2.1.5 Laboratory : Weed Science

Member :	Professor	Tominaga, Tohru, Dr. Agric. Sci.
	Senior Lecturer	Miura, Reiichi, Dr. Agric. Sci.
	Senior Lecturer	Wang, Guang-Xi, Dr. Agric. Sci.
	Doctor's program	3
	Master's Program	8
	Undergraduate	3
	Other	1

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Molecular and ecological analyses of herbicide resistance of paddy weeds

Repeated field applications of acetolactate synthase (ALS)-inhibiting herbicides have resulted in selection of resistant biotypes of more than 107 weed species throughout the world. Objective of this research is to analyze mechanisms of the ALS resistance with molecular and ecological techniques by using three paddy species: Monochoria korsakowii, M. vaginalis and Limnophila sessiliflora. In this research, we found that (1) in Japan, some populations originated from a preexisting and preadapted mutant M. vaginalis and showed lower genetic variation, whereas other populations showed higher genetic variation, and the resistance gene can be dispersed by outcrossing; (2) M. vaginalis has both chasmogamous (CH) and cleistogamous (CL) flowers on individual plants. We have studied on the reproductive characteristics that affect the selfing rate of M. vaginalis. The results suggest that this species has reproductive characteristics that make the selfing rate high; however, outcrossing also can occur. Under favorable light intensity conditions, such as on the edges of paddy fields or in fallow fields, it will produce more CH flowers and will have a higher outcrossing rate than in shaded conditions, and (3) the experiments on inheritance of ALS-inhibiting resistance and the ALS gene function are in progress.

b) Reproductive ecology of aquatic weeds in Monochoria

The plants of the genus Monochoria have somatic enantiostyly, i.e., each plant bears two morphs of flowers, left- and right-handed flowers, with the style deflection to the left and right, respectively. The major pollinators observed were Apis cerana japonica, Xylocopa

circumvolans and Bombus spp. The large anther of a flower morph touches the same position of bee's abdomen as the style of the other morph, thereby apparently facilitationg intermorph pollination. However, since the enantiostyly is somatic, this seems to lead to cross-pollination only when flowers of only one morph, by chance, are open on an individual. Recently, the materials of Monochoria have been collected worldwide, and the reproductive ecology is under research.

c) Changes of soil and vegetation under slash-and-burn agriculture in Zambia

As chemical fertilizers has become more and more easily available, a traditional slash-burn agriculture in the Miombo Woodland area of Zambia is being replaced by continuous cultivation. To evaluate the impact of this change on the sustainability and vulnerability of the local agroecosystem, a 2-ha experimental station has been set up in the Eastern Province of Zambia and the change of vegetation and soil under several different management regimes are being monitored. This is a joint research program with Zambia Agricultural Research Institute and the Laboratory of Soil Science, Graduate School of Agriculture, Kyoto University, and forms a part of the research project by RIHN, "Vulnerability and resilience social-ecological systems".

d) Distribution of alien Lolium species in Kobe and hybridization among Lolium species

Lolium rigidum is an annual grass and its seeds sometimes contaminate wheat and other grains imported to Japan. Its distribution and hybridization with L. perenne and L. multifrorum were investigated in Kobe City. The hybridization between L. rigidum and two other Lolium species was confirmed by morphological and genetic analyses using molecular markers. The spread of herbicide resistant gene through hybridization is under research.

e) Development of microsatellite markers and their effectiveness in Imperata cylindrica

Cogongrass (Imperata cylindrica) is an invasive perennial grass widely distributed in the world, and two ecotypes (C-type and E-type) are found in Japan. We isolated and characterized eight microsatellite loci from the two ecotypes to clarify expansion process, natural hybridization between two ecotypes and their reproductive strategy.

A-2.Publications and presentations

a) Publications

Books

- T. Tominaga: Lolium temulentum, an associated weed of barley and wheat. In "Natural History of Barley and Wheat" eds. Y. Sato and K. Kato. Hokkaido University Press. pp. 221-249, 2010.

- T. Tominaga: Weeds in Agriculture. In "Changes in Agriculture Systems and Its Impacts on Environment"ed. T. Kurata. Rinsen Book Co. pp. 137-182, 2010.

Original Papers

- Inagaki, H., T. Imaizumi, G.-X. Wang, T. Tominaga, K. Kato, H. Iyozumi and H. Nukui: Sulfonylurea-resistant biotypes of Monochoria vaginalis generate higher ultraweak photon emissions than the susceptible ones. Pesticide Biochemistry and Physiology 95; 117-120, 2009.
- Min Ao, Reiichi Miura and Tohru Tominaga: Root and rhizome systems of perennial grasses grown in Inner Mongolian grassland, China. Grassland Science 55: 187-192, 2009.
- Jun Maeda, Shingo Kaneko, Yuji Isagi, Tohru Tominaga: Isolation and characterization of polymorphic microsatellite loci for Imperata cylindrica, an invasive perennial grass, Conservation Genetics Resources 1:127-129, 2009.

Reports

- Miura, R. and Chiba H. Prosopis juliflora -an alien plant took root in the life of common people in India. Journal of Weed Science and Technology 54(4): 256-257. (in Japanese)
- Miura, R.: Cosmetics, supplements and the global trade -what is happening in agriculture in Kanmer. Newsletter for Indus Civilization Studies No. 6, 1-3, 2010. (in Japanese)
- Kuramitsu, H., Takenaka, S. and Miura, R.: Weed vegetation in a slash-and-burn experimental plot in the Eastern Province of Zambia and the germination characteristics of two dominant grass weed species. RIHN (Japan) Project Report E-04, 2010. (in Japanese)

b) Conference and seminar papers presented

- The Annual Meeting of the Weed Science Society of Japan: 5 presentations
- The 1st China-Japan-Korea Workshop on Pesticide Science: 1 presentation
- The Annual Meeting of the Millet Society of Japan: 1 presentation
- The 117th Annual Meeting of the Japanese Society of Breeding: 1 presentation

A-3.Off-campus activities

Membership in academic societies

- Tominaga, T. : Weed Science Society of Japan (Councilor, Editor-in-Chief of WEED

BIOLOGY and MANAGEMENT)

- Miura, R. : Weed Science Society of Japan (Editorial Board Member, International Exchange Committee member)
- Wang, G.-X. : Weed Science Society of Japan (Editorial Board Member, Terminology Committee Member)

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research (B) : Tominaga, T. : Spread of Imperata cylindrica by earth warming and its weed problems

A-4.International cooperation and overseas activities

International joint research, overseas research surveys

- Genecological study on the relationships among man, crop and weed in agro-ecosystems, Tominaga, T. (Iran, Turkey)
- Occurrences of herbicide-resistant weeds in upland fields and its control, Tominaga, T. (USA)
- Vulnerability and resilience of social-ecological systems, Miura, R. (Zambia)
- Environmental change and the Indus Civilization, Miura, R. (India)
- Improvement of fertility of sandy soils in the semi-arid zone of West Africa through organic matter management, Miura, R.(Niger)
- Ecological studies on aquatic plants and the management, Wang, G.-X. (China)

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level : Weed Science I (Tominaga), Weed Science II (Tominaga, Miura, Wang), Laboratory Course for Bioresource Science (Tominaga, Miura, Wang), Seminar (Tominaga, Miura, Wang), Introduction to Research (Tominaga, Miura, Wang), Outline of Bioresource Science I (Tominaga), Ecology (Tominaga), Science of Biosphere-Life, Food and Environment (Tominaga), Nature and Culture (Miura), Pocket Seminar (Tominaga, Miura, Wang)
- Graduate level : Weed Science (Advanced Course) (Tominaga), Weed Science

Seminar (Tominaga, Miura, Wang), Special Laboratory Work in Weed Science (Tominaga, Miura, Wang), Thesis (Tominaga, Miura, Wang)

B-2.Off-campus teaching etc.

Part-time lecturer

- Tominaga, T.: Graduate School of Agriculture, Kinki University (Weed Science, Advanced Course)
- Tominaga, T.: Tokyo University of Agriculture (Special Lecture)

Open lectures, etc.

- Tominaga, T.: The Millet Society of Japan Spring Seminar (Lecturer)
- Miura, R.: Kyoto University Museum Junior Lecture (Lecturer)
- Wang, G.-X.: Kyoto University Experimental Farm Open Lecture (Lecturer)

C.Other Remarks

- Tominaga, T.: Research Institute for Humanity and Nature (Project member)
- Miura, R.: Research Institute for Humanity and Nature (Project member)
- Wang, G.-X.: Wuhan Institute of Botany, Chinese Academy of Science (Guest Professor)