Spotlight on Honoured ISHS Members

› Ryutaro Tao

Position or previous position

Professor of the Graduate School of Agriculture Kyoto University
IHC2026 President
JSHS President

ISHS honour

ISHS Fellow

1. Tell us a bit about yourself (hometown, present location, family, hobbies, community involvement).

I grew up in a southern suburb of Osaka, Japan. That area is famous for seedless table grape producion. I had several chances to go to U-pick grapevine orchards with my family and friends. This likely affected my career choice for pursuing fruit tree science. I like traveling to places where I have never been. I like to travel because I can see new things I've never seen before. My job has allowed me to experience things I've never experienced before.

2. What got you started in a career in horticultural science?

Ever since I was a child, I have enjoyed growing plants and raising animals. I also liked to play with machines. I couldn't decide whether to go to the Faculty of Engineering or the Faculty of Agriculture at first. But in the end, I decided to go for the Faculty of Agriculture. I thought I would be able to spend more time in nature in that department. Then I decided to pursue fruit tree science because it struck me that fruit is pretty and delicious – not like the staple agronomic crops.

3. Give a brief overview of your career/ achievements.

I have been a Professor of Kyoto University since 1988. My present professional responsibilities include not only research activities but also educational activities in teaching classes in horticulture, pomology, cell biology, general genetics and so on at the Faculty and the Graduate School of Agriculture, Kyoto University. Currently I am serving as the Vice-Dean of the Graduate School of Agriculture.

My research career started when I began my thesis study on the development of tissue and cell culture systems for persimmon (*Diospyros kaki*) in 1983 at Kyoto University. Since then I have been working on research projects to utilize tissue and cell culture and transgenic techniques to improve fruit tree species. Since 1990, I also worked on the reproductive biology of fruit tree species. I worked specifically on the S-RNase-based self-incompatibility system in *Prunus* and floral induction in *Diospyros* and *Rosaceae*. I have also been extensively working on the sexual system in *Diospyros* and *Actinidia* for the last 10 years.

One of my major achievements was the development of a wide variety of efficient tissue culture systems for *D. kaki*. The systems included micropropagation, organogenesis, embryogenesis, plant regeneration from protoplasts, somatic hybridization, and *Agrobacterium*-mediated transformation. I also made the first field trial of a transgenic persimmon with the BT gene for insect resistance. This work was performed in a University of California at Davis experimental orchard in collaboration with Prof. A.M. Dandekar. With our collaborative efforts, a wide range of biotechnological techniques can now be utilized for persimmon breeding and propagation. These achievements were highly recognized worldwide. I was awarded the Cross-commodity Publication Award of American Society for Horticultural Science (ASHS) in 1997, and the Japanese Society for Horticultural Science (JSHS) Promising Researcher Award in 1997.

My most important achievement was the identification of the specificity determinant genes of the S-RNase-based gametophytic self-incompatibility (GSI) system in *Prunus* fruit tree species. It was known that GSI in *Prunus* is controlled by at least two genes for the pistil and the pollen S determinants. The identity of these determinants was unknown. I conducted 2D-PAGE gel electrophoresis to identify the pistil determinant S-RNase and cloned the gene for *Prunus* S-RNase for the first time in the world. The S-RNase DNA sequence information was utilized to develop the PCR-based methods for S genotyping. This technique is now used worldwide to type S genotypes of cultivars of SI *Prunus* species such as almonds, cherries, plums, and apricots. After the identification of the pistil S, I identified the pollen S of *Prunus*. This work had a very great impact not only in horticulture but also in plant science. This finding was the first identification of pollen S in the S-RNase-based GSI system.

› Farewell party at Prof. Abhaya M. Dandekar's house with the lab members after the two years of Japan Society for the Promotion of Science postdoc program for research abroad at Prof. Dandekar's lab at the Department of Pomology, U.C. Davis (1995).

› Collaboration study on self-incompatibility of cherries was conducted during late 1990s and early 2000s with Prof. Amy Iezzoni's lab at the Michigan State University (MSU). Photo was taken when Prof. Tao visited MSU in 2005.

› Celebration party for the JSHS Outstanding Horticulturist Award with Prof. Tao's former students and some of immediate seniors and juniors (2014).

It has now been found in diverse plant species in the *Rosaceae*, *Rutaceae*, *Solanaceae*, and *Plantaginaceae*. Based on the pollen S identification, marker-assisted selection of self-compatible (SC) individuals has been developed and utilized for SC breeding. With these achievements on *Prunus* GSI, I was awarded the Japanese Society for Horticultural Science (JSHS) Outstanding Horticulturist Award, the most important award of JSHS, in 2014. I was also awarded in 2019 the Japan Prize of Agricultural Science on the *Prunus* GSI study "The discovery of *Prunus*-specific self-incompatibility recognition system and its horticultural applications" from the Association of Japanese Agricultural Scientific Societies (AJASS), which includes over fifty Japanese scientific societies from diverse agricultural desciplines. The Japan Prize of Agricultural Science was established in 1926, and is highly regarded as the premier award for agricultural research in Japan.

My next achievements were in the reproduction biology of fruit tree species. Recently, I clarified the sex determination system in *Diospyros* together with my collaborators. Our results were the first identification of sex determination mechanism in plant dioecism. Our results were published in Science and in Plant Cell and Plant Journal. Notably, the first report of this series was published in the Japanese Journal for Horticultural Science, "The Horticulture Journal". Very recently, we also clarified the sex determination system in dioecious *Actinidia*. These findings were published in Plant Cell and Nature Plants. The basic information is now utilized to develop artificial methods for sex control in persimmon and kiwifruit.

I have also finished several important research projects that had practical applications in fruit tree species. I studied flowering controls in apples, pears, plums, and apricots, ploidy manipulations through unreduced gamete manipulations and others. These results have been published in more than 150 papers in refereed scientific journals, in 25 review papers and book chapters. Several publication awards were awarded to some of my papers.

My contribution to horticulture is not limited to my scientific activities, but also through educational activities to mentor students and young researchers in horticulture. I served as an advisor of more than 50 graduate Japanese and international students. Many of them are now working in horticultural professions including horticulture researchers.

I have a high level of professional conduct, and have always cared about the mentorship of my students. I have a humble approach to life. That is what has enabled me to have such an impact, not only in the world of fruit tree science, but the world in general.

4. What do you consider to be your greatest achievements?

The development of tissue and cell culture systems for persimmon (*Diospyros kaki*) and my studies on gametophytic self-incompatibility system in *Prunus* species were my greatest achievements.

5. Did you encounter difficulties along your career path and how did you deal with them or how did you turn them into opportunities?

When I was a doctoral student, I developed a sytem for plant regeneration from protoplasts and fused protoplasts. This did not go well initially. I was worried that I would not be able to obtain a doctoral degree if my results did not go well, without any guarantee of success. However, by continuing to experiment while consulting with other researchers, I eventually succeeded. I found a way to regenerate plants from protoplasts and fused protoplasts. Through this experience, I learned the importance of continuing to work hard and not giving up on anything.

6. Tell us about one funny/exciting/interesting experience that happened to you during your career.

Since I was a young student, I had a desire to do research abroad. The most exciting thing in my research life was that I was able to do fruit tree transformation research under the supervision of Prof. Abhaya Dandekar at the University of California Davis, in the US, for two years immediately after receiving my PhD.

7. What made you become a member of ISHS and why did you keep the membership? What contribution or role has ISHS played in your career?

I became a member of ISHS when I attended the International Horticultural Congress in Florence, Italy. Soon after, I started my job as an assistant professor at Kyoto University.

› Dinner after ISHS Board meeting in Leuven (2015).

› Prof. Tao made a presentation for the IHC2026 bid at the ISHS Council meeting in Istanbul (2018). IHC2026 has been successfully invited to Kyoto, Japan, and Prof. Tao became the IHC2026 President.

I have been a Society member ever since. As a member of ISHS, I have participated in many international symposia and have made many international friends. I was elected as the Treasurer for the ISHS Board from 2014 to 2018.

8. What advice would you give to young people interested in a career in horticulture/horticultural science?

Horticulture is a very attractive discipline because it is a field of study that can contribute to basic science as well as to practical development.

9. What are the most interesting new roles or opportunities you see emerging in the future within horticultural science?

As humans become wealthier on a global scale, the field of horticulture, which includes crops to enrich our lives, will become more attractive than the research that has focused on agronomic crops as staple food. It will be necessary to develop horticultural production systems and varieties that can cope with an aging population, as well as production styles and varieties that can be automated by robotics.