# Report on the Honeybee workshop

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Our project was selected as one of the SCA joint project at the SCA conference in Okinawa last year. The beekeeping itself is not a big industry, but beekeeping makes a contribution to sustaining the development of Asian countries both directly and indirectly.

By producing honey, beekeeping is promising a profitable venture as a means of a low cost/high yield enterprise, which does not require compulsory land ownership or capital investment. At the same time, beekeeping can also play a role as an economic activity that can generate a substantial income for those who only have limited resources. While best known for honey production, the honeybees can also contribute substantially to human nutrition through crop pollination. Honeybee pollination increases the quantity and quality of fruits, nuts, and seeds. Moreover, the honeybee is essential to global ecology due to its pollination.

Because of these reasons, our project meets the purpose and principles of the SCA project, which is "Foundation for Sustainable Development to A Prosperous, Harmonious and Greener Asia."

Asia has a suitable environment for the development of beekeeping as part of the foundation of the agriculture based economy. Actually, beekeeping is becoming an important industry in some Asian countries, such as China. However, there is still a large room for beekeeping development in Asia. One of the most important issues for accelerating beekeeping in Asia is to improve genetical traits of honeybees so that they will be more suitable in the tropical condition.

There are two species for honey production in Asia, that is, the European honeybee, *Apis mellifera* and the Asian honeybee, *Apis cerana*. Morphologically they are very similar, but their characteristics are quite different from each other. Each species has its strengths and weaknesses for beekeeping in the tropic areas and there has been no

clear conclusions regarding which species is more suitable in tropical Asia.

The European honeybee is commonly used in beekeeping all over the world. However, they are susceptible to infectious disease, and they also often suffer severe damage from parasitic mites. On the other hand, the Asian honeybee, produce much less honey than European honeybees, and they often escape from the hive especially under ill management. However, unlike European honeybees, Asian honeybees are much less susceptible to infectious diseases than European honeybees are, and they are more tolerant to the attack by mites. In addition, the Asian Honeybee is gentler than the European honeybee, which means they do not sting as often and are easily handled by non-skilled workers.

Recently, the Honey Bee Genome Sequencing Consortium completed the sequence of the European honeybee. Sequencing the honeybee genome provides researchers an invaluable tool for better understanding of bee traits. Exclusive gene expression analyses of honeybee genes are possible to be performed, and we can expand this analyses to Asian Honeybees. Then it will be now possible to compare the expression of the genes in two species, which will lead us to understand which genes are responsible for the target traits that we would like to improve. Finally, favorable traits will be improved by genetic transformation or other systems such as artificial selection, which has been the traditional method.

Dr. Chanchao, the co-organizer of the joint project, and my group have started to obtain the DNA sequences of target genes of Asian honeybees for future gene expression studies.

In the workshop, we decided to review several subjects about honeybee, which are strongly related to the project. I talked about the general background and the purpose of our project. Then, each speaker reviewed one of the important subjects and also presented the on-going results.

Dr. Punchihewa from Sri Lank introduced merits of beekeeping using Asian honeybee, especially in the case of his country. He introduced a new type of beehive, which is suitable for keeping bee in rural area. He emphasized the importance of keeping the genetic diversity of Asian honeybee for the future breeding of Asian honeybee. He also stressed that rural beekeeping played an important role to conserve genetic diversity.

The next two talks were related to bee diseases. Breeding honeybee strains, which

are resistant to diseases, is the main target of our project. Because thousands of honeybees live in narrow and crowded colonies, the humidity and temperature inside the beehives are quite high. This high density and the presence of stored honey make honeybees attractive targets for pathogens. Honeybees are attacked by numerous pathogens, which are significant threats to the health and well-being of the bees. Dr. Chen, from the USA is a specialist of insect viruses. She reviewed honeybee viruses, especially the transmission route of viruses using her current results. Also, she introduced a new and unexplained problem, termed “Colony Collapse Disorder” (CCD). CCD has been devastating massive numbers of honey bee colonies across the continental United States and has resulted in a loss of 50 to 90 percent of the commercial honey bee colonies, causing great concern both nationally and internationally. A study using a metagenomic approach found that the Israeli Acute Paralysis Virus (IAPV) had a strong correlation with CCD. Fortunately or unfortunately, IAPV may not be a direct cause of CCD, but it may be important to test specific strain of IAPV for their disease impact.

Dr. Yoshiyama, my colleague in Japan, is a specialist of antibacterial peptides. He reviewed the innate immunity system of insects and the features of innate immunity of honeybees.

Dr. Tan from China researches genetic diversity of Asian honeybees and he also compares various aspects of European and Asian honeybees. In this workshop, he introduced two interesting differences between two species. A pheromone produced by a queen is very important to keep homeostasis by suppressing the development of the ovary of worker bees. He found that the responses to the pheromone were not the same between these two species. He also introduced the different behavioral reaction to the hornet wasps between the two species.

Finally, Dr. Chanchao reviewed bee products, that is, honey, royal jelly, propolis and bee venoms. Especially, she emphasized the presence of huge diversities in content in honey among honeybee species.

Thanks to this workshop, we were able to reach some consensus on how to approach the issues related to our projects. However, because there are so many target traits that should be analyzed, we could not cover all of the traits in this workshop. We should have the same type of workshop in the near future.

To accelerate this project, we continue to make effort to gain financial support. We

believe that the authorization of the project by the SCA will be a great help to get a scientific grant.

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