and cereals were never to be cultivated in those ecosystems.

During a technical visit to the cocoa region of Bahia State (Brazil), whose production was in sharp decline, Alvim convinced the Brazilian authorities to transform an incipient financial Program into an institution able to deal with cocoa research and extension. The Plan for Cocoa Farming (CEPLAC) was then structured with two departments, the Cocoa Research Center (CEPEC) and the Extension Department (DEPEX). Alvim was the Scientific Director of CEPEC for over 25 years, and within a few years of taking the post cocoa production increased from 120,000 to 400,000 ton / year; his greatest achievement! Always concerned with environmental preservation, he created the Pau-Brazil Foundation, a non-governmental organization dedicated to develop conservationist actions in the Atlantic Tropical Humid Forests. In recognition for his contribution to Plant Science and Agriculture his name had been attributed to some plant genera and species as *Acanthosiris Paulo-alvinii* (Santalaceae), *Acrococus alvinii* (Bromeliaceae), *Alvimia* (Bambusae) *Alvimiantha* (Rhamnaceae), *Eschweilera alvinii* (Lecythidaceae), *Micoalvimia* (fungus), *Strychnos alvimiana* (Loganiaceae), and *Tibouchina Paulo-alvinii* (Melastomataceae).

Involved mainly with Applied Plant Physiology, Alvim's contribution to pure science was also considerable. He designed the viscous flow porometer for measuring stomatal aperture in homobaric leaves; he devised a ranking series of two liquids of different densities, allowing also the estimatation of stomatal opening; he created a phytotensiometer, to measure both stem growth and water status. His scientific legacy is substantial: around 250 papers in scientific journals of high impact such as Science, Nature, Plant Physiology, Physiologia Plantarum, and others.

The work of these two great physiologists of such diverse personalities was complementary: Maestri, concerned with the formation of researchers, and Alvim with Applied Physiology. It is not surprising that they participated in the creation and maintenance of Scientific Societies: In 1949, Alvim was one of the Founding Fathers of the Brazilian Society of Botany and chaired the Latin American Society of Plant Physiology (1972-1976), which was also later chaired by Maestri (1981-1983). Both were affiliated to the American Society of Plant Physiologists (now American Society of Plant Biologists) for several decades, becoming, later on, Life Members; they were also associated with the Scandinavian Society of Plant Physiology and to the Brazilian Society of Plant Physiology. Various awards and honors were granted to them: they were Knights of the Merit Order (Secretary of Science and Technology, Brazil); Alvim was awarded the Bahia State Citizenship (1973); the Diploma of Merit Honor of the Argentinean Society of Plant Physiology; the title of Emeritus Researcher of the IICA; the Inter-American Medal for Agriculture; and was a member of the Brazilian Academy of Sciences. Maestri was awarded the Medal of Merit in Research by UFV, and also the status of Emeritus Professor of the same university.

Upon their legal retirements both kept working for several years until illness no longer allowed them to continue. Alvim is survived by his wife Simone, his devoted secretary for over two decades, always receiving in their home Alvim's friends and peers with simplicity and elegance; he is also survived by daughters and sons Fátima, Alexandre, Marília, Heloísa, Léo and Paulo Cesário. Maestri is survived by his daughters Clotilde and Esmeralda. The work they both built during their lives was too great for them to leave the admiration and respect of their peers, family and friends.

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