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In memoriam

In Memoriam. Juan Pajares (1959 - 2020)

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Juan Pajares demonstrating a funnel trap at the REPHRAME meeting in Valladolid, Spain, 2014
(courtesy of Dr. David Hall)

Dr. Juan Alberto Pajares Alonso, Full Professor in the Agricultural Engineering School (ETSIIAA) at the University of Valladolid, Palencia, Spain, passed away on December 30th 2020 after a long illness. His death has been a great sadness for all his friends and colleagues (ETSIIA, 2020; Bravo, 2021; Sierra 2021; Oria de Rueda, 2021) more so because many of us could not give him a last goodbye due to the COVID-19 pandemic.

Juan was a key figure in research, development and promotion of forest health in Spain. During his career he published over 50 scientific papers on forest pests and diseases and a book and book chapter that are fundamental references in Forest Entomology (Gil and Pajares, 1986; Evans *et al.*, 2007). Perhaps his most notable single contribution was the identification of the pheromone of *Monochamus galloprovincialis* (monochamol) and its use to control the vector of one of the most threatening quarantine forest diseases in the European Union.

He was born in Palencia, Spain, and from an early age was fascinated by the natural world. At age 13 he started hiking and camping with friends in the beautiful mountains neighbouring his home town. He was a good student and showed interest in history and literature. Although he studied science, he never lost his passion for reading, a pastime that made him an immensely knowledgeable and engaging conversationist throughout his life.

Juan graduated in Forest Sciences at the Polytechnic University of Madrid in 1982 and obtained his Ph.D. in 1987 under the guidance of Professor Dr. Luis Gil Sánchez. For his dissertation he worked on grafiosis, a fungal disease vectored by Scolytinae beetles that in those years was taking European elms to the edge of extinction. At that time the taxonomic identification of such wide group of insects in Spain depended of keys developed in other countries. Juan's dissertation produced the first key to pine bark beetles of the Iberian Peninsula (Gil and Pajares, 1986) and it became the main reference to identify Spanish Scolytinae for the following 20 years. In 1988 Juan visited the laboratory of Dr. Gerald N. Lanier at the College of Environmental Science & Forestry of New York as a postdoc. Dr. Lanier was an expert in bark beetles who worked on pheromones, so Juan was exposed for the first time to the field of insect chemical ecology and to international collaborations, both of which he cultivated throughout his career. Indeed, some maintain that his lasting enthusiasm for wearing lumberjack shirts was acquired during his stay in New York. In 1989 he obtained a position at the National Institute of Agricultural Research (INIA) in Madrid and began his research on bark beetle attractants and pheromones in collaboration with experts such as Wittko Franke, who unfortunately also passed away recently (Szöcs and Tóth, 2021). In 1994 he obtained a permanent position as Forest Health Professor at the newly established ETSIIAA in Palencia, his home town, where he remained until his death.

From the very beginning, Juan aimed his research at finding and applying solutions to problems in forest health. Funded by national and international research projects he established a research group that developed new methods to attract and capture forest insect pests. Juan instinctively knew which was the best experimental approach to study each specific insect problem, often designing rather ambitious field experiments in which he actively participated every year. The image of

Juan wearing blue overalls and carrying logs up and down like all the rest is engraved in our memory.

Juan published over 50 scientific papers in indexed journals, mainly on forest entomology, but also on forest fungi such as *Fusarium* sp. and *Gremmeniella abietina*. Many of his contributions relate to the use of pheromone traps to control pine bark beetles such as *Ips* spp and *Tomicus* spp and their associated fauna and natural enemies. With the emergence of the pine wilt disease in Europe, caused by the nematode *Bursaphelenchus xylophilus*, his efforts concentrated on finding a way to control its main vector, the cerambycid beetle *Monochamus galloprovincialis*.

Initial tests showed that bark beetle balts were relatively successful at attracting *M. galloprovincialis*, but the research took a quantum leap in 2010 when, in collaboration with Dr. David Hall, a chemical ecologist at the Natural Resources Institute in the University of Greenwich (England), they identified the alcohol monochamol as the sex/aggregation pheromone of *M. galloprovincialis* (Pajares *et al.*, 2010). Monochamol proved to be a far superior attractant of *M. galloprovincialis* than any of the attractants tested previously, and it was the first example of a pheromone in the subfamily Lamiinae with enough attractant power to serve as a trap lure. Monochamol was patented in Spain (sold by SEDQ S.A. as "Gallopotec 2D") and nine other European countries, and today it is the key lure to sample a range of *Monochamus* spp. worldwide (Hanks and Millar, 2016). The discovery and implementation of monochamol has received two important accolades. It was selected as one of the "Examples of University Innovation 2012" by Red OTRI (Network for the Transfer of University Results, Spain), and as one of the 14 case studies of higher technology transfer in the European Union by the Association of European Science and Technology Transfer Professionals in 2013.

Juan developed a close friendship with David Hall during their collaboration which resulted in the identification of two further insect pheromones: the sex pheromone of *M. sutor* (Pajares *et al.*, 2013), a sister species of *M. galloprovincialis* and also a vector of the pine wilt disease, and the pheromone of *Dioryctria mendacella* (Hall *et al.*, 2013), a moth whose larvae attack the cones of stone pine causing serious economic damage. In the months before Juan's death, in collaboration with Jocelyn Millar, University of California Riverside, they were also able to identify the main component of the pheromone of the western cone seed bug, *Leptoglossus occidentalis*, an invasive species that has become a devastating pest of edible pine nuts in Spain and Italy. This was the culmination of over six years of work, and it is very sad that Juan was not here to witness the large numbers of bugs caught in traps baited with the synthetic compound in field tests inspired by him and carried out by his student, Laura Ponce, during the last year.

We would also like to mention the close collaboration between Juan and Dr. Diego Gallego (University of Murcia, Spain) that resulted in the development of several bait traps designs for *Monochamus* spp. and other forest beetle pests (Gallego, 2012).

Most of Juan's research was devoted to solving forest pest problems, often by means of rigorous field tests, but he also had a great enthusiasm for studying more basic aspects of insect behaviour and physiology. In collaboration with César Geme-

no, with whom he shared a laboratory in the INIA years earlier, they identified the cuticular hydrocarbons that mediate sexual recognition in *M. galloprovincialis* (Ibeas *et al.*, 2009). Later, when the sex pheromone of *M. galloprovincialis* became available, they identified the receptor neurons on the antenna of *M. galloprovincialis* that are responsible for the reception of the sex pheromone, host volatiles and volatiles emitted by burnt wood, providing evidence that this species is cued to trees that have been debilitated by forest fires (Álvarez *et al.*, 2015).

In the mid 1980's the Spanish Forest and Garden Health Working Group (Grupo de Trabajo Fitosanitario de Forestales, Parques y Jardines) was created to help coordinate the activities of the 17 Autonomous Communities that emerged from the Spanish Constitution of 1978. Juan participated in the annual meetings of the Working Group for two decades, contributing with his invaluable scientific and practical expertise. At the university, Juan taught Forest Health with an infectious passion and directed four Ph.D. dissertations which produced 20 indexed publications. Two more Ph.D. dissertations were underway at the time of his death. He often exhorted his students with the maxim that "*it is not enough to do a good job, it also has to look like it*" before they presented their results, leaving a lasting signature on the importance of communicating scientific results. One of the things that Juan was most satisfied with was his involvement in the creation of the Calabazanos Forest Health Center (Consejería de Medio Ambiente, Junta de Castilla y León, Palencia, Spain), training several of its technical personnel and collaborating actively with them until his death.

Juan received the unconditional support of his family, especially his wife Henar. He influenced positively all of those that had a chance to collaborate with him. He was both intense and amiable, determined and prudent, a charismatic person with whom it was so easy to engage on almost any matter due to his broad knowledge and interests. We have lost a great scientist and academic, but also a great person. Those happening to visit the Yutera Campus at the ETSIIAA of Palencia can ask to see the stand of grafiosis-resistant elm trees, whose specimen "Dehesa de Amaniel" was personally planted by him on the Tree Day of 2019, symbolically closing the circle of a life dedicated to making good science and good friends along the way.

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