

# **Report**

**JICA training course**

entitled

**“Duckweed functional food development and social implementation with focus on methods for pure culture and examination of duckweeds”**

26 March 2023 – 1 April 2023

By

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Supported by

**The Co-Creation Program (Country Focus) under JICA Technical Cooperation Project  
Science and Technology Research Partnership for Sustainable Development (SATREPS)**

**Sunday – March 26, 2023**

**Key Activities**

- Boarding flight TG660 at 13.00 am from Bangkok International Airport (Thailand).
- Arrival at Haneda Airport (Japan) at 9.10 pm.
- Picked up by Prof. Mazaaki Morikawa.
- Traveling by train to check in at Superhotel Shinagawa.

**Key Messages learned**

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**Figure 1:** Ticket from BKK airport to HND airport

**Monday – March 27, 2023**

**Key Activities**

- Traveling by train to Food and Health laboratory, Saraya Co. Ltd. (Ibaraki)
- Lunch with Mr. Tabata & Mami
- Meeting with Saraya's research team
- Presentation and discussion about properties and functionality of Wolffia food
- Check-in to Central Hotel Takahagi
- Dinner with Saraya's research team

**Key Messages learned**

- SARAYA Co., Ltd. was established in 1952.
- The company was based on three core foci: Sanitation, Health, and Environment.
- Some key products are disinfectants, sweetener, and sustainable homecare products.
- New directions in the health and food.
- Dr. Suvimol's presentation on the properties and functionality of Wolffia protein isolate showed very positive results including antimicrobial and probiotic properties.



**Figure 2:** Train transport from Tokyo to Ibaraki



**Figure 3:** Lunch with Mr. Hiromitsu Tabata (GM, Food and Health Laboratory)

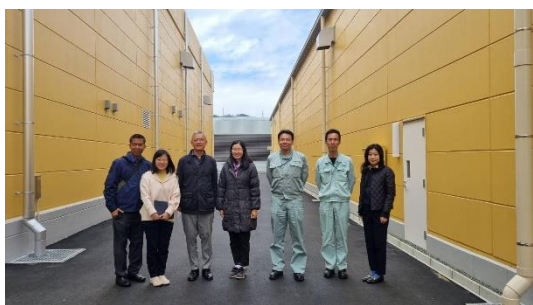
**Tuesday – March 28, 2023**

**Key Activities**

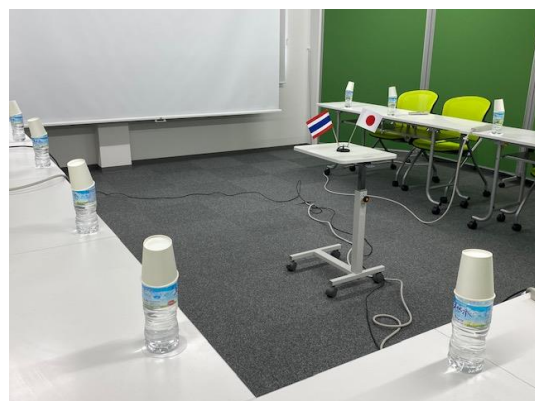
- Presentation and discussion on technical aspects of Wolffia food development
- Tour of Saraya factory
- Lunch at Saraya factory
- Traveling by Shinkansen Super-express to Osaka
- Check-in to Trusty Osaka Abeno Hotel
- Dinner with Prof. Morikawa and Dr. Kamal Shuvro Sajjad (Floatmeal)

**Key Messages learned**

- SARAYA (KANTO) factory was open in Mar 2020 in an area of 57,000 km<sup>2</sup> and employs approximately 250 people.
- The production is divided into food additive area, Quasi drugs area, and food area (monk fruit sweetener).
- Annual production output is approximately 3 million pieces per month
- Food and health laboratory is also located at the KANTO site.
- The technical aspects of Wolffia food development were discussed under confidentiality.



**Figure 4:** Tour of Saraya (Ibaraki) factory



**Figure 5:** Presentation and discussion with Food and Health laboratory, Saraya Co. Ltd.

**Wednesday – March 29, 2023**

**Key Activities**

**Key Messages learned**

- Traveling to Head Quarter Office, Saraya Co. Ltd. (Osaka) by train
- Meeting with Saraya executives
- Presentation and discussion about Wolffia food development and social implementation
- Tour of Saraya’s WAKUPAKU wellness center and restaurant
- Traveling by JR train to Kyoto University
- Picked up by Prof. Tokitaka Oyama
- Check-in to Kyoto University dormitory

- Saraya Co., Ltd. is committed to sustainability, food security, and social contribution.
- Healthy food and wellness are the new directions of the company, based on the existing know-how on food sanitation and food business network.
- WAKUPAKU is a wellness center affiliated with Saraya Co., Ltd., located on the eighth floor of the Namba Parks shopping center.
- WAKUPAKU’s concept is “exercise + diet = health.”
- The center consists of health check, restaurant, and exercise studio.
- Wolffia menu will be offered as superfood at WAKUPAKU.



**Figure 6:** Presentation and discussion at Head Quarter Office, Saraya Co. Ltd. (Osaka)



**Figure 7:** Tour of Saraya’s WAKUPAKU wellness center

**Thursday – March 30, 2023**

**Key Activities**

- Meeting with Prof. Oyama’s lab and research team
- Tour of duckweed ponds around Kyoto University
- Tour of Prof. Oyama’s lab and research facilities
- Discussion about duckweed physiology and research projects in the laboratory of Prof. Oyama
- Dinner with Prof. Oyama and Dr. Ito

**Key Messages learned**

- Duckweed species: *Lemna* sp. and *Landoltia punctata* can be found all year around in some ponds located in Kyoto University.
- In Prof. Oyama’s laboratory, some of the key research areas include circadian rhythm, flower induction, and dormancy development in duckweeds.
- Another task is to maintain duckweed culture collections.





**Figure 8:** Duckweed pond No.1 in Kyoto University



**Figure 9:** Duckweed pond No.2 in Kyoto University



**Figure 10:** Tour of Kyoto University



**Figure 11:** Tour of Prof. Oyama's lab and research facilities

**Friday – March 31, 2023**

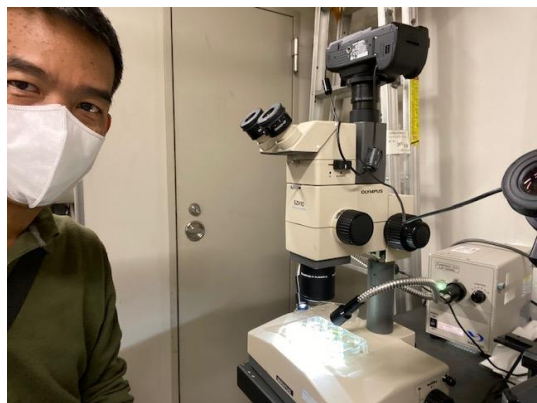
**Key Activities**

- Training on duckweed culture techniques
- Training on duckweed flowering and dormancy induction
- Training on genetic transformation of duckweed
- Discussion about future research collaboration

**Key Messages learned**

- Culture collections are maintained in various medium formulas depending on the duckweed species, including NF, SH, and Hutner.
- 1/20X bleach solution about 3 min is used for sterilization of duckweeds.
- Duckweed flowers can be observed for some species, such as *Wolffia microscopica*, but not all species. Common conditions that induce flowering include photoperiod, salicylic acid, and nutrient deficiency.
- Genetic transformation can be achieved for some duckweed species, such as *Lemna minor* and *Lemna gibba*, but not all species. A number of *Agrobacterium* strains such as GV3101, can be used. Duckweed fronds are first induced by growth hormones to form callus, then dipped into *Agrobacterium*

culture, and selected on regeneration medium.



**Figure 12:** Training of duckweed flower induction techniques



**Figure 13:** Training of duckweed culture techniques

**Saturday – April 1, 2023**

**Key Activities**

- Traveling to Osaka Kansai Airport
- Boarding flight TG623 at 11.35 am from Osaka Kansai airport (Japan).
- Arrival at Bangkok International Airport (Thailand) at 3.35 pm.

**Key Messages learned**

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**Figure 14:** Ticket from KIX airport to Bkk airport