Chair Agricultural Ecology

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.
	Assistant Professor	Shimono, Yoshiko, Dr. Earth Envrion. Sci.
	Doctor's program	2
	Master's Program	9
	Undergraduate	4
	Researcher	1

A. Research Activities (2010.4-2011.3)

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

As chemical fertilizers has become 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 of the Research Institute for Humanity and Nature, entitled "Vulnerability and resilience social-ecological systems".

c) Range expansion and hybridization between two ecotypes of Imperata cylindrica in Japan

Imperata cylindrica is an invasive perennial grass widely distributed in the world, and two ecotypes (common ecotype (C-type) and early flowering ecotype (E-type)) are found in Japan. The C-type populations are commonly found in south-western parts of Japan, whereas the E-type populations are found scattering including northern parts of Japan. However, recent global warming is likely to result in the range expansion of C-type in northern parts of Japan, and the putative hybrids between two ecotypes have been observed in the region. We compared the present range of two ecotypes with that in 1980's and investigated the expansion process and natural hybridization between two ecotypes through molecular analysis, and reproductive strategy of this weed through artificial crossing between two ecotypes.

d) Distribution of herbicide-resistant Lolium species in port

Because herbicide-resistant weeds have spread in agricultural fields of grain-exporting countries, their seeds are introduced into other countries as contaminants in imported grain. The spread of resistance genes through seed and pollen can cause significant economic loss. To assess the extent of the problem, we investigated the establishment and spread by herbicide-resistant annual ryegrass (Lolium species) in grain imported port in Japan. Some herbicide-resistant ryegrass were found near entrance of feed crop company or along main road in Kashima port, Ibaraki and Sakaide port, Kagawa. Establishment of herbicide-resistant weeds derived from international grain seems to be a common phenomenon. It is necessary to monitor the establishment of herbicide-resistant weeds in grain-importing countries in order to predict the spread of resistance genes in fields and to identify effective weed management options that avoid the use of inefficient chemicals.

A-2.Publications and presentations

a) Publications

Books

- Tominaga, T. and R. Miura:
Weed flora and effect of heribicide -special references to rice paddy weeds-, In Coservation Ecology of Urban Ecosystems, ed by Nemoto, M., Baifukan, Tokyo, 69-99, 2010

- Tominaga, T.:
Darnel, accampanied weed of wheat cultivation, In Natural History of Wheat and Barley, ed by Sato, Y. and K. Kato, Hokkaido Univ. Press, Sapporo, 221-249, 2010

- Tominaga, T.:
Weeds in Agriculture, In Change of Agriculture Systems and Environmental Issues, ed by Kurata, T., Rinsen Shoten, Kyoto, 137-182, 2010

Original Papers(including book-reviews)

- Tanaka, S., R. Miura and T. Tominaga:
Small-scale heterogeneity in the soil environment influences the distribution of lawn grass and weeds. Weed Biology and Management 10; 209-218, 2010

- Wang, G-X., X-C. Wan and T. Tominaga:
Morphological variation in the paddy weeds of Monochoria. Journal of Weed Science and Technology 55; 245-253, 2010

- Hanasaki, Y., R. Miura and T. Tominaga:
Variation of Imperata cylindrica in Kinki district, Japan revealed by AFLP analysis. Journal of Japanese Society of Revegetation Technology 36; 299-303, 2010

- Shimono, Y. Takiguchi, Y., and Konuma, A.:
Contamination of internationally traded wheat by herbicide-resistant Lolium rigidum Gaudin. Weed Biology and Management 10: 219-228, 2010.

Reports,others

- Shimono, Y.:
Generalized linear models for count data using R. Journal of Weed Science and Technology 55 (4): 287-294, 2010.

b) Conference and seminar papers presented

- The 49th Annual meeting of the Japanese Society of Weed Science: 7 Presentations

- The 58th Annual Meeting of the Ecological Society of Japan: 2 presentations

A-3.Off-campus activities 1

Membership in academic societies

- Tominaga, Tohru : The Japanese Society of Weed Science (Councilor, Editor of Weed Biology and Management)

- Miura, Reiichi : Weed Science Society of Japan (Editorial comittee member, International exchange comittee member), Society for Plant Species Biology (Councilor), Japanese Society for Tropical Agriculture (Editorial comittee member)

A-3.Off-campus activities 2

Research grants

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

- Grant-in-Aid for challenging Exploratory Research : Tominaga Tohru : Is the evolution of herbicide resistance in weeds accelerated by gene duplication?

- Grant-in-Aid for Scientific Research (B) : Tominaga Tohru : Range expansion and hybridization between two ecotypes of Imperata cylindrica
in Japan acceralated by earth warming

2.Other Research Grants

- Research grant for environmental problems by Nippon Seimei financial group：Shimono, Yoshiko：Establishment and spread of herbicide-resistant weeds introduced by internationally traded grain commodities.

A-4.International cooperation and overseas activities 1

Membership in academic societies

- Tominaga, Tohru: Weed Science Society of America（Member）, Weed Science Society of Europe（Member）

International joint research, overseas research surveys

- Control of weedy rice、Tominaga, Tohru、Shenyang Agriculture University, China

A-4.International cooperation and overseas activities 2

Visiting Research Scholars

- Research Fellow　1（China）

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level : Outline of Bioresource Science 4 (Tominaga), Weed Science 1(Tominaga), Weed Science 2(Tominaga, Miura and Wang), Ecology (Tominaga), Introduction to Foreign Literature in Bioresource Science II (Miura), Laboratory Work of Bioresource Science 1, 2 (Tominaga, Miura and Wang), Nature and Culture : Perspectives from Agriculture (Miura), Seminar in Agricultural Ecology (Tominaga, Miura and Wang)

- Graduate level : Weed Science (Advanced Cource) (Tominaga), Weed Management (Advanced Cource) (Miura and Wang), Special Lecture on Plant Production Science (Tominaga), Seminar in Weed Science (Tominaga, Miura and Wang), Research in Weed Science (Tominaga, Miura and Wang)

B-2.Off-campus teaching etc.

Part-time lecturer

- Miura, Reiichi: Nara University of Education, Faculty of Education, Life Science Special Lecture

- Tominaga, Tohru: Research Institute for Humanity and Nature (Project member)

Open lectures, etc.

- Tominaga, Tohru: Special Lecture, Tokyo University of Agriculture, Lecturer

- Tominaga, Tohru: Special lecture for the 7th memorial open lecture of Yukinaga House, Yukinaga House Committee, Lecturer

B-3.Overseas teaching 2

Lectures and seminars

- Tominaga, Tohru

Global warming and weed problems(Lecturer) : Shenyang Agriculture University(China)

Special notes：

Miura Reiichi: Health Supervisor