DUCKWEED

2015 Kyoto

京都

The Third International Conference on

Duckweed Research and Application

July 3 – 6, 2015

Science Seminar House of Faculty of Science

Kyoto University, Kyoto Japan

Program & Abstracts

Organizing Committee

Tokitaka Oyama	Graduate School of Science, Kyoto University
Masaaki Morikawa	Graduate School of Environmental Science, Hokkaido University
Yasuyoshi Sakai	Graduate School of Agriculture, Kyoto University
Klaus-J Appenroth	Institute of General Botany and Plant Physiology, Friedrich Schiller University of Jena
Jay J. Cheng	Peking University, Shenzhen Graduate School
Eric Lam	Rutgers, the State University of New Jersey
Tamra L. Fakhoorian	International Lemna Association
Hai Zhao	Chengdu Institute of Biology, Chinese Academy of Science
Eduardo Mercovich	MamaGrande

Host

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Introduction

The 3rd International Conference on Research and Applications at Kyoto is a wonderful opportunity for people working on various duckweed projects. The ICDRA is biannually held; the 1st ICDRA 2011 at Chengdu, China, the 2nd ICDRA 2013 at New Brunswick, the USA. “Aquatic Plants” at the Banbury Center, Cold Spring Harbor Laboratory 2009 was a kind of kickoff meeting for duckweed research and applications in new era.

Here I would like to brief the history of duckweed in the scene of Japanese culture. The Japanese islands have a temperate humid climate and large areas of lands have been used for rice production in paddy fields for long time. Then duckweeds have been familiar to people. The Japanese word “Uki-kusa” for duckweed is very “floating weeds”. Duckweed firstly appeared as “floating sands ” in the oldest collection of Japanese poetry that was compiled in the mid-8th century. Thereafter “Uki-kusa” was frequently referenced in Japanese poetry. It was a symbolic representative of “transience” of life and mind due to its floating nature, or it was used in a rhetorical manner to evoke the feeling “melancholy or woeful”. Thus the duckweed was useful as an intermediary in the poetry world, and there were no “scientific” viewpoints on it. In fact, “Uki-kusa” was also called “Nenashi-kusa” meaning weeds without roots, though neither Wolffia nor Wolffiela was in Japan in those days. These were stories in the times that Kyoto was the capital both in name and reality. Moving to the Edo (the old name for Tokyo) period started from the 17th century, natural sciences gradually grew in Japan and botanical interests were developed. Many varieties of crops and flowers were developed in that era of national isolation. Natural history also grew for plants in Japan. Duckweeds were also described in illustrated books of Japanese Flora. *Spirodela polyrhiza, Lemna aequinoctialis* or *L. minor,* and *L. trisulca* were listed in the same section. In our time, *L. aequinoctialis* is the dominant species that people can observe in Japan and *L. trisulca* is almost unobservable in nature. After the opening of Japan to the world in the mid-19th century, sciences and technologies have been dramatically developed. By the end of the 19th century, duckweeds in Japan were described in international journals by Japanese botanists and *Landoltia punctata* (*Spirodela oligorhyza*) and *Wolffia microscopica* were listed as non-native duckweeds in addition. Since then, duckweeds have become plant materials for physiological researches. Flower induction and growth regulation by chemical and physical cues were intensively studied using several *Lemna* plants from the mid-20th century. Today not only for basic physiologies but for applied technologies, duckweeds become important tools in Japan. Base on these backgrounds, duckweeds have been a familiar teaching material of the plant science in schools from elementary

school to college.

This history of duckweed in a bit fortunate background is just the case in Japan. The popularity of duckweed in a country might depend on geometric conditions and cultural factors. However, now duckweed is getting to be a modern model plant with a wide range of applications. Based on the long history of duckweed usages for basic and applied sciences and also for trials to solve environmental and industrial problems, recent progress in the development of experimental tools like genetic transformation, genome editing, mass cultivation and also in the accumulation of genomic, systematic, ecological information is surely spreading “the duckweed fields”. I expect this conference to accelerate the usages of this model plant in various manners.

Here I briefly comment on the lecture of Plenary Lecture, Prof. Kiyotaka Okada in Ryukoku University. He has been studying Arabidopsis for basic plant sciences for 30 years. He has led the process of Arabidopsis to become the model plant in the plant science. He has also led the Japanese basic sciences; he did his duties in National Institute for Basic Biology (NIBB) of national Institutes of Natural Sciences (NINS) as the Director-general from 2007 to 2013, and now he keeps playing an active part in NINS as an Executive Director. He will give us a lecture about how to use a vast amount of information from Arabidopsis studies to further applications of plants.

Tokitaka Oyama
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Important Contact Information

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Emergency call

Police: 110
Ambulance/Fire Fighting: 119
In the Campus: 090-5253-5226 or 075-753-2255

Wireless Internet Access

Wi-Fi routers are prepared for participants in the Science Seminar House.
Data traffic may be limited

You may use KYOTO Wi-Fi on the streets in Kyoto City (mainly around bus stops) for free. (http://kanko.city.kyoto.lg.jp/wifi/en/)

Conference Venues

Science Seminar House of Faculty of Science

(North Yoshida Campus)

Registration

Science Seminar House of Faculty of Science

Dinner

North Cafeteria

Kyoto City Map

Campus Map

Science Seminar House----------10

North Cafeteria----------

From Kyoto Garden Palace Hotel and Kyoto Heian Hotel to Science Seminar House (~3 km)
These two hotels locate close to each other.

(1) Take a taxi (~10 min, ~1,000 yens/ride).
At most four people can ride in a taxi. You may use a direction sheet for taxi driver that uploaded in the website of the ICDRA.

(2) Take a bus (~10 min to the bus stop on foot, ~10 min bus ride, 230 yens)
Bus stop, Karasuma-Imadegawa, at the N.E. corner of Karasuma-Dori and Imadegawa Dori. Take a 203 Line bus (east bound) and get off at Kyodai-Nogakubu-Mae. The bust stop locates close to the main gate of the North Campus. English

(3) Walking (40~50 min, free)
You may enjoy the Imperial Palace Garden and Kamo River on the way.

From SEIFU Kaikan (~700 m)
Walking (~10 min)

Daily Schedule

Friday, July 3 (1st day)

3:00 - 7:00 PM	Registration of Attendees (Seminar House entrance)
3:00 - 7:00 PM	Posters on boards
3:00 - 5:00 PM	Open Discussion with Snacks and Refreshments
5:00 - 7:00 PM	Get Together Party at Science Seminar House

Saturday, July 4 (2nd day)

9:00 AM - 6:00 PM Registration Continues (Seminar House entrance)

9:10 AM Welcoming Address by **Prof. Akira Nagatani**,

Chairperson of Department of Botany,
Graduate School of Science, Kyoto University

9:15 - 9:45 AM Plenary Lecture

9:15 AM "Beyond the Arabidopsis Research -- Lessons from Research Development in the Past 20 Years ---"

Prof. Kiyotaka Okada

Executive Director, National Institutes of Natural Sciences;

Professor, Department of Agriculture, Ryukoku University

10:00 - 10:15 AM Coffee/Snack Break

10:15 - 11:45 AM SESSION 1: GENETIC ENGINEERING-1

10:15 AM "Omics and genetic transformation research of duckweed" (L1)

Hai Zhao, Chengdu Institute of Biology, CAS, Chengdu, China

10:45 AM "Genetic engineering of Lemnaceae: tools for research and applications" (L2)

Almudena Mollá-Morales, Cold Spring Harbor Laboratory, NY, USA

11:05 AM "Sequencing, assembling and annotating *Lemna minor* genome for use in transcriptomic analyses" (L3)

Van Hoeck Arne, SCK CEN and University of Antwerp, Belgium

11:25 AM "Callus induction and plant regeneration from duckweed *Landoltia punctata*" (L4)

Jiaming Zhang, Hainan Bioenergy Center, Institute of Tropical Bioscience and Biotechnology, Hainan, China

Saturday, July 4 (2nd day) (continued)

11:45 AM -1:45 PM Lunch in Science Seminar House with concurrent Poster Session

1:45 - 2:35 PM SESSION 2: GENETIC ENGINEERING-2

1:45 AM "Fast forward approach to a high-resolution genome sequence map and quantification of intraspecific structural and sequence variations in *Spirodela polyrhiza* strains" (L5)

Eric Lam, Rutgers, the State University of New Jersey, New Brunswick, NJ, USA

2:15 AM "Whole Genome Sequencing of Lemna minor" (L6)

Evan Ernst, Cold Spring Harbor Laboratory, NY, USA

2:35 - 3:25 PM SESSION 3: DUCKWEED-MICROBE INTERACTION-1

2:35 AM "Starch production capability of rootless duckweed and its enhancement by plant growth promoting bacteria (PGPB)" (L7)

Kazuhiro Mori, Interdisciplinary Graduate School, University of Yamanashi, Kofu, Japan

3:05 AM "Microbial community structure associated with different duckweed species in different environmental waters" (L8)

Yan Li, Interdisciplinary Graduate School, University of Yamanashi, Kofu, Japan

3:25 - 3:40 PM Coffee/Snack Break

Saturday, July 4 (2nd day) (continued)

3:40 - 5:10 PM SESSION 4: DUCKWEED-MICROBE INTERACTION-2

3:40 PM "Plant growth-promoting bacteria (PGPB)-induced accelerated growth, increased chlorophylls and enhanced photosynthesis of duckweed (*Spirodela polyrrhiza*)" (L9)

Tadashi Toyama, University of Yamanashi, Kofu, Japan

4:10 PM "Enhanced growth of *Lemna minor* by *Acinetobacter calcoaceticus* P23 in environmental water" (L10)

Masashi Kuroda, Graduate School of Engineering, Osaka University, Osaka, Japan

4:30 PM "Growth promotion of *Wolffia globosa* by *Acinetobacter calcoaceticus* P23" (L11)

Maiko Sakaguchi, Graduate School of Engineering, Osaka University, Osaka, Japan

4:50 PM "Molecular mechanisms of duckweed growth-promotion by *Acinetobacter calcoaceticus* P23" (L12)

Jog Rahul, Graduate School of Environmental Science, Hokkaido University, Sapporo, Japan

5:10 - 6:00 PM Poster session with snack and drink

6:00 - 8:00 PM Dinner at the North cafeteria

Sunday, July 5 (3rd day)

9:00 - 10:10 AM SESSION 5: BASIC PLANT SCIENCE with DUCKWEED -1

9:00 AM "Using duckweeds for basic research in plant physiology: Exploring plant biological clock systems" (L13)

Tokitaka Oyama, Department of Botany, Graduate School of Science, Kyoto University, Kyoto, Japan

9:30 AM "A new resource for cytogenetic studies in karyotype evolution of duckweeds" (L14)

Hieu Xuan Cao, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany

9:50 AM "*Spirodela polyrhiza* post-transcriptional regulation responses to environmental and hormonal stimuli" (L15)

Paul Fourounjian, Waksman Institute of Microbiology, Rutgers University, Piscataway, NJ, USA

10:10 AM - 10:25 AM Coffee/Snack Break

Sunday, July 5 (3rd day) (continued)

10:25 - 11:55 AM SESSION 6: BASIC PLANT SCIENCE with DUCKWEED -2

10:25 AM "Making duckweed a crop plant: Accumulation of starch" (L16)

Klaus-Juergen Appenroth, Institute of General Botany and Plant Physiology, University of Jena, Jena, Germany

10:55 AM "How fast can duckweeds grow?" (L17)

Sowjanya Sree Kandregula, Amity Institute of Biotechnology, Amity University Uttar Pradesh, Noida, India

11:15 AM "Different genetic patterns of two natural duckweed populations in China" (L18)

Jie Tang, School of Environment and Energy, Peking University Shenzhen Graduate School, Shenzhen, China

11:35 AM "Impact of the alien invasive species *Lemna minuta* on the congeneric native *Lemna minor*" (L19)

Simona Paolacci, School of Biology Earth and Environmental Science, University College of Cork, Cork, Ireland

11:55 AM - 2:00 PM Lunch in Science Seminar House with concurrent Poster Session

Sunday, July 5 (3rd day) (continued)

2:00 - 2:55 PM SESSION 7:DUCKWEED APPLICATIONS-1

2:00 PM "Accumulation of Selenium in Duckweed (*Landoltia punctata*) and Its Effects on Ultrastructure, Antioxidant Enzymes and the Chlorophyll a fluorescence OJIP transient" (L20)

Yu Zhong, School of Environment and Energy, Peking University Shenzhen Graduate School, Shenzhen, China

2:20 PM "The application research of duckweed on heavy metal remediation and wastewater treatment" (L21)

Yang Fang, Chengdu Institute of Biology, CAS, Chengdu, China

2:40 PM "Duck weed powder as a replacement for fish meal in the feed used in Tilapia (GIFT) fry rearing" (L22)

M. H. Soma Ariyaratne, National Aquatic Resources Research and Development Agency, Colombo, Sri lanka

3:00 PM "An ongoing analytical study of the growth performance of Nile tilapia raised in tanks with fresh duckweed in comparison with those raised with commercial feed" (L23)

Godwin Nwachukwu Isitor, Rivers State University of Science and Technology, Rivers State, Nigeria

3:20 PM - 3:35 PM Coffee/Snack Break

Sunday, July 5 (3rd day) (continued)

3:35 - 4:45 PM SESSION 8: DUCKWEED-MICROBE INTERACTION-3

3:35 PM "Duckweed as a platform for bioremediation and biomass production through interaction with C1-microbes" (L24)

Yasuyoshi Sakai, Graduate School of Agriculture, Kyoto University, Kyoto, Japan

4:05 PM "Yeast mannan promotes the growth of *Lemna minor*" (L25)

Ayumu Kuramoto, Graduate School of Environmental Science, Hokkaido University, Sapporo, Japan

4:25 PM "Estrogen degradation by utilizing the symbiosis of *Rhodococcus zopfii* Y 50158 and duckweed for developing eco-friendly water purification technology" (L26)

Ami Kawahata, Graduate School of Environmental Science, Hokkaido University, Sapporo, Japan

5:10 - 6:00 PM Poster session with snack and drink.

Remove poster at the end of this session

6:00 - 8:00 PM Dinner at the North cafeteria

Monday, July 6 (4th day)

9:10 - 10:10 AM SESSION 9: DUCKWEED APPLICATIONS-2

9:10 AM "The Duckweed a Valuable Bioenergy Plant for Biofuel Production and Waste Water Treatment" (L27)

Yubin Ma, Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences, Shandong, China

9:40 AM " "Rolling Up Our Sleeves"- Building the Duckweed Industry from the Water Up" (L28)

Tamra Lynn Fakhoorian, International Lemna Association (ILA), KY, USA

11:00 AM Leave Kyoto University for Otsu Port of Lake Biwa by bus

12:30 PM- 3:30 PM Farewell & Cruising Party on the lake BIWA (BIWA-KO)

Lake Biwa: Japan's Largest Lake, One of the oldest lakes in the world.

5:00 PM Arrival at hotels/university in Kyoto

Ship "Bianca"

Poster List

P1

Co-adhesion to *Lemna minor* of rapidly colonizing bacteria and *Acinetobacter*

Yusuke Yamakawa[1], Kyoko Miwa[1], Masashi Kuroda[2], Michihiko Ike[2], Masaaki Morikawa[1]
[1]Graduate School of Environmental Science, Hokkaido University
[2]Graduate School of Engineering, Osaka University

P2

Effect of aquatic plant growth-promoting bacteria on the growth of rice

Keita Kagemoto[1], Tadashi Toyama[2], Kazuhiro Mori[2], Kyoko Miwa[1], Masaaki Morikawa[1]
[1]Graduate School of Environmental Science, Hokkaido University
[2]Graduate School of Medicine and Engineering, University of Yamanashi

P3

Effects of environmental bacterial community on growth of duckweeds

Kouhei Takagi, Tsubasa Hanaoka, Tadashi Toyama and Kazuhiro Mori
Department of Civil & Environmental Engineering, Interdisciplinary Graduate School, University of Yamanashi

P4

Characterization of microbial consortium and methane oxidation in the methanotroph-duckweed symbiotic system

Hiroya Yurimoto[1], Ryohei Umeda[1], Hiroyuki Iguchi[1], Tokitaka Oyama[2], and Yasuyoshi Sakai[1]
[1]Graduate School of Agriculture, Kyoto University
[2] Department of Botany, Graduate School of Science, Kyoto University

P5

Effects of external addition of plant hormones and some minerals on the growth of duckweed *Lemna minor*

Desi Utami, Masayuki Sugawara, Kyoko Miwa, Masaaki Morikawa
Graduate School of Environmental Science, Hokkaido University

P6

Effects of external organic compounds on growth and turion formation of rootless duckweed *Wolffia arrhiza*

Satoshi Soda, Yuichiro Takai, Hiroki Kohno, Masafumi Tateda, and Michihiko Ike
Graduate School of Engineering, Osaka University

P7

Developing a manipulation system of partial illumination to the microarea of duckweed plants for the detection of intercellular signaling on cellular circadian clocks

Jun Yomo, Tomoaki Muranaka, masaaki Okada, Shogo Ito, Tokitaka Oyama
Department of Botany, Graduate School of Science, Kyoto University

P8

Evaluation of growth of *Lemna gibba* under various photoperiod conditions

Masaaki Okada, Tomoaki Muranaka and Tokitaka Oyama
Department of Botany, Graduate School of Science, Kyoto University

P9

Diversity of circadian rhythms and photoperiodic responses in duckweed

Tomoaki Muranaka, Tokitaka Oyama
Department of Botany, Graduate School of Science, Kyoto University

P10

Improvement of fast and efficient *Agrobacterium* mediated stable transformation methods for *Lemna* species

Shogo Ito, Yoko Utsumi and Tokitaka Oyama
Department of Botany, Graduate School of Science, Kyoto University