

Molecular evolution of cultivated plants and future prospects

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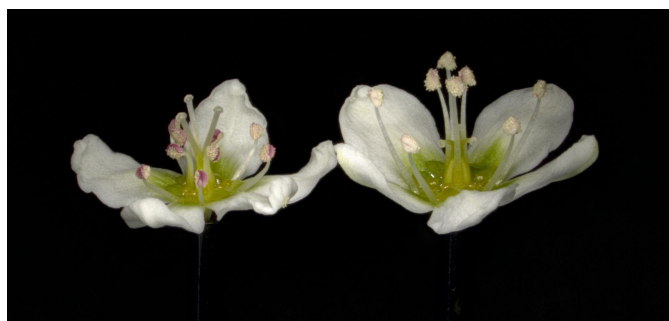
Q. What is the one thing you want to know the most right now?

We are studying the evolution of organisms by analyzing genetic information encoded in nucleic acids such as DNA and RNA. We have previously focused on the evolution of genes involved in immunity and reproduction, as they are directly related to the survival of organisms and have diversified in various organisms due to intense natural selection acting on. Lately, as you may know, it is easy to obtain a huge amount of genetic information at genomic level from any organisms. Therefore, we are trying to elucidate the evolution of organisms by analyzing such big data with population genetics and molecular evolutionary approach. We are, particularly, interested in the evolution of cultivated plants (buckwheat, adzuki beans, rice, etc.) that have changed considerably the morphology and phenotypes in a short period of time under artificial selection.

Q. What do you consider to be a challenge at the moment?

Genomic information contains remains of ancient organisms in various forms. I think it is important to mine evolutionarily critical factors that have caused the changes of morphology and phenotypes of organisms and/or traces of those past changes from vast amount of genomic information with utilizing the ever-increasing power of computer . It

should be noted nonetheless that analyzing the data with methods that are de facto standard currently may yield unexpected results and problems for new data sets when certain conditions have changed. (Even such cases, you will get “some results” ; it is often difficult to check each one individually as so many data exist and one has to judge if the results obtained are sound or correct!!). Analysis of big data always requires great and extra caution. When we start to analyze new kind of data that did not exist before, even if AI assists the analyses in near future, we need to properly verify each and every step of analysis, and we need to develop a new tool to deal with it, whenever existing approach encounter problems.



Q. Could you share your thoughts on the future prospects of this field?

With respect to the evolution of cultivated plants, it is important to clarify the factors that have caused the transformations, i.e., domestication of wild plants, in a short evolutionary period and the tran-

sitions that have encountered. This is because domestication of plants is the major factor that has led to humans thriving on the globe and expanded population. Cultivated plants have spread habitats from their native land, adapted locally to the respective environment, and have been selected by humans, whether consciously or unconsciously. Considering the expected population growth and the intense impact on existing cultivated plants of changing environment, i.e., global warming, I believe that it will be essential to continue to develop novel cultivated plants as well as to rapidly improve existing cultivated plants. I myself am not directly involved in its breeding and/or development of cultivated plants, but I would like to contribute to the acquisition of basic knowledge that will contribute such development.



Q. What was the most enjoyable moment and the most challenging moment during your research?

I enjoy the time I spend doing research every day. Especially after my serious illness, I'm very thankful just to be able to do research. I'm very much satisfied whenever an experiment succeeds as expected, even if it's something very trivial (such as simply extracting DNA from a plant), and I am enchanted by the moment when I make a new discovery and have grasped a fact that only I know in the world. I also enjoy being able to share the results with my collaborators and other researchers both in Japan and abroad. Each is different in how much fun it is, so it's hard to choose which one is the best. On the other hand, I don't recall any difficult moments with respect to research. (If I need to pick one, hard time is the time to get my degree as it took some time, but I think that overcoming that hurdle has made my subsequent research career bearable.) When experiments or data analysis con-

tinue to fail, one may think that it is difficult to overcome at first glance, but I believe that it is a great opportunity to make new discoveries there. If you are failing simply by a lack of your survey of existing knowledge or literatures, it will give you time for self-improvement, and if that is not the case, it is likely that many other researchers have faced the exactly same problem, and, once you can overcome that problem, a new world will open up for you and others. Therefore, it is important to keep challenging and no need is there to be worried or discouraged just because it is difficult. (Of course, there are times when you continue to fail even after trying several times. I think it is pointless to continue the same thing more than three or four times. From my past experiences, I have come to think that it is also an option to wait for a while, until new technology to be developed and try to solve the problem with a different approach.)

Q. Do you have a message for undergraduate and graduate students who are interested in joining your lab?

Research is fun, but there are times when research does not progress as expected or tentatively stopped. I think that what allows you to continue to live as a researcher at such times is a strong interest and affection in the research subject you have pursued. I felt that many excellent and respectful researchers I have met so far have an extraordinary passion and interest in their own research subjects. It seems that one does not succeed as researchers just because they have a high IQ, a good memory, a wealth of knowledge, or with good hand on experiments. If you can find a research subject that you want to devote your life to investigating while you are a graduate student or even at postdoc, I think that will be very meaningful for the rest of your life. Take your time and, by trial and error, please find what you really want to know.