Research Topics

1. A New Method for Calculating Rice Field Methane Emissions Adopted for the 2006 IPCC Guidelines

This February in its Fourth Assessment Report the Intergovernmental Panel on Climate Change (IPCC) more or less concluded that “global warming is already happening, and it is caused by the increased greenhouse gas (GHG) emissions by human activities.” It is anticipated that humanity will enter a period of time warmer than any other in human history, and the measures must be addressed. For that purpose, worldwide initiatives are in progress, such as GHG emission reductions in the developed countries made under the Kyoto Protocol, which was adopted in 1997, and based on the UN Framework Convention on Climate Change (UNFCCC), which had been adopted at the 1992 Earth Summit. Also, the framework for the "post Kyoto-agreement" was debated at the Heiligendamm Summit this year.

The UNFCCC requires parties to estimate their GHG inventories of emissions and sinks, and to report them to the convention secretariat. Their estimation methods have been prepared in the form of the Guidelines by the IPCC. In the past, the parties did their estimates with the Guidelines released in 1996. However, in 2006 the Guidelines were revised, and from now on the parties are encouraged to use the revised Guidelines as the standard calculation methods for determining their GHG emissions. These revisions adopted a method for calculating rice field methane (CH_4) emissions which was developed by a team in which our institution played the leading role.

In the agricultural sector, rice fields are a significant anthropogenic source of methane, a major GHG. The measurement method in the 1996 IPCC Guidelines still had a great deal of uncertainty for reasons including determination of the emission factor[i] from a paucity of measured data. For that reason we built and analyzed a database which holds measurements of methane emitted from rice fields, and carried out research meant to propose a more precise calculation method.

This research involved collecting data on rice field methane emission measurements in Asian countries from the existing literature, and building a database comprising data on 868 growing periods at 103 locations in eight countries. These data were used in analyzing the relationship between average methane flux of entier growing periods and the factors controlling the flux. We then proposed a revised method for calculating the methane emitted from rice fields, which was adopted for the new IPCC guidelines.

Basically, the calculation method follows that in the previous IPCC guidelines by multiplying an emission factor (EF), which represents emission intensity, by the rice harvested area (A) and by the number of rice cultivation days (t) of all rice fields in the world for each of the categories such as irrigated rice fields and rainfed rice fields (Equation 1). Category-specific emission factors (EFi) are determined by multiplying the baseline emission factor (EFc) by correction factors, or scaling factors[ii], that takes into account influences on the emissions of methane, such as water management and organic amendment application (Equation 2).

Amount of methane emitted ($Gg\ yr^{-1}$)

$$= \Sigma_{ijk} (EF_{ijk} \cdot t_{ijk} \cdot A_{ijk} \cdot 10^{-6}) \qquad \text{Equation 1}$$

$$EFi = EFc \cdot SFw \cdot SFp \cdot SFo \cdot SFs,r \qquad \text{Equation 2}$$

Where:

EF_{ijk} = emission factor for rice fields in each category ($kg\text{-}CH_4\ ha^{-1}\ day^{-1}$)

t_{ijk} = number of rice cultivation days in rice fields of each category (day)

A_{ijk} = harvest area of rice fields in each category ($ha\ yr^{-1}$)

EFc = baseline emission factor ($kg\text{-}CH_4\ ha^{-1}\ day^{-1}$)

SFw = scaling factor used for rice field type and water management during growing period

SFp = scaling factor used for water management before growing period

SFo = scaling factor used for application of organic amendments

SFs,r = scaling factors used for soil type and rice cultivar (only when applicable)

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[i] Emission factor: Emission intensity per unit area, used in calculations.

[ii] Scaling factor: A coefficient that shows how methane emission is affected by rice field type, water management, organic amendment application, and other influences.

[iii] Uncertainty range: The IPCC guidelines assign an uncertainty range to emission factors and other values. Because in this case there are sufficient data as the basis for determining calculation factors, we have used the 95% confidence interval as the uncertainty range.

[iv] 2006 IPCC guidelines: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm (vol. 4, p. 5.44–53).

Table 1 Conversion factors of various organic amendments

Amendment	Conversion factors for organic amendment (CFOA)	Uncertainty range
Compost	0.05	0.01-0.08
Farmyard manure	0.14	0.07-0.20
Green manure	0.50	0.30-0.60
Straw on season (within 30 days before rice cultivation)	1	0.97-1.04
Straw off season (more than 30 days before rice cultivation)	0.29	0.20-0.40

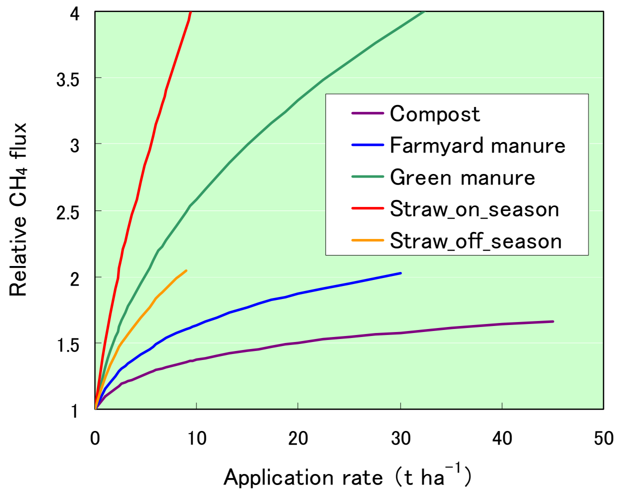


Fig. 1 Relationship between amounts of various organic amendments and methane emissions (compared with no organic amendments). See Table 1 for the categorizations of straw amendment.

Here, the baseline emission factor (EFc), which is the basis for calculation, is meant for rice fields which have a drainage period of less than 180 days before cultivation, which are continuously flooded during the growing season, and which are given no organic amendments. An analysis using the database yielded a value of 1.30 kg-CH_4 ha^{-1} day^{-1} (uncertainty range:[iii] 0.80 to 2.20). The 1996 IPCC guidelines used in the past set the baseline emission factor at a uniform 200 kg ha^{-1} per crop, which did not take into account differences in rice growing season length due to cultivar and climate. By contrast, the improved method can better calculate the actual amount of methane emitted. Additionally, it is now possible to correct the relationship of increased methane generation to water management and organic amendments prior to the growing season (Fig. 1, Table 1), whose significant influence on the amount of methane emitted is now known (Equation 3).

$$SFo = (1 + \Sigma_i\, ROA_i \cdot CFOA_i)^{0.59} \qquad \text{Equation 3}$$

Where:

SFo = scaling factor used for application of organic amendments

ROA_i = application rate of organic amendments in fresh weight (t ha^{-1})

$CFOA_i$ = conversion factor given in Table 1

See the 2006 IPCC guidelines[iv] for a detailed explanation of the calculation method outlined here.

Because these guidelines are used around the world for building GHG inventories, they make a considerable contribution to refining the calculation of the world's GHG emissions as called for by the UNFCCC. (K. Yagi and H. Akiyama)

2. Publication of the "Revised Agricultural Environment Monitoring Manual for Water Environment Conservation"

There is now broad awareness of the significant impact of agriculture on the water environment, and in many places people are implementing various measures for water environment conservation, such as the introduction of conservation agriculture techniques. The precise implementation of such measures requires first determining the situation at a locality and then implementing the most effective measures which suit that situation. To determine the situation at a locality, one must monitor the runoff of nitrogen, phosphorus, pesticides, and other substances from agricultural lands into rivers and groundwater. It is also necessary to estimate the load in the involved watershed of agriculture-derived nitrogen and other substances from statistical data. To determine the effectiveness of implemented measures, one must conduct a reevaluation based on monitoring, and then make further improvements to the measures if needed.

In 1999, the National Institute for Agro-Environmental Sciences (NIAES) published the "Agricultural Environment Monitoring Manual for Water Environment Conservation (in Japanese)" as a comprehensive and practical survey manual to perform such agriculture-related water environment monitoring. Relevant agencies in Japan have been using the manual.

Since 1999, NIAES has gained many new research findings related to water environment monitoring in our research projects. And because remarkable progress has been achieved in related research areas as well, we incorporated these latest research results for publication of this revised monitoring manual (Fig. 1, 2, 3).

The manual uses recent research to explain agricultural environment monitoring methods in plain language. Below are the revised manual's and chapters (Table 1).

The PDF version of this revised manual in Japanese can be downloaded from NIAES website:
http://www.niaes.affrc.go.jp/techdoc/monitoring/index.html

Printed versions have been provided to mainly agriculture-related independent administrative institutions and public institutions, as well as to universities and environment-related institutions in Japan. (K. Banzai and K. Sugahara)

Fig. 2 Water quality monitoring using an automatic water sampler (IV-3)

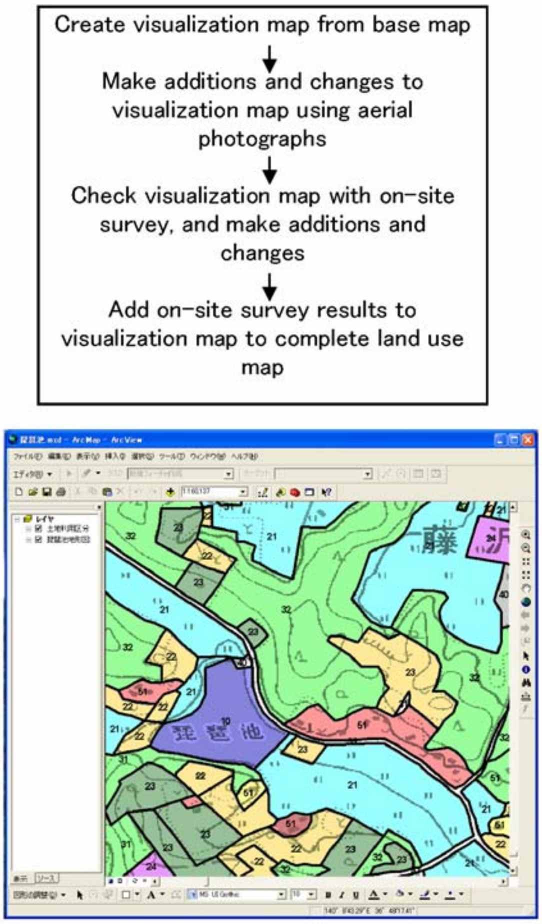


Fig. 1 Procedure to create maps showing the current state of land use (II-5)

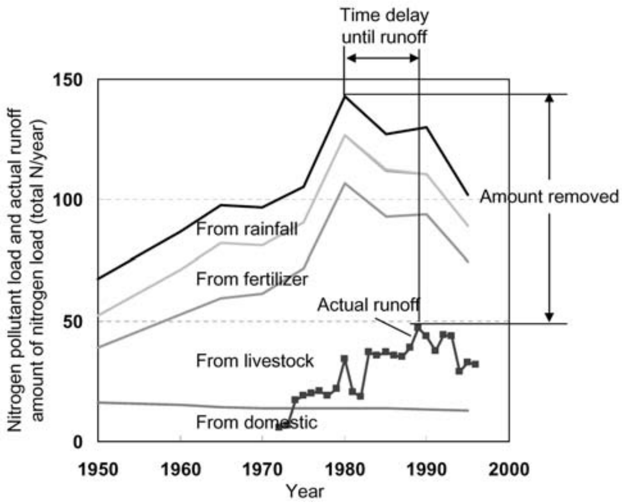


Fig. 3 Method for estimating nitrogen load according to pollutant load source in a catchment basin (VI-1)

Table 1 Makeup of Revised Manual

Ⅰ	Basics of Agricultural Environment Monitoring
Ⅱ	Watershed Environment Survey Methods
Ⅲ	Survey Methods for Watershed Load Sources
Ⅳ	Water Advection Survey Methods
Ⅴ	Pollutant Matter Behavior Survey Methods
Ⅵ	Watershed Water Quality Assessment Methods
Ⅶ	Assessment of Water Environment Using Biota
Ⅷ	Information for Water Environment Conservation

3. Simple Measurement of Cadmium Concentration in Unpolished Rice and Soil Using the Immunochromatographic Assay Method

Introduction

At its July 2005 session, the Codex Alimentarius Commission adopted international standards for cadmium (Cd) concentrations in foods including wheat (0.2 ppm), peeled potatoes (0.1 ppm), and vegetables (0.2 to 0.05 ppm). In July 2006, a new standard of 0.4 ppm was adopted for polished rice. It is anticipated that Japan's standards for domestic agricultural produce will be toughened. This creates a need to monitor pre-harvest Cd concentration to prevent the distribution of polluted foods, and otherwise manage risk at production sites, and that necessitates the development of fast and simple analysis methods that can yield results one or two days after sampling, and can be used by agricultural technicians on site. Under present circumstances, analyses are time-consuming and costly due to the need for complicated procedures such as acid digestion or organic solvent extraction, and expensive precision analytical instruments such as ICP spectrometry or atomic absorption equipment.

Recently the Kansai Electric Power Group developed a Cd detection kit for rice, which uses a technique for immunological measurement called the immunochromatographic assay method. This kit is a test-paper type that uses the antigen-antibody reaction of the Cd-EDTA complex and the anti-Cd-EDTA antibody, which reacts specifically with it, and can detect Cd in concentrations of at least 0.01 mg L^{-1} from the extent of coloration. The immunochromatographic assay method is mainly used as a qualitative analysis method to determine whether a target substance is above a certain level or not. A familiar example of it is the pregnancy test. Because antigen-antibody reactions themselves are quantitative, it is conceivably possible to a certain extent to estimate concentration by reading coloration with an instrument and comparing it with a reference liquid. In this research, we explored methods of estimating the Cd concentration in unpolished rice using this kit, and examined the possibility for its use in quick and simple determinations for contaminated rice, with the assumed users being agricultural extension agencies and others who do not have precision analytic instruments or other such equipment.

Measuring the Cd Concentration in Unpolished Rice Using the Immunochromatographic Assay Kit

The immunochromatographic assay kit (made by Kansai Electric Power) comprises a process for extracting and refining the Cd from unpolished rice, and an immunochromatographic assay component. Detection follows the procedure illustrated in Figure 1.

Preteatement (Cd extraction and purification): Add 20 mL of 0.05 mol L-1 hydrochloric acid solution to a 2-g sample of powdered and dried unpolished rice, shake for 1 h, and then filtrate. To remove heavy metals (such as Mn, Zn, and Cu) that exhibit cross-reactivity with Cd and interfere with the antigen-antibody reaction, allow 5 mL of this filtrate to pass through an interfering substance removal column and adsorb the Cd into the column. Wash interfering substances out of the column by adding 5 mL of 0.1 mol L-1 hydrochloric acid solution to the column, then add 5 mL of 0.05 mol L-1 nitric acid solution to elute the Cd. The interfering substance removal column contains silica gel coated with a chelating

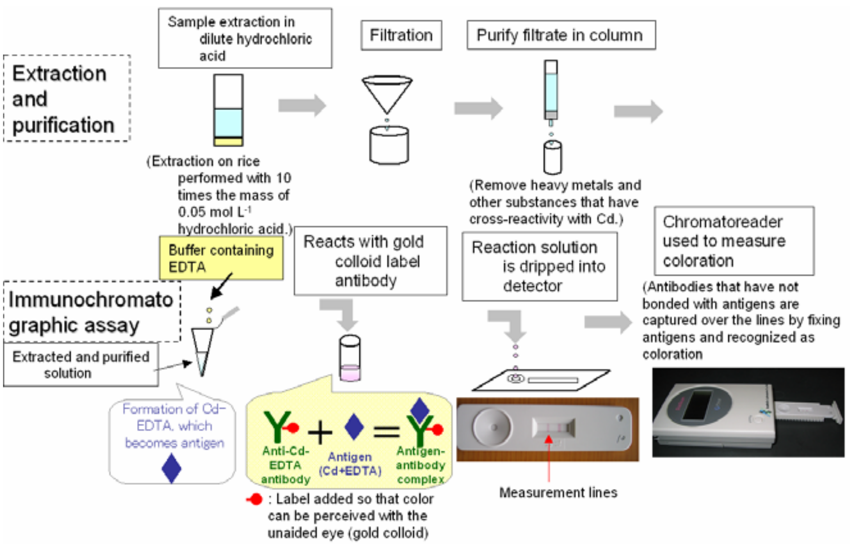


Fig. 1 Procedure to detect Cd in unpolished rice using the immunochromatographic assay kit

agent that specifically adsorbs Cd.

Detection by immunochromatographic assay: Mix 380 µL of EDTA buffer solution with 20 µL of the pretreated solution, and allow 100 µL of the mixture to react with a gold colloid label antibody. Drop 75 µL of that into the immunochromatography detection device, wait 40 to 50 min for coloration to stabilize, and measure the extent of coloration with a chromatoreader.

Figure 2 presents the results of coloration extent measurements made by performing immunochromatographic assays on pretreated solutions of unpolished rice with various concentrations of Cd, and on Cd reference solutions. Coloration readings corresponding to Cd concentrations assume a sigmoid curve, which is usual for the antigen-antibody reaction, and in the Cd concentration range from 0.01 to 0.1 mg L^{-1}, there was a good linear relationship between the logarithmic values of Cd concentrations and our readings. Thus, we found that it is possible to create a calibration curve (exponential equation) using 0.01 to 0.1 mg L^{-1} Cd reference solutions, and from the coloration readings calculate the Cd concentration of an extracted and purified solution.

Figure 3 plots the relationship between unpolished rice Cd concentrations quantified by a precision analysis (acid digestion and inductively coupled plasma mass spectroscopy (ICP-MS)) and Cd concentrations in unpolished rice calculated by the immunochromatographic assay method. We obtained a good regression with a slope of about 1.

Table 1 shows the spread in Cd concentrations obtained when using the immunochromatographic assay method to measure samples with concentrations near those of the international standard (0.4 mg kg^{-1}) and the Japanese standard (1.0 mg kg^{-1}), and reference samples (NIES CRM Nos. 10a and 10b). No. 10-a, which has an extremely low concentration, was higher in all runs than the certified value, but Sample 10-b and Sample I, for which runs were all near the international standard (0.4 mg kg^{-1}), were distributed in the range of 80 to 120% of the known concentration. Judging by these results, it is possible to use the Immunochromatographic Assay Kit for roughly determining Cd concentrations of unpolished rice in the field if measurements are repeated a number of times.

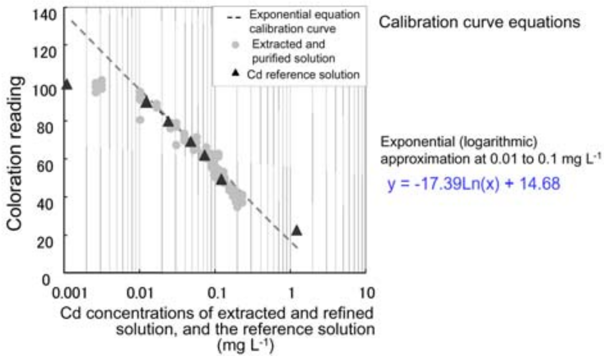


Fig. 2 Calibration curve for exponential equation approximations. Coloration readings are shown with an attenuation rate in which 0.001 mg L^{-1} is 100.

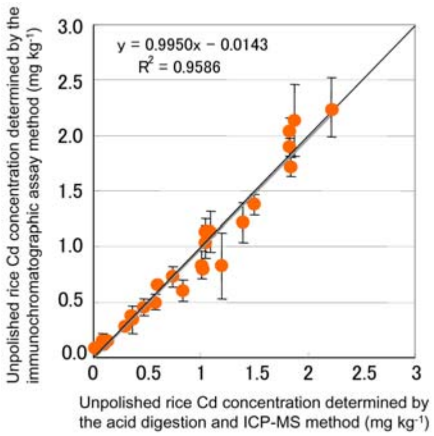


Fig. 3 Comparison of unpolished rice Cd concentrations determined by the immunochromatographic assay method (pretreatment + immunochromatographic assay) and the acid digestion and ICP-MS method. Immunochromatographic assay values are the averages of three runs.

Table 1 Distribution of Cd concentration values measured in unpolished rice samples (reference samples and samples close to concentrations of standards) using the immunochromatographic assay method in comparison with certified or ICP-MS measured values. Average value ± standard deviation.

	Certified values or ICP-MS measured values (mg kg^{-1})	Immunochromatographic assay method (mg kg^{-1})
NIES CRM No.10-a	0.023±0.003*	0.065±0.017
NIES CRM No.10-b	0.32±0.02*	0.31±0.05
Sample I	0.47	0.47±0.05
Sample II	1.05	0.98±0.22

* certified values

Points to Keep in Mind When Measuring Cd Concentration with the Immunochromatographic Assay Kit

This method can be used as a simple and quick means of approximating Cd concentration but because of the average 14% (2 to 41%) coefficient of variance in measurements of unpolished rice Cd concentration, a close examination using precision analysis is needed to determine, for example, whether a sample near a standard value meets the standard.

Additionally, we are now investigating whether this immunochromatographic assay kit can be used for soil Cd concentration measurements as well. The Agricultural Land Soil Pollution Prevention Law requires that soil Cd concentration be determined by extracting Cd from the soil using 0.1 M hydrochloric acid, which means there will be problems with Cu and other interfering elements, but it appears that if a column is used for purification as with unpolished rice, comparatively precise measurements can be made. (K. Abe)

4. Decreasing Dieldrin Residue in Cucumbers by Using Low-Absorption Rootstock

Introduction

Dieldrin (Fig. 1) is one of the 12 substances regulated by the "Stockholm Convention on Persistent Organic Pollutants" (Stockholm POPs Convention) (adopted in 2001, entered into force in 2004), and in the past was widely used on agricultural land in Japan as an insecticide (registered in 1954, registration lapsed in 1975). Dieldrin is very stable in the environment, with a reported half-life in soil between 5 and 25 years. As such, once it is added to the soil, it does not easily decompose, and it remains in farmland even now, over 30 years since its use was discontinued in Japan. Dieldrin levels exceeding the residue standard were recently detected in cucumbers produced in several regions. This discovery attracted public concern as a matter that weakens confidence in “food safety;” producers were obliged to take urgent measures such as discarding cucumbers, and testing cucumbers and soil for the residues.

To avoid such problems, we compared the absorption of dieldrin in soil by various cultivars using cucumbers grafted with squash rootstock, and examined the effectiveness of reduction of residual dieldrin in cucumbers using various low-absorption cultivars.

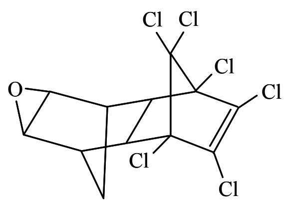


Fig. 1 Chemical structure of dieldrin

Differences Among Cultivars in the Absorption of Dieldrin by Grafted Cucumbers

Most cucumbers in Japan are grown with grafted vines using squash rootstock. Thus, when looking for cultivars that absorb less dieldrin, one must examine both the squash rootstock and the cucumber scion. Before the grafting test, therefore, we used soil contaminated with dieldrin to grow young plants of 10 squash cultivars commonly used as rootstocks for growing cucumbers, and of 23 cucumber cultivars used as scions. Dieldrin concentrations in their shoots were compared (Fig. 2). We found that for the squash plants used as rootstock and the cucumber plants used as scions, there were two- to three-fold differences in the absorption of soil dieldrin among cultivars. Judging from this result, taking advantage of inter-cultivar differences in absorption ability appears to offer hope for reducing contamination.

Which Controls Dieldrin Absorption — Rootstock or Scion?

To offer “low-absorption cultivars” for the production of grafted cucumbers using squash rootstock, one must determine whether the dieldrin absorption of the grafted plant is controlled by the squash rootstock or the cucumber scion. To test this, from among the tested cultivars (Fig. 2) we chose three squash rootstock cultivars (from largest to smallest absorption: Shintosa-1gou > Hikaripower-gold > Yuyuikki-black) and two cucumber scion cultivars (Sharp 1 > Natsubayashi), all with different dieldrin absorptions. These were used to make grafts with all six possible scion/rootstock combinations, which were cultivated in pots containing two types of soil with residual dieldrin. Dieldrin concentrations of the resulting cucumbers were compared (Fig. 3).

Dieldrin in the cucumbers of the grafted plants increased or decreased in both the Sharp 1 and Natsubayashi cucumber scion cultivars in accordance with the squash rootstock cultivar used. From largest to smallest concentrations, the squash cultivars were Shintosa-1gou > Hikaripower-gold > Yuyuikki-black. This order matches that of the dieldrin absorption ability of rootstock cultivars (see Fig. 2). The dieldrin absorption of grafted plants was influenced little by differences in scion cultivars but greatly by rootstock cultivars. Therefore, the selection of low-absorption rootstock cultivars is important for reducing the concentration of dieldrin in grafted cucumbers.

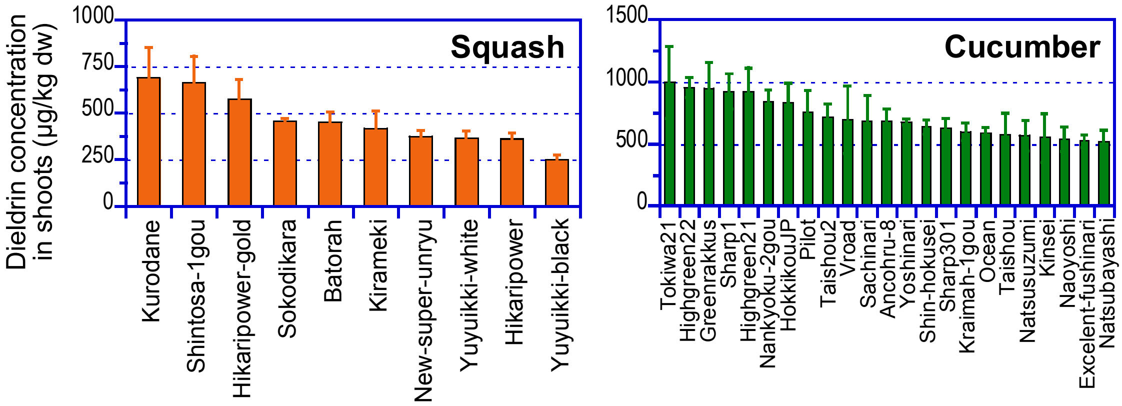


Fig. 2 Inter-cultivar differences in shoot dieldrin concentrations of squash (rootstock) cultivars and cucumber (scion) cultivars. Error bars indicate standard deviations (*n*=3).

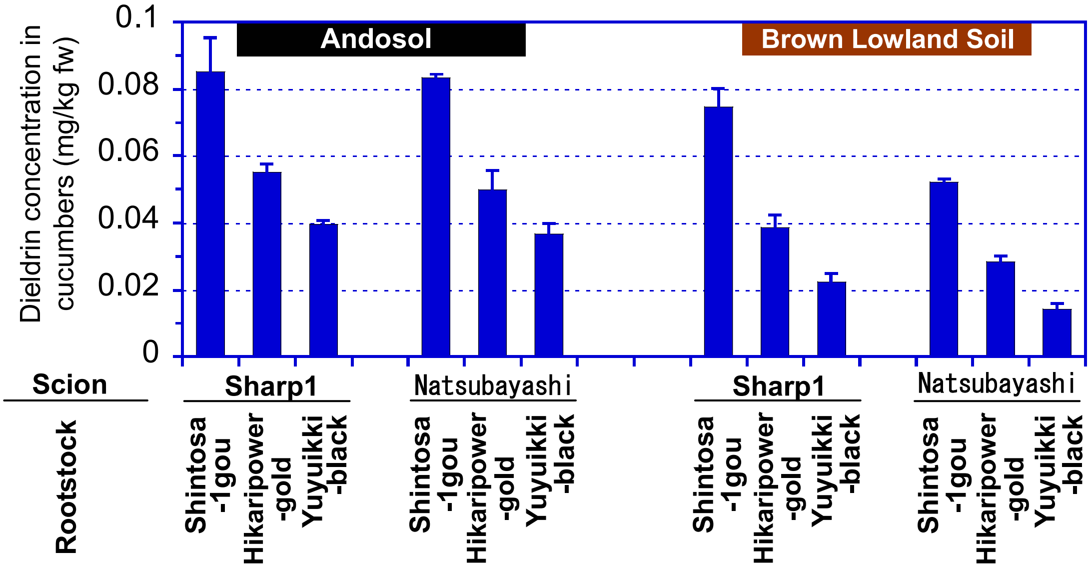


Fig. 3 Influence of rootstock cultivar difference on dieldrin concentration of grafted cucumbers. Error bars indicate standard errors (*n*=3).

Reducing the Concentration of Dieldrin in Cucumbers with Low-Absorption Rootstock Cultivars

Although the test results presented here are from cultivation in pots, when using low-absorption rootstock such as the Yuyuikki-black, the dieldrin concentration in cucumbers was about 30 to 50% lower than when using high-absorption rootstock, no matter which scion cultivar was used (Fig. 3). Currently, regional agricultural research agencies are conducting local demonstration testing on the effectiveness of reducing the concentration of dieldrin in cucumbers by using low-absorption rootstock cultivars. This is a promising technique that can reduce the dieldrin contamination of cucumbers without requiring extra cost or labor, and it is hoped that it will be included in prefectures' manuals of measures to cope with agricultural problems.

This work was supported in part by a Grant-in-aid (Hazardous Chemicals) from the Ministry of Agriculture, Forestry and Fisheries of Japan. (T. Otani and N. Seike)

5. "The Invasive Alien Species" Golden Mussel Has Broadened Its Distribution to About Half of the Lake Kasumigaura Shore

The Golden Mussel, a Invasive Alien Species

Exotic organisms are not originally present in a certain region, but invaded from another region mainly due to human activity. The Invasive Alien Species Act gives the designation of "Invasive Alien Species" to exotic organisms from other countries especially which have (or may have) a seriously harmful impact on ecosystems and human livelihoods. The Invasive Alien Species Act regulates importation, keeping, transport, and other actions for such organisms.

The golden mussel is a bivalve species designated as a Invasive Alien Species. It is a native to China, and is known for the heavy damage on natural environments and human livelihood (Fig. 1).

Fig. 1 Photograph of golden mussels attached to a rock from the western shore of Lake Kasumigaura

The Golden Mussel Has Invaded Lake Kasumigaura!

The invasion of the golden mussel into the Kiso-Nagara-Ibi River system and Lake Biwa-Yodo River System was confirmed in the 1990's, and reports began to emerge on damage to various water facilities. Starting in the second half of the 1980's, there were reports that golden mussels were mixed into shipments of live Asian Clams (*Corbicula fluminea*) imported from China; it is therefore likely that the golden mussel invaded Japan via these shipments. Since 2000, the presence of the golden mussel has been newly confirmed in prefectures outside of Western Honshu, such as Aichi, Gunma, and Shizuoka prefectures. In November 2005, someone discovered a large number of golden mussels attached to net pens in Lake Kasumigaura in Ibaraki Prefecture.

Lake Kasumigaura is Japan's second-largest lake after Lake Biwa, and its water is used mainly for tapwater and agricultural water supplies throughout the large Kanto region. It is possible that the golden mussel will have a serious impact on such water utilization facilities connected with Lake Kasumigaura. However, the discovery was recent, and almost nothing was known of the golden mussel's ecology in the lake prior to that. The National Institute for Agro-Environmental Sciences (NIAES) therefore surveyed the distribution of the golden mussel in Lake Kasumigaura and estimated the time of its invasion.

The Golden Mussel Has Already Broadened Its Distribution to Half of the Lake Kasumigaura Shore

From June to September 2006, we performed a habitat survey of the golden mussel in 90 locations along the shore of Lake Kasumigaura at depths of under 1 m; we used techniques such as looking for them visually under rocks, and searching on underwater embankments by manually feeling for them. This survey confirmed their presence at 41 locations, mainly along the shore in the lake's western part (Fig. 2). We found many golden mussels on concrete embankments and under rocks (Fig. 3), and the highest concentration was a survey site at Hasamado in Ami Town, Inashiki County. At this location, one survey member was able to collect 152 golden mussels in 10 min. Judging by the distribution and density data for the entire lake, the mussel's habitat range is expanding outward from the lake's western area. When considered in the light of golden mussel growth rate data obtained in the past, the present size of the golden mussels inhabiting the lake suggests that they invaded the lake no later than 2004.

This survey was conducted only in parts of Lake Kasumigaura that are shallower than 1 m, while the lake has an average depth of 4 m and a maximum depth of 7 m. Reports from past research say that golden mussels establish themselves in the greatest density at the depth of 6 m. The mussel's actual distribution may have a greater extent than indicated in Figure 2.

It is known that in part of the area belonging to the Lake Kasumigaura system, golden mussels that invaded irrigation water facilities have already caused damage such as plugging water distribution pipes. Areas where the golden mussel is distributed will require caution, for example when moving fishing equipment and operating irrigation facilities. Especially in the vicinity of areas where this species is found in high density, it will perhaps be necessary to take measures of some kind to pre-

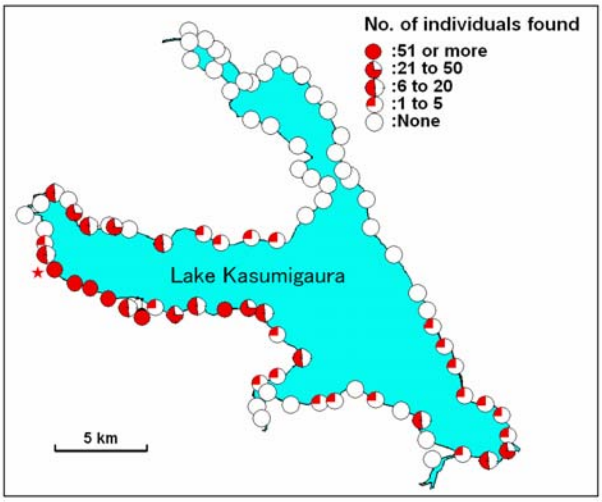


Fig. 2 Distribution of golden mussels in Lake Kasumigaura. The survey was performed by having one person look for mussels for 10 min at each survey location. Circles identify survey locations, and the more individuals found, the more each circle is filled in. The star identifies the location where the most individuals were found.

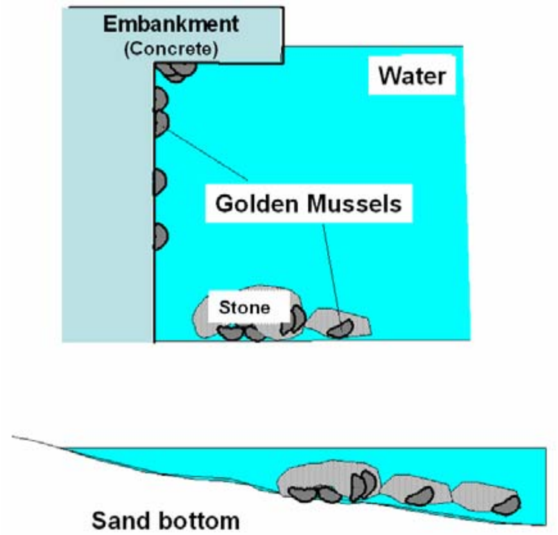


Fig. 3 Diagrams showing where golden mussels were found on concrete embankments (above) and sandy beaches (below)

vent the spread of golden mussels, such as restricting the movement of fishing gear and aquatic products. (K. Ito)

6. Low Possibility of Hybridization Between Genetically Modified Soybeans and Wild Soybeans in Cultivated Fields

Introduction

Genetically modified (GM) soybeans with tolerance to herbicides are being grown in more and more areas throughout the world for reduction in labor and cost in weed management and so on. Although GM soybeans are currently not commercially grown in Japan, an ancestor species, the wild soybean (*Glycine soja*), grows along rivers, in vacant lots, and other places in Asian countries such as China, South Korea and Japan (Fig. 1). It is concerned that they might hybridize with wild soybeans growing nearby if GM soybeans were grown. However, soybeans and wild soybeans are strongly disposed toward fertilization within the same flower (autogamy), making for a very low possibility of fertilization by pollen moving to another flower (allogamy). Further, because the plants flower at different times, it follows that natural hybridization of GM and wild soybeans would occur with difficulty.

Two Conditions Used to Facilitate Hybridization

In this experiment, we set up conditions in an experimental field under which hybridization between GM and wild soybeans could easily occur. (1) GM and wild soybeans were planted next to one another so that in the summer, the climbing wild soybeans entwined around the GM soybeans (Fig. 2). (2) To make the flowering periods overlap more, we planted GM soybeans three times. As a result, flowering overlapped 25 to 32 days. The combination in which GM soybeans were planted on July 20 brought both species' full-bloom periods closest together (Fig. 3).

Color and Size of Hybrid Seed

We harvested and inspected a total of 32,502 wild soybean seeds, and found one that was a hybrid with the GM soybean. This hybrid seed was found from among the 11,860 seeds yielded when GM soybeans were planted on July 20 (Table). We cultivated this hybrid seed, some characteristics such as size of pods/seeds and the color of seeds were between GM and wild species (Fig. 4).

Conclusion

There have been reports of natural hybridization between non-GM soybeans and wild soybeans, but this is the first instance that GM soybeans were used. These results show that if GM soybeans are cultivated in Japan, it is possible they would naturally hybridize with wild

Fig. 1 Wild soybeans entwined around tall goldenrod (Tsukuba, Ibaraki)

Fig. 2 A wild soybean entwined around a GM soybean (August 31, 2005)

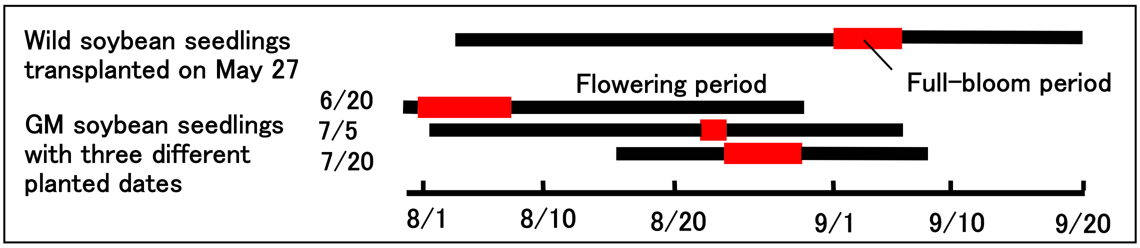


Fig. 3 Comparison of flowering periods of GM soybean planted at three different dates and wild soybeans transplanted on May 27

Table The number of total and hybrid seeds in wild soybean in hybridization test with GM soybean

GM soybean seeds planted dates	6/20	7/5	7/20	Totals
The number of seeds of wild soybean	7,814	12,828	11,860	32,502
The number of hybrid seeds in wild soybean	0	0	1	1

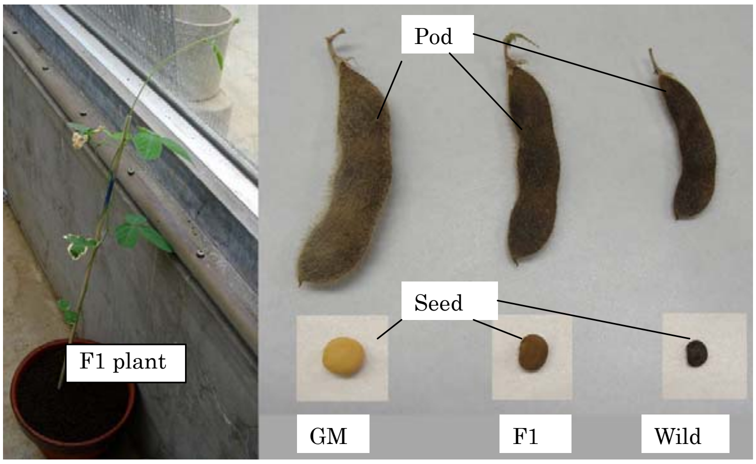


Fig. 4 Hybrid of GM and wild soybeans obtained in this test (left), and pods and seeds of GM, hybrid and wild soybeans

soybeans growing naturally nearby. However, considering that only one hybrid seed was obtained by artificially overlapping the two species' flowering periods and also growing them very close to one another, as in this experiment, this clearly shows that the possibility of hybridization in nature between wild soybeans and GM soybeans is extremely low. (Y. Yoshimura, K. Matsuo and A. Mizuguti)

7. Environmental Characteristics of Irrigation Ponds as Dragonfly Habitats

As alternatives to wetlands in the floodplains of rivers, paddy ecosystems are important habitats for aquatic organisms. In Japan many freshwater species inhabit irrigation ponds: for example, about half of the species of freshwater plants and of dragonflies depend on these ponds. The irrigation ponds that supply water to rice paddy fields were constructed mainly in the Edo era (from the 17th to 19th centuries), and in the 1950s there were about 300,000 ponds. However, because of agricultural development and urbanization the number of irrigation ponds has rapidly decreased and the environmental quality for the organisms inhabiting the ponds has declined. Consequently, the abundance of many pond-dwelling species has been reduced, and some species are endangered. To conserve the organisms living in the ponds we need to gain an understanding of the environments in which these organisms thrive. We therefore investigated the relationship between pond environment and the species composition of dragonflies, as a representative organism found in the ponds. The study sites were about 70 ponds located to the southeast of Mt. Tsukubasan in Ibaraki Prefecture. We surveyed the species and abundance of dragonflies in the study ponds, the environments within the ponds, and the land uses around the ponds. Land use was analyzed by a geographic information system (GIS). The data obtained were analyzed by multivariate analysis.

A total of 41 dragonfly species were recorded at the study sites. The number and composition of these species varied among the ponds. A cluster analysis was performed to classify ponds with similar species compositions into the same groups; the analysis produced six pond groups (Table 1). In addition, an indicator species analysis (INSPAN) was performed to determine the indicator species (species representative of each pond group), and four to nine indicator species were statistically selected for each of groups 1, 2, and 4 (Table 1). Groups 1, 2, and 4 had more species of dragonfly than groups 3, 5, and 6 (Table 1).

To characterize each pond group, the study ponds were ordinated by another statistical method, non-metric multidimensional scaling (NMDS) (Fig. 1). The ponds were plotted on a coordinate system the axes of which were correlated with certain environmental variables; thus, ponds with similar characteristics were plotted near each other. The ponds of each group were distributed near each other on the ordination space (Fig. 1), indicating that each group had specific environmental characteristics. Correlation analyses between the two axes and the environmental variables of the ponds gave the following results. The ponds in group 2 were surrounded by forests, and the bottoms of ponds were covered with debris such as dead leaves. The ponds in group 4 were relatively large in area and were surrounded by open space in the form of crop fields and wastelands. These characteristics were consistent with the habitat preferences of the indicator species. The ponds in group 1, however, were distributed around the intersection of the two axes, indicating no distinctive environmental characteristics. The indicator species of group 1 (Table 1) were common dragonflies found in many ponds, a fact that was consistent with this result. The ponds of groups 5 and 6 were characterized by concrete revetment and were considered to be bad habitats for dragonflies, because fewer dragonfly species were found there than in the other ponds and no indicator species were selected from these groups. In contrast, many species inhabited pond groups 1, 2, and 4, so these groups were good habitats for dragonflies. In particular, groups 2 and 4 had different environmental characteristics, suggesting that it is important to conserve the environments of different groups of ponds.

This study revealed the irrigation pond characteristics that provide good environments for dragonflies. To ensure the viability of species and populations of organisms, it is important to make a network of habitats as well as to conserve each habitat. The irrigation ponds sometimes dry up through drought or are drained for desilting; at these times aquatic organisms cannot survive in them. However, if the organisms are able to immigrate from other ponds after the dried ponds have refilled with water, their populations will recover. We are developing methods for analyzing the effect of the spatial distribution of ponds on dragonfly populations. (K. Tanaka, T. Yamanaka, N. Iwasaki, D. S. Sprague and Y. Nakatani)

Table 1 Classification of ponds and indicator dragonfly species representative for each pond group

Group	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Mean no. of species	12.2	11.0	7.3	15.8	6.9	6.0
Indicator species	*Sympetrum infuscatum* *Macromia amphigena* *Orthetrum albistylum* *Pseudothemis zonata*	*Copera annulata* *Orthetrum triangulare* *Mnais pruinosa* *Anax nigrofasciatus*	No	*Cercion calamorum* *Cercion sieboldii* *Ischnura senegalensis* *Ischnura asiatica* *Deielia phaon* *Crocothemis servilia* *Sinictinogomphus clavatus* *Anax parthenope* *Epophthalmia elegans*	No	No

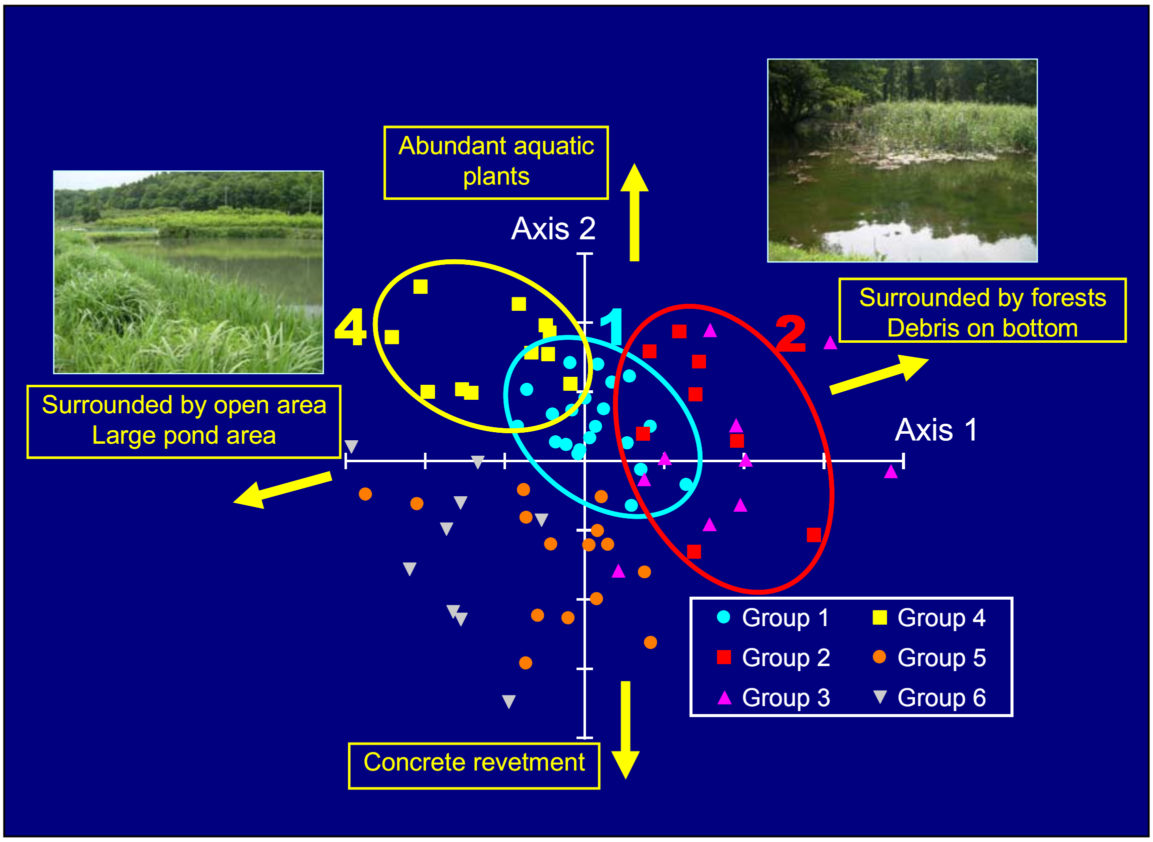


Fig. 1 Grouping of ponds on the basis of dragonfly habitat characteristics.
Circles show the pond groups for which indicator species were selected in Table 1.
Yellow arrows and boxes indicate environmental characteristics.
Photographs show typical ponds in groups 2 and 4.

8. The Smaller Tea Tortrix Moth Exhibits Resistance to Mating Disruptant (Sex Pheromone)

Introduction

Chemicals known as sex pheromones, which induce mating behavior in insects, are used in mating disruptants that serve as environmentally friendly pesticides. These pest control agents do not directly kill insects. Instead, sex pheromones wafting in the air make it difficult for adult male insects to recognize the sex pheromones emitted by adult female insects for mating, thereby preventing adult males from locating adult females of their own species. This effectively reduces opportunities for adult males to mate, and decreases the number of offspring. Because sex pheromones act differently on each insect, this technique can be used to block target insects alone, and therefore makes very environmentally benign insect pest control possible. Further, because mating disruptants using sex pheromones interfere with the species recognition process, developing resistance requires that the ways of species recognition should be changed, and it was therefore believed that the possibilities of such changes are small.

The effective ingredient of mating disruptant is (Z)-11-tetradecenyl acetate (Z11-14:Ac) has been used to control the smaller tea tortrix moth (*Adoxophyes honmai*) (Fig. 1), but its effectiveness has plummeted, and in 1996 this was reported as the world's first instance of mating disruptant resistance. To develop mating disruptants that do not cause resistance, we are conducting research to

Fig. 1 The smaller tea tortrix moth. Adult male on left, adult female on right.

Fig. 2 The mating disruptant formulation using sex pheromone, placed in tea bushes

determine what causes the expression of resistance.

The mating disruptant formulation is a tube-like object folded in two (Fig. 2). These are placed throughout a whole tea field at intervals of 1.5 to 2 m. The sex pheromone components are sealed into a polyethylene tube or other container so that they are slowly released over a period of several months.

Selection of Insect Strain with Resistance to Mating Disruptant

We collected many smaller tea tortrix moth from a tea field in Shizuoka Prefecture where resistance has been reported. Into a container that contained a mating disruptant (Z11-14:Ac) in high concentration, we put adult males and females, allowed them to mate, and collected the eggs. The insects born from these eggs would be descended from insects that can mate even in the presence of high-concentration of the mating disruptant. The offspring were raised on artificial food and became adults in about one month. We repeatedly raised insects in the same way and selected insects that can mate even under conditions of higher mating disruptant concentration. Our test was conducted by releasing 10 male and 10 female adult smaller tea tortrix moth into 1-L glass containers into which we had put mating disruptant (Z11-14:Ac), then checking to see what percentage of them were able to mate. The higher the mating rate at the same concentration, the greater the insects' resistance. Just after collecting moths from the field, about 60% of them were able to mate at a concentration of 0.001 mg/L, however, total interference occurred at 0.1 mg/L. The same held true until the 35th generation after selection. In the 46th generation, about 80% of the moths were able to mate at a concentration of 0.1 mg/L, and the mating rate did not show much decline even if the concentration was raised. Even at 1 mg/L, at least 60% of the moths could mate (Fig. 3). Because the strength of this resistance remained unchanged for 4 years after this selection, it was clear that the insects had gained resistance to the mating disruptant.

Attraction of Mating Disruptant-Resistant Insect Strain in an Indoor Wind Tunnel

Sex pheromone components needed to attract the smaller tea tortrix moth are the two substances, (Z)-9-tetradecenyl acetate (Z9-14:Ac) and Z11-14:Ac (mixed in a 7:3 ratio). The pheromone has no attractive power without one of these components. We used an indoor wind tunnel (30 cm in diameter and 2 m long) to investigate the reactivity to sex pheromone components of adult males from a standard strain having no resistance and from the resistant strain (R strain). Adult males from the standard strain (blue) reacted well to a sample of the binary mixture of Z9-14:Ac and Z11-14:Ac (Fig. 4, left), but did not react to a sample of only Z9-14:Ac without Z11-14:Ac (Fig. 4, right). However, adult males from the R strain (red) reacted strongly to the sample of only Z9-14:Ac without Z11-14:Ac (Fig. 4, right). This

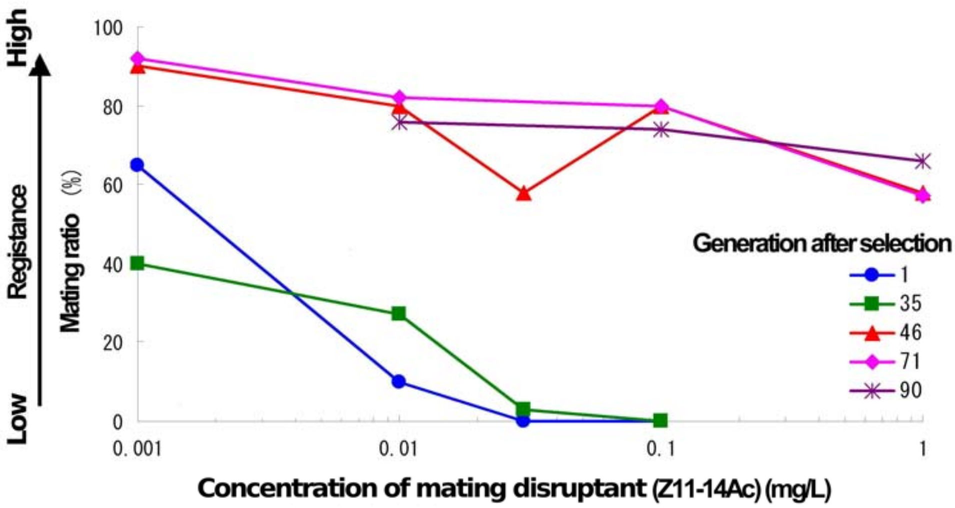


Fig. 3 Acquisition of strong resistance to the mating disruptant

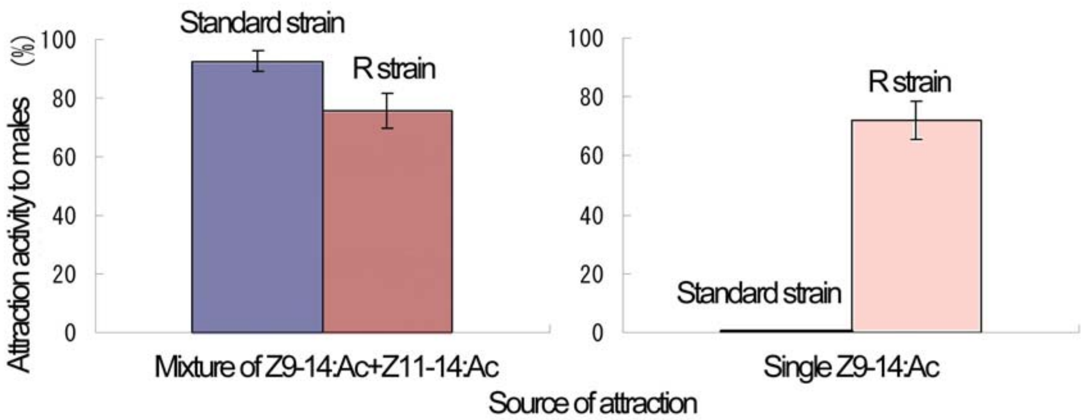


Fig. 4 Reactivity of adult males to sex pheromone components

means that R-strain adult males had gained an unexpected character.

Reason for Resistance to the Mating Disruptant

When the atmospheric concentration of the mating disruptant (Z11-14:Ac) is high, it interferes with the sex pheromone signal released by adult females, making it difficult for adult males to find adult females. However, because R-strain adult males do not need Z11-14:Ac as a sex pheromone signal, they are less susceptible to the mating disruptant. This appears to be one reason for the manifestation of resistance to the disruptant.

Conclusion

It is conceivable that there was in the field a very small number of adult male smaller tea tortrix moth that can locate adult females without Z11-14:Ac, and that owing to the continued use of Z11-14:Ac as a mating disruptant, the percentage of adult males with this character gradually increased, and resistance to mating disruptants appeared. Future use of sex pheromones for insect control through mating disruption will require periodic examination of resistance. (H. Sugie and J. Tabata)

9. Enhancement of Rice Plant Canopy Photosynthesis by Elevated Atmospheric CO_2 Concentration Is Dependent on Leaf Nitrogen Concentration

Introduction

Atmospheric CO_2 concentration is now 380 ppm and rising, and is predicted to reach between 540 and 970 ppm by the end of this century. Rising atmospheric CO_2 concentration will conceivably have a major influence on crop production. Especially the influence on production of rice, which is a staple food for about one-half of the world's population, is important from the perspective of a stable food supply. This makes it necessary to accurately predict the future amount of rice production.

It is known that rising CO_2 concentration promotes photosynthesis of a single-leaf in upper layer of rice canopies, but the extent gradually declines as plant growth proceeds. However, it is not clear whether enhancement of total photosynthesis of rice plant canopies, which consist of many individual leaves, declines in conjunction with growth. Because a simple integration of single-leaf measurements does not adequately explain the canopy responses and influences on canopy photosynthesis are directly linked to the growth rate of rice plant, they are one cause of uncertainty in predicting future rice plant production. This research was conducted to determine if the enhancement of canopy photosynthesis by elevated CO_2 concentration declines as it does in individual leaves, and if so, to find the causes.

Response of Canopy Photosynthesis to Elevated CO_2 Concentration

We used six controlled-environment chambers (Fig. 1) in the National Institute for Agro-Environmental Sciences to grow rice plants (the "Nipponbare" cultivar) for three years under two conditions: current atmospheric CO_2 concentration (380 ppm) and elevated CO_2 concentration (680 ppm). By continuously measuring the CO_2 balance in each of these controlled-environment chambers, we calculated the daytime photosynthetic rates and nighttime respiration rates of the rice plant canopies.

This experiment revealed, for the first time on the canopy level, that the canopy photosynthesis enhancement rate due to elevated CO_2 concentration was highest in the initial growth stage, and gradually declined as growth proceeded (Fig. 2). On the other hand, enhancement rate of canopy nighttime respiration was also highest in the initial stage but does not declined in parallel with that of canopy photosynthesis after then. Because

Fig. 1 Naturally sunlit controlled-environment chambers at the National Institute for Agro-Environmental Sciences. Here it is possible to investigate plant response, canopy photosynthesis and respiration rates, and other things under natural sunlight conditions with controlling the air temperature, humidity, and CO_2 concentration inside the chamber.

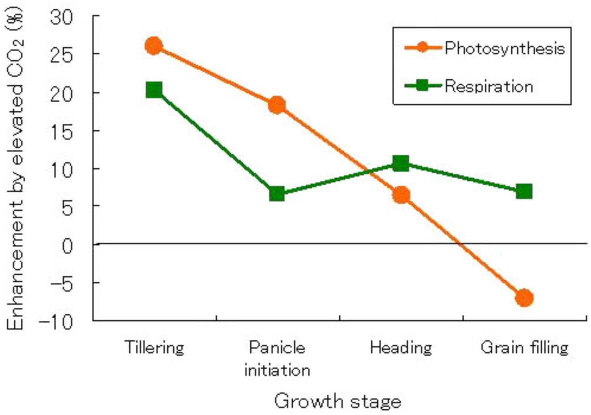


Fig. 2 Changes in the rate at which canopy photosynthesis and respiration are enhanced by elevated CO_2 concentration during rice growth period. Although the photosynthesis enhancement rate by elevated CO_2 concentration gradually declined as the rice plants grew, there was no decrease in the respiration enhancement rate.

rice plant growth rate is determined by the balance of rice plant canopy photosynthesis and respiration, the enhancement rate of rice plant growth due to elevated CO_2 concentration declines as plant growth proceeds.

Reason for Declining Canopy Photosynthesis Enhancement Rate

Generally, the photosynthetic capacity of individual leaves is closely related to leaf nitrogen concentration. We therefore investigated the relationship between canopy photosynthetic capacity (photosynthetic rate per amount of light captured) and leaf nitrogen concentration, and found that there is a curvilinear relationship between them (Fig. 3). Further, we found that the relationship differs according to CO_2 concentration. It is evident from Fig. 3 that when leaf nitrogen concentration was high, the canopy photosynthesis enhancement rate was high, and that as leaf nitrogen concentration decreased, the enhancement rate declined. Because at both CO_2 concentrations, leaf nitrogen concentration declined as growth proceeded, the canopy photosynthesis enhancement rate fell off. Additionally, it was observed that leaf nitrogen concentration of rice plants grown at the high CO_2 concentration was lower than that of rice plants grown at the ambient CO_2 concentration. This phenomenon was also a factor that lowered the canopy photosynthesis enhancement rate. In other words, we found that change in the rice plant canopy photosynthesis enhancement rate can be explained by change in leaf nitrogen concentration, which is in turn governed by progress in plant growth and high CO_2 concentration.

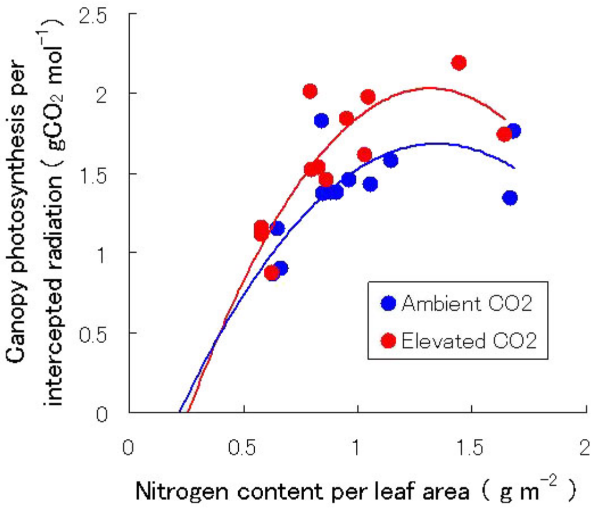


Fig. 3 Relationship between rice plant canopy photosynthetic efficiency and leaf nitrogen concentration, obtained from a 3-year experiment. As the nitrogen content per unit leaf area (leaf nitrogen concentration) dropped, the difference between the two CO_2 concentration groups became smaller. This result implies that the rate at which canopy photosynthesis is enhanced by increased CO_2 concentration declines in tandem with nitrogen concentration, when leaf nitrogen concentrations of rice plants grown under ambient and elevated CO_2 concentration are same.

Conclusion

These results indicate that accurately predicting rice production when CO_2 concentration has risen requires accurately predicting the nitrogen concentration in rice plants (especially leaves) under elevated CO_2 concentration. Also, we expect that nitrogen management is important to develop adaptive cultivation techniques, which take maximum advantage of the "fertilizer" effect of higher CO_2 concentration on rice plant growth. (H. Sakai)

10. Monitoring Spatio-Temporal Changes in Flooding and Rice Cultivation in the Mekong Delta Using Satellite Data

Introduction

Considerable concern exists regarding the effect that changes in climate and future water-resource development in the upper Mekong catchment will have on river stream-flow and how this will impact on agricultural production. In order to predict future Asian food production, it is important to observe both the extant water environment and agricultural land-use changes over a large region, and to understand their dynamic interrelationship. Various types of satellite data have been employed to observe agricultural area and to detect changes in inundated areas. However, the long period of monitoring cycles and low resolution of the former satellite sensor often affect the estimate accuracy of flood expansion and crop growth. We therefore tried using time-series satellite data acquired by MODIS/Terra, which provides high-resolution ground surface reflectance data almost daily. We developed a method for analyzing the spatio-temporal changes in the flooded areas as well as rice growth stage using water and vegetation indexes, which show the status of inundation and plant coverage of the ground surface. Here we describe the results obtained by this method to monitor 5-year flooding and rice-cropping patterns in the Mekong Delta.

The Mekong Delta in Vietnam

Since adopting a market-oriented economy, the production efficiency of Vietnamese agriculture has improved considerably, increasing about 2.3-times to 36.2 million ton in 2004 compared to the 15.9 million t harvested in 1985. The Mekong Delta is located on the southern end of the Indochina Peninsula and produces approximately half of the rice in Vietnam. According to agricultural statistics of UN Food and Agriculture Organization (FAO), Vietnam is the world's second-largest rice exporter after Thailand (3.8 million t in 2003, approximately 13% of the world's total rice exports). Nearly 90% of the rice exported from Vietnam is produced in the Mekong Delta. The Vietnamese rice is consumed in many Asian countries such as the Philippines and Indonesia and so forth. It indicates that the Mekong Delta is an important region for predicting future Asian rice supply.

Determination of Annual Flood Dynamics in the Mekong River

Figure 1 shows the estimated result of the first day, last day, and duration of flooding in the Mekong Delta for the years 2000 through 2004. The results indicate that the duration and the last day of large-scale floods (2000-2002) were longer and ended later than those of small- or middle- scale floods (2003-2004). It was also found that the spatio-temporal distribution of the floodwater, which restricts rice cropping from the rainy season to the early dry season, was uneven in upstream-regions for any given year.

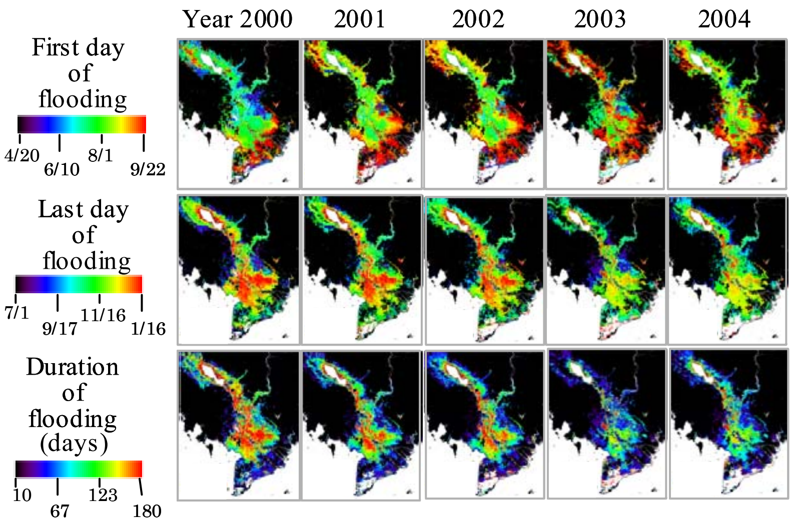


Fig. 1 Estimated first day of flooding, last day of flooding, and flooding period in the Mekong Delta for the years 2000 through 2004

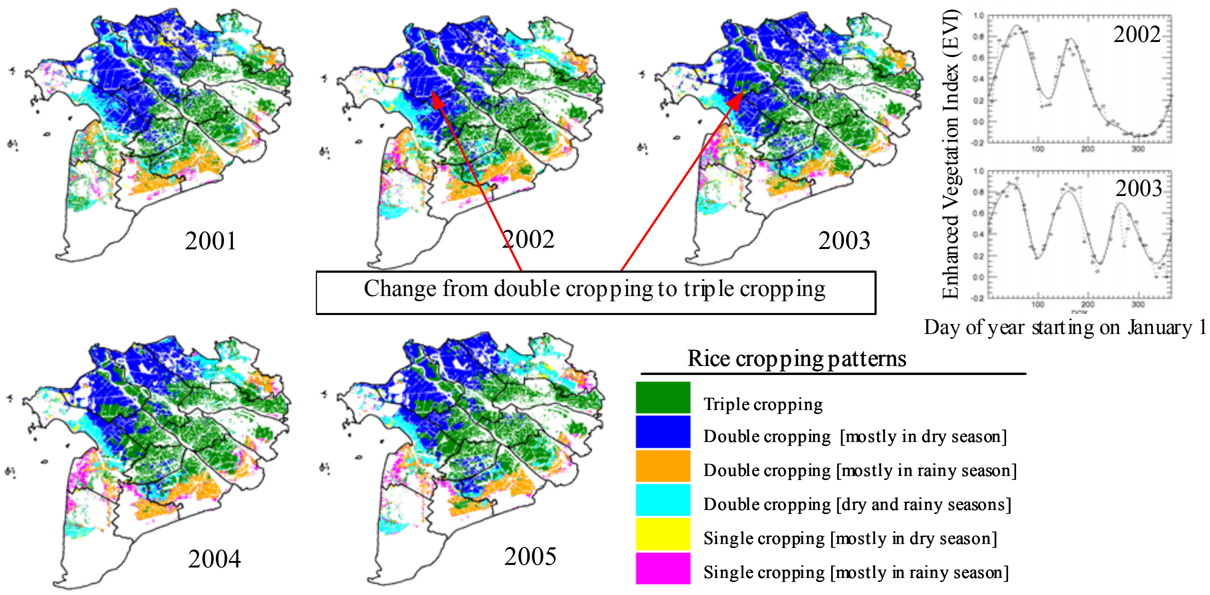


Fig. 2 Estimated rice-cropping patterns in the Mekong Delta in Vietnam. Graphs on the right show the changes in the vegetation index at the locations indicated by the red arrows.

Yearly Changes in Rice-Cropping Patterns

We classified rice-cropping patterns (such as triple cropping or double cropping [mostly in the dry season]), according to the number and timing of peaks in smoothed Enhanced Vegetation Index (EVI) data (Fig. 2, right).

In the upstream-regions (blue areas), the cropping pattern was classified as double rice cropping which is practiced so as to avoid flooding in the rainy season. In the coastal-zone (orange areas), the intrusion of saline water from the sea through the canal network occurs due to decreased river-water flow during the dry season. Since this has a negative effect on rice cultivation in the dry season, the farmers in these areas employ double rice cropping mostly during the rainy season. In the mid-stream region, where neither flooding nor salinity intrusion have serious impacts, there is an extensive triple-cropping region (green areas). These findings show that rice-cropping patterns in the Mekong Delta are very closely related to the amount of water resources, which changes both qualitatively and quantitatively due to the influence of the Asian monsoon. In addition, annual changes in the rice-cropping patterns observed from 2001 through 2005 indicate a pronounced increase in rice production, with midstream and upstream areas changing from double cropping to triple cropping. In the areas where on-site surveys were performed (see arrows in Fig. 2), we found that the construction of new dykes had made it possible to grow rice during the rainy season by protecting the areas from inundation due to flooding.

Conclusion

An annual increase in intensive agricultural production in the Mekong Delta has accompanied the introduction of market-oriented economy, relaxed controls on land use, and the mitigation of flooding events due to renewed development in flood-control infrastructure. The economy has had the effect of changing land use, particularly in coastal areas where rice fields are rapidly being converted into shrimp ponds (white areas in Fig. 1). Such transitions are not restricted to the Mekong Delta, and have also occurred elsewhere in Asia. Consequently, there are concerns that both agricultural production and regional environment will be affected by the rapid land-use changes that have occurred in response to rapid economic development. These changes in the water environment are particularly serious when considered within the context of global warming and the development of water resources. In order to deal with these problems effectively, it is necessary to accurately determine the state of land use through continuous monitoring using satellite data. (T. Sakamoto, N. Ishitsuka, H. Ohno and M. Yokozawa)

11. A Web-Based Illustrated Key to Japanese Species of the Tribe Pilophorini (Hemiptera, Miridae)

Introduction

Many species in plant bug tribe Pilophorini are believed to prey on mites and small insects, and play a role as a natural enemy of mites and other organisms in the natural environment. *Pilophorus setulosus*, the most common species of this tribe, is found in large numbers in agricultural ecosystems, chiefly rural farming districts, and it lives on various deciduous trees. This tribe, especially its largest genus *Pilophorus* Hahn, includes many species that are similar to one another in color and morphology (Fig. 1). Although they frequently turn up in biota surveys and other investigations, there are few illustrated references or other sources that can be used to identify them, and identification has been difficult for people who are not classification experts. For that reason, we prepared and made available an illustrated key, which graphically shows the characters used in identifying species. Thereby, we provided a means of easily identifying these insects.

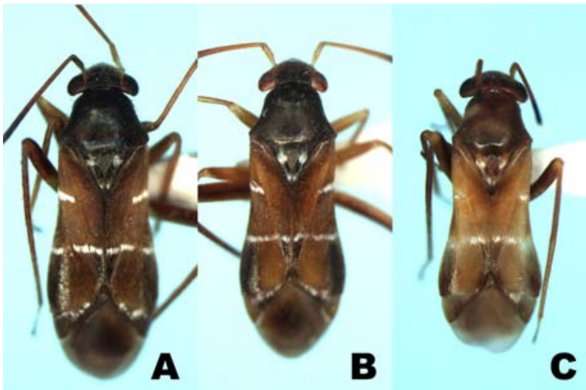


Fig. 1 Three species in the genus *Pilophorus* Hahn. A: *P. setulosus* Horváth, B: *P. erraticus* Linnavuori, *C: P. okamotoi* Miyamoto & Lee.

Tribe Pilophorini

The tribe Pilophorini belongs to family Miridae (plant bug), subfamily Phylinae, and is a comparatively small group with about 150 species known worldwide. Seventeen species have been found in Japan. They are very small bugs ranging in length from 2 to 4 mm. Members of the genus *Pilophorus* Hahn, found among this group, are known for their slim bodies, which are myrmecomorphic. These species have characteristic 2 rows of silvery scale-like setae on hemelytra, and look just like ants whose abdomens have been constricted (Fig. 2). It is said that nearly all the species of this tribe are predatory, but the details of their ecology have yet to be elucidated.

Web-Based Illustrated Key

I created a key to the Japanese species of the tribe Pilophorini which contains 17 species, and I prepared illustrations of useful characters to distinguish the species, like as the arrangement of the scale-like setae. I combined these into an illustrated key of the tribe Pilophorini (Fig. 3) and made it publicly available on the website (http://www.niaes.affrc.go.jp/inventry/insect/ illust_keys/pilophorini/key_pilophorini_e01.html). On the left appears the insect's entire body with arrows showing which part of the body is represented by enlarged images on the right. Users look at the indicated characters and choose which of two options matches the specimen they are trying to identify. Repeating this action leads them to the right species. We have also prepared an English-language version of this page. Presently, it is just a key for identifying species, but there are plans to enhance it with explanations and images of each species. (Y. Nakatani)

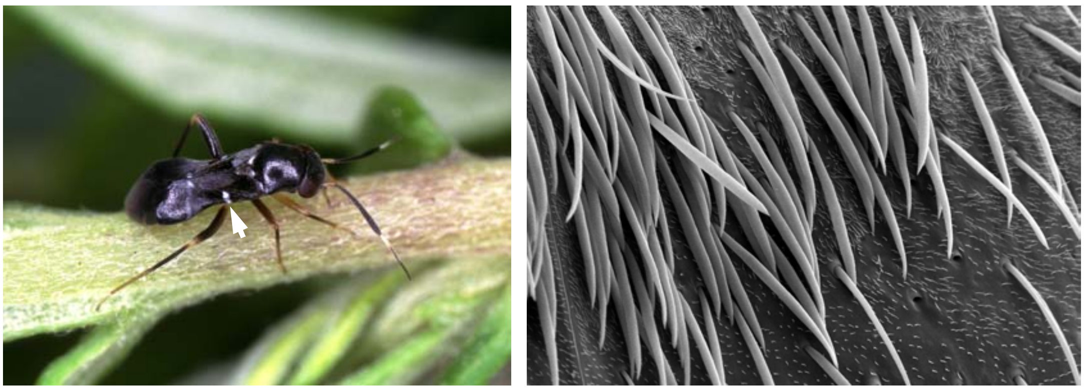


Fig. 2 Left: *Pilophorus typicus* adult (arrow shows a row of silvery scale-like setae).
Right: SEM image of silvery scale-like setae.

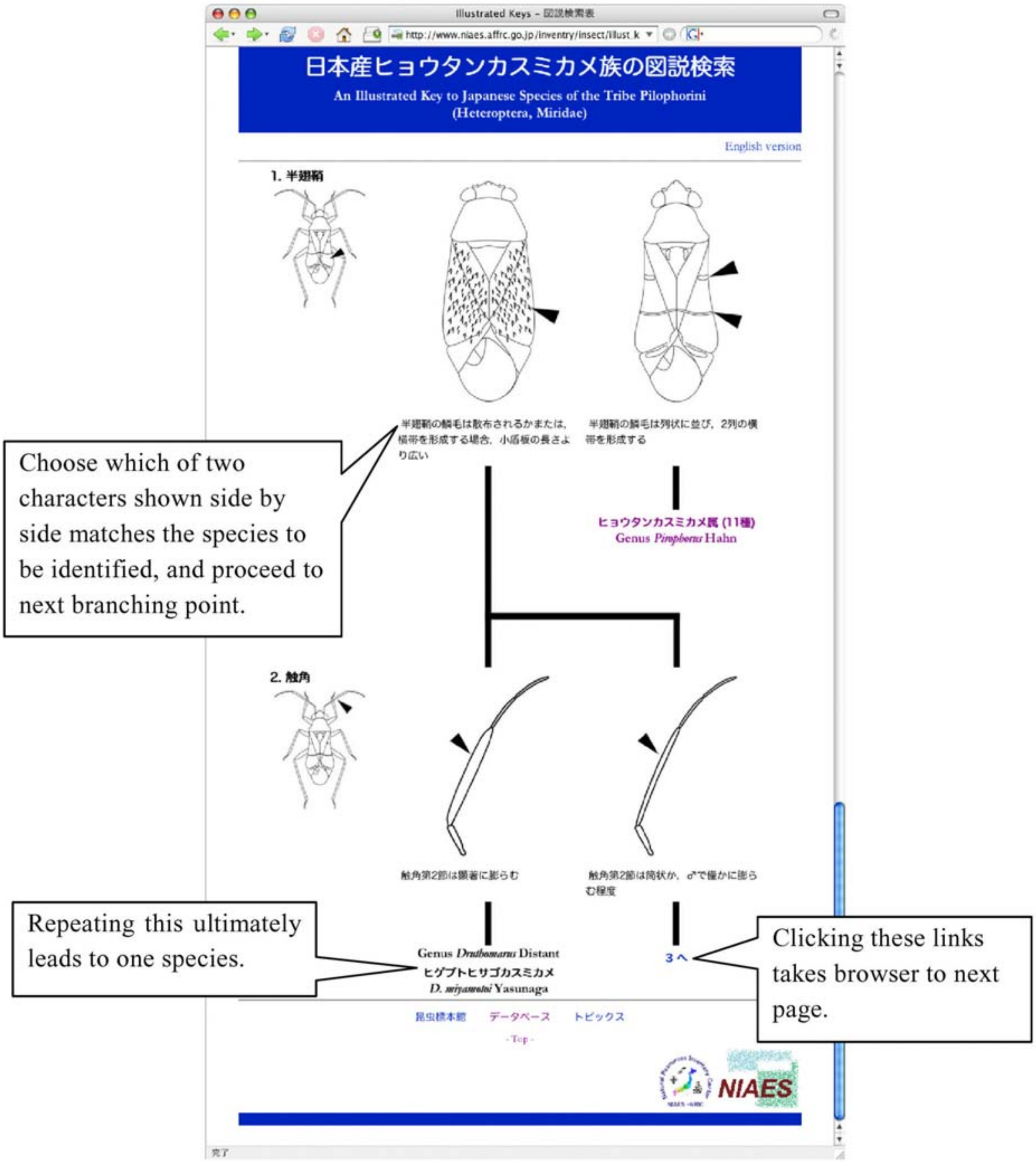


Fig. 3 Screen shot of tribe Pilophorini illustrated key. Users choose which of two characters shown side by side matches their species and proceed to the next branching point. Repeating this ultimately leads to one species.

Major Symposia and Seminars

1. International Workshop on Development of Database (APASD) for Biological Invasion

The workshop was held from 18 to 22 September 2006 at Taiwan Agricultural Chemicals and Toxic Substances Research Institute (TACTRI), Taichung, Taiwan, Republic of China (ROC), sponsored by Food and Fertilizer Technology Center (FFTC), for the Asian and Pacific Region, National Institute for Agro-Environmental Sciences (NIAES), Japan, Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ), TACTRI, Council of Agriculture, ROC. Countries represented were Cambodia, Japan, Malaysia, the Philippines, Taiwan, Thailand, and Vietnam.

Introductions of invasive alien species (IAS) to the Asia–Pacific region have recently increased along with increases in global trade and human travel. Many plants, animals, and microbes have invaded countries worldwide, causing great economic damage and having biosafety and ecological impacts. Hence, IAS have become an important global concern, and the need to exchange research and monitoring information among countries in order to prevent the spread and damage these species cause has become vital and more urgent than ever.

Toward this end, the Asian-Pacific Alien Species Database (APASD, http://apasd-niaes.dc.affrc.go.jp/) was introduced by NIAES at an international seminar held in Tsukuba, Japan, in 2003 as a means of facilitating the accumulation and searching of data on IAS. This database seeks to enable the sharing of recent information on invasive alien species among countries in the Asia Pacific region, and to maximize its value it needs to be operated as a regional network in conjunction with existing international databases on IAS.

Since the introduction of APASD in 2003, aspects of the APASD system have been improved and data input has continued. A follow-up workshop held in Taichung, Taiwan, in 2004, aimed to establish a constructive linkage/cooperation mechanism to further build up the database. This 2006 workshop was designed as a follow-up activity to the previous two seminars; the intention was to update the APASD system to make it more functional and user-friendly. This is in line with FFTC's commitment, in collaboration with NIAES, to continue to support the development of the APASD and to organize related programs such as training workshops to improve the functionality of the system for wider use among countries in the region.

During the 2-day paper presentation and discussion, 15 speakers representing seven countries in Asia presented a total of two keynote speeches, three resource papers, two database demonstrations/practical exercises, six country reports, and two institutional presentations. They shared and exchanged information, knowledge, and experiences on the status of the development of the APASD, and they discussed the critical issues concerning IAS in each country, for the following objectives, to determine the status of development of the APASD toward enhancing the sharing of recent information on IAS among countries in the region; to deliberate on the critical issues concerning alien invasive species, with regional scientists providing data and confirming the species to be inputted to the database; to establish a cooperative mechanism to further solidify the building-up of the database; and to discuss and exchange research and monitoring information on IAS and the updating of the APASD system to make it more functional and user-friendly. (K. Hirai)

Photo taken in front of TACTRI, 2006

2. Korea–Japan Joint International Symposium: Nitrogen Behavior and its Effective Management in Agro-Ecosystems

Since FY 2003 NIAES has been running a research project on “Water quality conservation in agro-ecosystems and assessment of risk to the environment”. This project is underpinned by a Memorandum of Understanding forged with the National Institute of Agricultural Science and Technology (NIAST) of the Republic of Korea. On 21 September 2006, the Korea–Japan Joint International Symposium, relevant to the above-mentioned project, was held at the International Technical Cooperation Center of the Rural Development Administration, in Suwon, Korea.

With the ultimate aim of preventing environmental pollution of agro-ecosystems by nitrogen loads attributable to agricultural activity, participants shared information on case studies of technological and political planning in Japan, Korea, China, the United States, and the Netherlands. It was clarified that underground and surface waters are being polluted by the excessive application of nitrogen fertilizers and the disposal of livestock excreta onto agricultural lands. Quantitative evaluation of nutrients that flow out from non-point sources is needed to prepare for their effective management.

Nine speakers gave presentations on the following topics: 1) Keynote lecture: “Status of nitrogen pollution in agro-ecosystems in Korea” (C-H Kim, NIAST, Korea); 2) Keynote lecture: “Nitrogen cycling and environmental conservation agriculture in Japan” (K. Kumazawa, Japan); 3) “Nitrogen management in Korean agriculture” (Y. Lee, NIAST, Korea); 4) “Integrated nutrient management in two cropping systems in China” (F-S Zhang, China Agricultural University, China); 5) “Environmental issues related to nitrogen management practices in the United States” (P. P. Motavalli, University of Missouri, USA); 6) “Nutrient management and water quality protection in EU countries” (O. F. Schoumans, Alterra, the Netherlands); 7) “Prediction of soil nutrient outflow to groundwater by soil water and electrical conductivity sensing” (D-S Oh, NIAST, Korea); 8) “Assessment of nitrogen pollution risk in rivers by using mesh data from agricultural Statistics” (K. Kohyama, NIAES, Japan); and 9) “Influence of land use on nitrogen load to the Saemangeum Basin” (D-B. Lee, NIAST, Korea).

The lectures and the general discussion were summarized as follows:

1) Keynote lectures

Dr. Kim explained the current status of non-point sources and the excess amount of nutrients in Korea, systems for the management of water quality, the current status of water quality monitoring, and the reduction in nitrogen and phosphorus loads by such measures as the prevention of soil erosion. Dr. Kumazawa then provided information on an extensive range of subjects, including the current status of nitrate pollution in the groundwater of Japan, research on the sources of nitrate in groundwater, the environmental impact of livestock excreta and other organic wastes, the nitrogen balance in arable lands, and environmentally-friendly agriculture with the cyclical use of nitrogen in Japan.

2) General lectures

Dr. Y. Lee explained the history of nutrient management in Korean agriculture and the current status of nutrient management, and then asked “Who has responsibility for the problem of livestock excreta?” Professor Zhang reported that the load on the environment can be mitigated by integrated nutrient management based on the diagnosis of nutritional needs in crops. Professor Motavalli showed how to improve nitrogen management practices related to fertilizers and manure in the grain belt of the United States; he proposed new ways of reducing the influence of these substances on the environment.

Dr. Schoumans explained that the outflow of phosphorus is becoming more important in the Netherlands than is indicated in the “Nitrates Directive” and “Water Framework Directive”, which are common policies in the EU. Dr. Oh showed how to predict the leaching of soil nutrients from the results of soil column experiments, and Dr. Kohyama showed how to evaluate nitrogen pollution risk in rivers from mesh data on agricultural statistics. Finally, Dr. D-B. Lee reported that the nitrogen loads generated by urban living are the main sources of pollution in the Saemangeum Basin.

3) General discussion:

At the opening of the general discussion, Dr. Ki-Cheol Eom, Chairman of the general discussion, asked “Who has responsibility for the problem of livestock excreta?” in response to the lecture by Dr. Y. Lee. This question sparked an active discussion on 1) the importance of farm practices, 2) the importance of regional differences in livestock excreta, 3) support measures and stewardship responsibility, 4) the restriction of manure application on the basis of measurements of phosphorus outflow, and 5) the problem of the offensive odors emitted by such materials as barnyard manure. In our country, the problem of livestock excreta is still unsolved despite the enforcement of the so-called “Livestock Excreta Legislation”, and there is a need to evaluate the negative environmental effects of organic matter application at a catchment scale. (K. Sugahara)

3. Third Meeting for the Presentation of NIAES Research Topics

The Third Meeting for the Presentation of NIAES Research Topics, subtitled "Thinking about Agriculture and the Environment", was held on 28 September 2006 at the Shinjuku Meiji Yasuda Seimei Hall in Tokyo. NIAES became an independent administrative institution in April 2001, and since that time we have been carrying out research activity with continuous 5-year mid-term plans. We held a research presentation meeting twice during the first 5-year plan period, in 2002 and 2004. Because the first 5-year mid-term plan ended in March 2006, we held a third meeting to introduce oral and poster presentations on the research results from this first period. The meeting was attended by a total of 221 participants, including 156 from government agencies, private companies, universities, public agencies and corporations, and 65 from NIAES.

The meeting opened with speeches by Yohei Sato, President of NIAES, and Kenji Takahashi, Director General of the Agriculture, Forestry and Fisheries Research Council, and a special lecture, entitled "Impact of agriculture on the Earth's environment from the viewpoint of environmental history", by Hiroyuki Ishi, a Professor at Hokkaido University. The following four research topics from the first plan period, and the directions of research for the second plan period, were then presented in: "Seeking agriculture that fosters rich biota"(Shori Yamamoto, Senior Researcher, Biodiversity Division), "Pesticides in the atmosphere: diffusion and control" (Yasuhiro Yogo, Director of Organochemicals Division), "Water quality changes caused by increasing food demand in East Asia"(Junko Shindo, Senior Researcher, Carbon and Nutrient Cycles Division), and "How will increased atmospheric CO_2 and global warming affect paddy rice growth and yield?"(Toshihiro Hasegawa, Senior Researcher, Agro-Meteorology Division). Also, Ichiro Taniyama, Director of the Natural Resources Inventory Center, gave a speech entitled "Disseminating information surrounding the agricultural environment". He talked about the data and resources that the Natural Resources Inventory Center possesses, and their usage.

At the question-and-answer session after these presentations, there were discussions about water management in abandoned paddy fields, the possibility of considering international trade in food for future water quality prediction models, and the level of CO_2 at which rice yield is affected. All topics addressed by lecturers at the meeting dealt with historical time and space and highlighted the importance of these concepts.

Poster presentations on 17 research topics were displayed before the lectures and during the break, and there were active discussions and exchanges of opinions among the researchers and participants.

A questionnaire on this meeting gathered the impressions and opinions of 90 participants. Most of the comments were positive: "Topics were explained intelligibly", and "It was good that the meeting was held in Tokyo". In terms of the research topics, lectures, and poster presentations, many participants were interested in global warming and food production; this reflects the social interests of today's society. However, there were also negative comments such as, "Should pursue broader perspectives (in order to solve environmental problems)" and "Explanations insufficient for the general public". (T. Imagawa)

Professor Hiroyuki Ishi of Hokkaido University, delivering the special lecture

4. NIAES International Symposium 2006, "Evaluation and Effective Use of Environmental Resources for Sustainable Agriculture in Monsoon Asia—Toward International Research Collaboration"

The NIAES International Symposium, entitled "Evaluation and Effective Use of Environmental Resources for Sustainable Agriculture in Monsoon Asia—Toward International Research Collaboration", was held on 12 to 14 December 2006 in Epochal Tsukuba, with the support of the Agriculture, Forestry and Fisheries Research Council of the Ministry of Agriculture, Forestry and Fisheries. The symposium aimed to give an overview of various environmental problems in and around agro-ecosystems in the monsoon Asian region and to explore international research collaboration to solve these agro-environmental problems.

On the first day of the symposium, the six invited speakers gave excellent and informative lectures on agro-environmental research in monsoon Asia. The topics were:

- Agro-environmental research and development of consortium in monsoon Asia (Yohei Sato, NIAES, Japan)
- Environment and sustainable agriculture in monsoon Asia (Koji Tanaka, Kyoto University, Japan)
- Rice research for poverty alleviation and environmental sustainability in Asia (Robert S. Zeigler, International Rice Research Institute, Philippines)
- Rice production in Southeast Asia for sustainable agriculture and environment—international collaboration for rice technology development (Shu Fukai, University of Queensland, Australia)
- Impact of nitrogen cycling on global warming in agro-ecosystems of East Asia (Ryusuke Hatano, Hokkaido University, Japan)
- Effect of global warming on invasion of alien plants in Asia (R.M. Kathiresan, Annamlai University, India)

Dr. Yohei Sato, President of NIAES, presented an overview in which he pointed out that Asian countries are blessed with the food production platform of paddy rice agriculture, but that they are facing potential agro-ecosystem collapse because of such events as global warming, urbanization, pollution by hazardous chemicals, and invasion by alien species. He also emphasized the need for an international research network on agro-environmental issues throughout monsoon Asia. Professor Tanaka, Dr. Zeigler, and Professor Fukai overviewed the issue of international research collaboration on the basis of their abundant experience, and discussed pathways for achieving international research collaboration. Specific agro-environmental issues were highlighted in the lectures that followed. Professor Hatano presented data on the emission of large amounts of nitrogen to the environment through agricultural activities and warned of the effect of this nitrogen on global warming. Professor Kathiresan overviewed the issue of invasion of monsoon Asian countries by alien plant species and suggested how global warming is accelerating this invasion.

On days 2 and 3 of the symposium the following four workshops were held, and the current status of research and future research strategies were discussed.

- Workshop 1: Invasive Alien Plants in Asia: Status and Control

This session was organized by Dr. Y. Fujii of NIAES. Ten speakers invited from Sri Lanka, Thailand, China, Vietnam, and Japan revealed the current status of alien plant invasion and its control. In a general discussion, Professor J. Silander (University of Connecticut, USA) and Professor T. Yahara (Kyushu University, Japan) gave valuable comments.

- Workshop 2: Monsoon Asia Agricultural Greenhouse Gas Emission Studies

This workshop, organized by Dr. K. Yagi of NIAES, was the second workshop for Monsoon Asia Agricultural Greenhouse Gas Emission Studies (MAGE); the first workshop was held in Tsukuba in March 2006 (see Annual Report 2006, pp. 12–13). Eight speakers invited from China, Thailand, India, the Philippines, and Japan reported on the current status of greenhouse gas emissions in agriculture and discussed ways of collaborating to reduce these emissions.

- Workshop 3: Prediction of Rice Production Variation in East and Southeast Asia under Global Warming

This workshop was organized by Dr. H. Toritani of NIAES. Fourteen speakers invited from China, Vietnam, Thailand, and Japan reported on their current achievements, mainly from the viewpoint of how global warming and a rise in CO_2 levels will affect rice production in Asia and how we can predict these effects. In the general discussion, Professor K. Kobayashi (University of Tokyo, Japan) gave critical comments based upon his studies using FACE (free-air CO_2 enrichment).

- Workshop 4: Ecological Risk Assessment of Gene Flow from Genetically Modified (GM) Crops

Eight speakers invited from China, the Philippines, Korea, and Japan gave valuable reports on the ecological risk assessment of GM crops. Some speakers stressed that GM crops are safe, whereas others emphasized the difficulty of evaluating the risks posed by GM crops. The organizer of this workshop, Dr. K. Matsuo, emphasized the need for exchange of information, not only among scientists but also between scientists and the general public.

At the end of the symposium, all participants agreed to adopt the following Symposium Statement (see p.30). (M. Saito)

5. Public Seminars on Alien Plants (Third through Sixth)

Four public seminars, including international seminar at Tsukuba City, were held as outreach activities for “Risk Assessment of Invasive Alien Plants and their Control,” a project under the Special Coordination Funds for Promoting Science and Technology - Research and Development Program for Resolving Critical Issues of the Ministry of Education, Culture, Sports, Science and Technology. These four events had a total of 642 participants.

(1) Third Public Seminar: Held at Okayama University in Okayama City on 5 August 2006. There were 168 participants. Talks were as follows.

1) On the purposes of the Invasive Alien Species Act and our National Project
2) Botanical gardens and the "Invasive Alien Species Act"
3) On *Azolla* problems
4) Learning from the aquatic aliene plant outbreaks in water systems of southern Okayama Prefecture
5) Attempts to develop technologies to control the alien plant weeping lovegrass (*Eragrostis curvula*)
6) Alien plants that are strongly allelopathic, and containing toxic substances
7) Advantages and problems of alien plants

The seminar concluded with free discussion on the subject “How should we deal with alien plants?” There were opinions and questions from participants, and discussion.

(2) Fourth Public Seminar: Held in Fukuoka City on 21 October 2006. There were 77 participants. The following presentations were given.

1) Developing ways to scientifically assess the risks of alien plants
2) What kind of invasive alien plants are currently distributed in Japan?
3) Alien plants that cause problems through strong allelopathy and toxicity
4) Soils preferred by alien and native plants
5) Investigation of the route of invasion by genetic approach, and shutting out further invasions
6) Determining species from seeds: Building an alien plant database
7) Investigating the impacts on wild plants of the herbicides used to control alien plants
8) Developing technologies to control alien plants now spreading throughout Japan

(3) Fifth Public Seminar: Held at the Tokyo International Forum Hall on 10 December 2006 with the support of the Ministry of Agriculture, Forestry and Fisheries and the Ministry of the Environment. There were 127 participants. The following presentations were given.

1) Background and purpose of this research
2) What kind of invasive alien plants are currently spreading in Japan?
3) Soils preferred by alien and native plants
4) Invasive alien plants that cause problems

through strong allelopathy and toxicity in Japan

5) Developing the scientific risks assessments for invasive alien plants
6) Invasive alien plants in tropical Asia: The case of Thailand
7) The impacts of alien plant invasions on the biodiversity of national parks in Vietnam
8) Investigating the invasion routes of alien plants on the genetic level, and shutting out further invasions
9) Determining species from seeds: Building an alien plant database
10) Investigating the impacts on wild plants of the herbicides used to control alien plants
11) Development of technologies for alien plant control for the purpose of recovering plant diversity

Photo 1 Fifth Public Seminar, 10 December 2006, Tokyo

(4) Sixth Public Seminar (International Seminar): Held at the Tsukuba International Conference Hall (Tsukuba City) on 12 through 15 December 2006. This event was an international workshop with the support of the National Institute for Agro-Environmental Sciences (NIAES). There were 270 participants.

In tandem with the worldwide expansion of freight and passenger traffic, there is a considerable increase in the economic and ecological damage caused by invasive alien plants in the Asia-Pacific region. Presentations were given on the policy measures and situation relating to alien species in Japan, and on the achievements of research in the project “Risk Assessment of Invasive Alien Plants and their Control” at this workshop. To solve these problems, which are shared by Asian countries, we discussed sharing information and setting up an international network. Dr. Yohei Sato, President of NIAES, proposed creating the Monsoon Asia Agro-Environmental Research Consortium (MARCO).

This Sixth Public Seminar invited researchers the five countries that compose the Monsoon Asia program (China, India, Sri Lanka, Thailand, and Vietnam). We discussed on the invasion of alien plants, their damage, and control, which enabled participants to exchange opinions on specific types of weed damage and control methods. Japanese participants sought much information and asked many questions about control and future invasions, and there was enthusiastic debate. (Y. Fujii)

Photo 2 Sixth Public Seminar (International Seminar): 12 through 15 December 2006, Tsukuba

Research Collaborations

1. Establishment of the Research Consortium, MARCO

The Monsoon Asia Agro-Environmental Research Consortium (MARCO) was established on 14 December 2006 by the adoption of the below-mentioned statement at the NIAES International Symposium "Evaluation and Effective Use of Environmental Resources for Sustainable Agriculture in Monsoon Asia—Toward International Research Collaboration" held from 12 to 14 December 2006 at Tsukuba International Congress Center.

NIAES will pursue the following activities for the purpose of conducting research under the MARCO: (1) to provide venues regularly for events such as international symposia for exchanging research information, (2) to provide a website as a venue for exchanging consortium information, and (3) to help train the people who will carry on activities under the consortium.

Symposium Statement: To Further Advance Agro-Environmental Research in Monsoon Asia

The 276 participants from 15 countries in the international symposium "Evaluation and Effective Use of Environmental Resources for Sustainable Agriculture in Monsoon Asia—Toward International Research Collaboration", hosted by the National Institute for Agro-Environmental Sciences (NIAES) and supported by the Agriculture, Forestry and Fisheries Research Council of the Ministry of Agriculture, Forestry and Fisheries, hereby confirm and agree upon the following points by consensus.

1. In monsoon Asia it is urgent that we solve environmental problems affecting agriculture in order to achieve sustainable development while maintaining a sound agro-ecosystem.
2. Solving these problems requires that researchers, administrative authorities, research institutes, and other entities connected with agriculture and the environment in the countries of this region make a concerted effort under close collaboration.
3. For that purpose, we shall create the Monsoon Asia Agro-Environmental Research Consortium, which transcends the boundaries of specialization and countries, and conduct agro-environmental research through international collaboration under the consortium.

2. Conclusion of Agreement for Education and Research between NIAES and the University of Tokyo

NIAES and Graduate School of Agricultural and Life Sciences, the University of Tokyo (UT), concluded an agreement for improved education of graduate students and the support of their advanced research. Dr. Yohei Sato, President of NIAES, and Professor Hiroshi Komiyama, President of UT, as well as Professor Katsumi Aida, Dean of the Graduate School of UT, executed the agreement on 1 April 2006. Under this agreement, NIAES researchers participate in the education of graduate students at a newly established cooperative laboratory, the "Ecological Safety Laboratory". Education using NIAES's accumulated research resources will contribute toward raising young talent people who will be able to work in agro-environmental research in future.

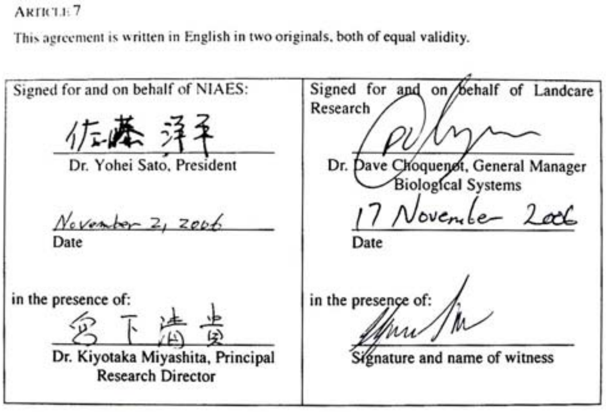
3. Conclusion of Cooperative Agreement between NIAES and Toyohashi University of Technology

NIAES and Toyohashi University of Technology (TUT) concluded a cooperative agreement for the promotion of research on science and technology. Dr. Yohei Sato, President of NIAES, and Professor Tatau Nishinaga, President of TUT, executed the agreement at NIAES on 21 September 2006. The cooperation includes exchange of scientists, exchange of research and technical information, and research cooperation. This cooperation between agriculture and technology will lead to new developments in agro-environmental sciences.

Signing ceremony for the agreement between NIAES and TUT

4. Conclusion of MOU between NIAES and Landcare Research New Zealand Limited

NIAES and Landcare Research New Zealand Limited, New Zealand, concluded a Memorandum of Understanding (MOU) concerning scientific and technical cooperation on 17 November 2006. NIAES and Landcare Research agreed to collaborate on some projects related to the conservation of biodiversity and ecosystems and reduction of the impacts of invasive species in natural and agricultural environments. The scope of activities under this MOU includes exchange of scientists, exchange of technical information and cooperative research.



ARTICLE 7

This agreement is written in English in two originals, both of equal validity.

Signed for and on behalf of NIAES:	Signed for and on behalf of Landcare Research
佐藤 洋平 Dr. Yohei Sato, President	Dr. Dave Choquenot, General Manager Biological Systems
November 2, 2006 Date	17 November 2006 Date
in the presence of: 宮下 清貴 Dr. Kiyotaka Miyashita, Principal Research Director	in the presence of: Signature and name of witness

Signatures on the MOU between NIAES and Landcare Research

Visitors

1. Open House Day 2006

The Institute opened its doors to the public on 19 April during Science and Technology Week 2006. Visitors including students and various professionals—more than 1200 in total. They studied displays on research topics, watched specimens in the exhibition rooms of the Natural Resources Inventory, attended mini lectures, tried hands-on experiments, and participated in vegetable picking in the field. All events were arranged under the general theme “Let’s hand over sound farmland and environment to future generations.” (Photos 1, 2)

Photo 1 Visitors looking at familiar wildflowers

Photo 2 Explanation of greenhouse gas emissions from farmland

2. Summer Science Camp 2006

Science Camp 2006, organized by the Japan Science Foundation (JSF), was held at various institutes and universities. This program aims to give an excellent opportunity for high school students to experience advanced science and technology and expand their interest in sciences.

Summer Science Camp 2006 at NIAES took place from 9 to 11 August 2006, with 12 high school students from all areas of Japan. Every student participated in one of the three courses: a) use of mass spectrometry for the ultramicroanalysis of environmental pollutants, b) the study of allelopathy (chemical interactions between plants), and c) the study of the behavior of wild animals with a GPS device. (Photos 3, 4, 5)

Photo 3 Learning how calculate the concentration of pollutants

Photo 4 Lecture on the application of allelopathy

Photo 5 Walking around the field with a GPS recorder

Advisory Council 2006

The Advisory Council 2006 met on 26 April 2007 at NIAES to provide outside opinions and recommendations on the management of NIAES. The members of the council are external experts and include a professor, a consumer representative, and the directors of other independent administrative institutions (see Appendix).

The following comments were made:

1) To optimize research productivity at NIAES it is desirable to establish a new system that can evaluate the yearly achievements of researchers and reflect the evaluations in their working conditions. It is also desirable to evaluate the productivity of administrative staff.

2) NIAES needs to follow up on its own scientific results and promote technology transfer to society.

3) NIAES should be praised for having established a human resources development program, which will enhance the research ability of the institute in the future.

4) Collaboration with non-government research organizations or the private sector should be promoted to the same extent as that with educational and other official research organizations.

5) The establishment of the Monsoon Asia Agro-Environmental Research Consortium (MARCO) for the promotion of collaborative study among countries in the monsoon Asia region is a worthwhile move.

6) The results of a number of studies have been useful for the development of new methods applicable for farms. Examples are “Uptake of dieldrin and endrin from soils by zucchini” and “Inhibitory effects of rootstocks on Cd uptake by eggplant.”

7) It is an important task for NIAES to develop standard international methods for the risk assessment of ecological systems.

8) The establishment of methods of analyzing soil bacteria by PCR-DGGE is a valuable step.

9) We need to promote research on the modes of action of allelochemicals and search for ones that are new to science.

10) Long-term research is significant in the environmental monitoring of greenhouse gas fluxes and radionuclides and in the accumulation of agro-environmental resources.

11) NIAES activities, such as open seminars held in regional areas of Japan and a meeting with an NPO to discuss environmental issues, make important social contributions.

12) Contributions to international organizations such as IPCC are remarkable accomplishments.

13) We need to promote our activities in giving technological assistance to developing countries.

Academic Prizes and Awards

1. CIGR Merit Award

Dr. Yohei Sato, President of NIAES, won the 2006 CIGR Merit Award. This award is aimed at those members who have performed remarkable work for CIGR.

CIGR (Commission Internationale du Génie Rural—the International Commission of Agricultural Engineering) was set up by a constituent assembly on the occasion of the first International Congress of Agricultural Engineering, held in Liège, Belgium, in 1930. It is an international, non-governmental, non-profit organization that regroups, as a networking system, regional and national societies of agricultural engineering as well as private and public companies and individuals all over the world.

The main aims of CIGR are to stimulate the development of science and technology in the field of agricultural engineering; to encourage education, training and mobility of young professionals; to encourage international mobility; to facilitate the exchange of research results and technology; and to represent the profession at a worldwide level among multi-lateral activities.

As the Chairperson of the Board of Section I of CIGR, a technical section that deals with Land and Water Engineering, Dr. Sato has contributed his time and energy to organizing Inter-Regional Conferences on the Environment and Water in several countries and regions and has endeavored to stimulate and promote the multi-lateral activities of Section I, as well as conferences and workshops.

The commendation ceremony was held at the University Bonn, Germany, on 5 September 2006 on the occasion of the XVI CIGR World Congress. Dr. Sato was also elected one of the Honorary Vice Presidents at the General Assembly of the Congress.

2. The Young Scientists' Prize: Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science, and Technology, 2006

Research on estimate of N_2O emission factors and investigation on mitigation options for N_2O emissions from agricultural fields

The Minister of Education, Culture, Sports, Science, and Technology presented the Young Scientists' Prize to Dr. Hiroko Akiyama for her outstanding research on estimate of nitrous oxide (N_2O) emission factors and investigation on mitigation options for N_2O emissions from agricultural fields.

N_2O is a major greenhouse gas, and the IPCC (Intergovernmental Panel on Climate Change) has estimated that agricultural fields account for 24% of the world's N_2O emissions. Therefore, intensive research on the more accurate estimation of N_2O emissions from agricultural fields and the development of mitigation options is being conducted worldwide.

By systematic review and analysis of published papers, Dr. Akiyama and her colleagues revealed that the world average fertilizer-induced N_2O emission factor for rice paddies was 0.31% of applied nitrogen. This emission factor was much lower than the previous default value of 1.25% given in the IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1997, 2000). In 2006 the default value of the N_2O emission factor in the IPCC guidelines was revised in accordance with the research conducted by Dr. Akiyama and her colleagues (IPCC 2007).

Furthermore, Dr. Akiyama and her colleagues developed an automated N_2O monitoring system. Using the system, they found that the use of coated nitrate fertilizer, rather than conventional uncoated one, was effective in mitigating N_2O emissions from Andosols, oxic volcanic soils that cover about 50% of Japanese upland fields. Moreover, they showed that organic fertilizer applications are important sources of N_2O emission; they estimated that the total amount of N_2O emissions resulting from the application of organic fertilizer to the upland fields of Japan is similar to that from chemical fertilizer application.

Dr. Akiyama's research has contributed to the accurate estimation of N_2O emissions from agricultural fields and the mitigation of these emissions.

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3. The Japanese Society of Grassland Science Encouragement Prize (Mitsui Prize)

The fate of polychlorinated dibenzo-p-dioxins, dibenzofurans and coplanar polychlorinated biphenyls (dioxins) in crop plants

On 25th March 2007, the Japanese Society of Grassland Science (JSGS) awarded its Encouragement Prize (Mitsui Prize) for FY 2007 to Dr. Ryuichi Uegaki. The prize is awarded to young JSGS members aged of 37 or less whom their research progress shows future promise. The outlines of study undertaken by Dr. Uegaki are as follows.

1. Changes of dioxins levels in crop plants during growth stage were investigated. Results indicated that, the dioxins concentrations of crop plants were relatively high during the early growth stage, then, gradually decreased when come to the vegetative stage, but increased again during productive period. In the early growth stage of plants, the isomer profiles of dioxins were similar to those in soil. However, the profiles were predominantly changed to resemble those in the atmospheric gas phase as the crop grew.
2. The transition route of dioxins in corn is clarified. Corn was grown in two growth chambers with two different soils, which contaminated with dioxins at two different concentrations and isomer profiles. Results clearly proved that the dioxins in corn are derived from the atmospheric gas phase, and did not come from the absorption from soil by roots.
3. The correlation between the period of exposure to the atmospheric dioxins and their concentration in forage was examined in order to clarify either dioxins can be accumulated in forage. Results showed that the accumulation of dioxins in forage did not occurred. Therefore, it would be difficult to decrease the level of dioxins contamination in forage through the adjustment of the cultivation period.

These studies indicated that, the major transition route of dioxins to crop plants is through the atmospheric gas phase. In this contact, Dr. Uegaki proposed that the effective countermeasure to the transition could be made through the improvement and good maintenance of the atmospheric environment. The “Law Concerning Special Measures Against Dioxins” was promulgated in Japan since July 1999. The law regulates emission and effluent, and it mandates the monitoring and surveillance of dioxins in the atmosphere. Recently, the concentration of dioxins in the atmosphere has been decreased. Therefore, it can be expected that the concentration of dioxins in crop plants will also decreased.