Natural Resources Inventory Center

The mission of the Natural Resources Inventory Center is: 1) to perform fundamental research on the classification, identification, characteristics, and functions of agro-environmental resources such as soils, insects, and microorganisms; 2) to promote and support research through the collection, preservation, exhibition, lending, and donation of specimens and samples; 3) to store agricultural environment information in databases and develop inventory systems that can be accessed with the aid of tools such as the Internet; and 4) together with related research groups, to collect and evaluate microbial and insect genetic resources as a sub-bank under the MAFF GeneBank Project. The Natural Resources Inventory Center has 3 laboratories: Soil Classification, including the Soil Museum; Insect Systematics, including the Insect Museum; and Microbial Systematics, including the Microbe Museum. As part of the mid-term research plan of NIAES formulated in FY 2001, these laboratories have carried out the following research: 1) classification and elucidation of the functions of soils and development of a framework for the soil inventory; 2) construction of a database for type specimens of insects and development of a framework for the insect inventory; 3) classification and identification of microorganisms co-inhabiting sound plants, analysis of their functions, and development of a framework for the microorganism inventory; and 4) collection and evaluation of insects and microorganisms as genetic resources under the MAFF GeneBank Project.

Major topics in 2004–2005 are described in the following Topics and in "Invasion and occurrence of the banana moth, *Opogona sacchari* (Bojer) (Insecta, Lepidoptera), over a wide area of Japan", in the Highlights on page 9.

Topic 1: **Newly opened Natural Resources Inventory Museum**

"Inventory" means a list of property or stock, and our research institute uses this word in the sense of a bank storing specimens and information on agricultural environmental resources. For visitors' convenience in understanding the purpose and content of agricultural environmental inventory research, part of the Soil Preservation and Monolith Experiment Building has been refurbished as the Insect and Microorganism Exhibition Room, and a Natural Resources Inventory Museum has been opened. The entrance hall has exhibits of typical soil monoliths (soil profile specimens) from the hilly to the coastal regions of our country, as well as displays on such subjects as how soil monoliths are created. On the left-hand side of the entrance hall are located the Soil Sample Storage Room and the Soil Monolith Exhibition Room, where soil samples have been stored for 50 years. The Insect and Microorganism Exhibition Room is located to the right-hand side of the entrance hall. The exhibition theme there is "Diverse Insects and Microorganisms in the Agricultural Environment". In this room can be seen the results of research on the insects and microorganisms that inhabit the agricultural environment, as well as various specimens. Furthermore, by reflection on a large-sized liquid crystal display, many visitors can simultaneously search the various databases released by our research institute. (Y. Ueda)

Topic 2: **Soil resource inventory for classification**

We surveyed subsoils to 5 m depth in the Omoi River area and analyzed their physico-chemical properties. Data on the physical and chemical properties of subsoils are essential for soil classification and evaluation of nitrate-carrying capacity in arable land. We compiled databases on soil monolith information and on the results of soil surveys and research projects on heavy metals, and we developed a browser for the soil monolith database. We devised a soil information system by developing the functions of input, search, edit, and display of soil maps and statistical data on the Internet. We also compiled a data set of soil profiles based on the results of soil surveys of arable lands in Japan; this data set is available for use with the EPIC model. We modified the EPIC model program by using C++ program language under the Windows OS to adapt it to Japanese soils. The average, median, standard deviation, mode, and maximum and minimum values of Cd, Cu, Zn, and Pb contents in Japanese arable soils were calculated from our heavy metal database. Soil genesis and heavy metal content were investigated on 2 series of river terraces by using principal component analysis. Surface analysis of soil thin sections by electron probe microanalysis (EPMA) showed heavy metals accumulated around areas of mottling, together with iron. We prepared a manual for estimating and mapping Cd risks in soybean from prediction equations derived from the relationship between Cd content in soybean and soil properties. (M. Nakai)

Topic 3: **Bacteria and fungi on healthy leaf sheaths and panicles of intact rice plants**

To study the microbial communities on rice plants, we isolated bacteria and fungi from the leaf sheaths and panicles of intact rice plants cultivated in paddy fields in Tsukuba, Japan, between 2001 and 2003, Two leaf

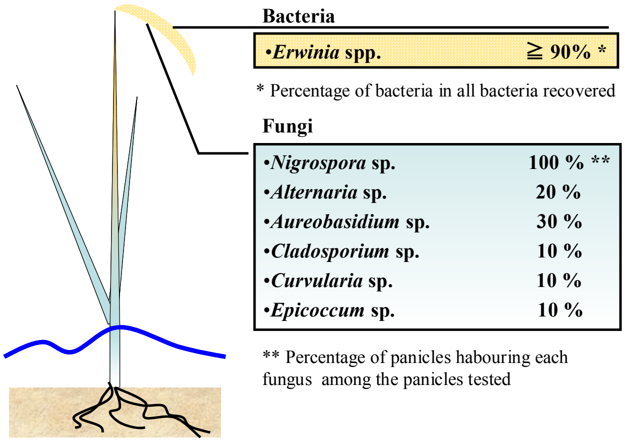

Fig. 1 Dominant bacteria and fungi on rice panicle

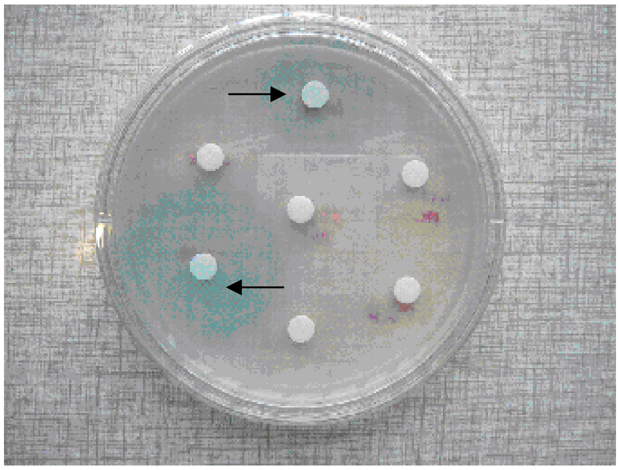

Fig. 2 Production of full QSRM on detection medium by bacteria isolated from rice plants.
A culture filtrate of the bacteria was placed onto a round filter paper. Arrows indicate the QSRM, which are detected as a diffuse blue pigmentation.

sheaths per hill were sampled; one was used for isolating bacteria and the other for fungi. Ten sheaths were used for each experiment. The sample was washed in a washing buffer (10 mM phosphate buffer, pH 7.0; WB) on a shaker to isolate epiphytic bacteria. Before being washed, the sample was covered at both ends (ca. 5 mm) with melted paraffin to avoid contamination with microorganisms from inside the leaf sheaths. Appropriate dilutions of the buffer solution containing the isolates were plated onto nutrient agar (NA). The washed samples were ground in a mortar by adding WB for further isolation of the bacteria remaining in or on the leaf sheath, and the dilutions were plated onto NA. Bacterial population sizes were estimated after 5 days of incubation at 25 °C, and 25 colonies per sample were selected for the analysis of 16S rDNA sequences. For isolation of fungi, each panicle was washed in WB, cut into 5 subsamples (1 cm long), and then incubated on water agar plates for 28 days at 23 °C. The bacterial populations ranged from 10^4 to 10^5 and 10^5 to 10^7 cfu/g fresh weight, respectively, in the washing and ground solutions of the leaf sheath, respectively. Bacteria belonging to the genera *Microbacterium* and *Sphingomonas*, and a few different fungi (*Cladosporium*, *Alternaria*, and *Epicoccum*) were most frequently isolated 1 month before heading. The predominant microflora at heading time consisted of *Sphingomonas* (bacterium) and *Cladosporium*, *Phaeosphaeria*, and *Nigrospora* (fungi). Two panicles (ca. 5 cm long) per hill were sampled at heading time by cutting with sterilized scissors. One sample was used for isolation of fungi and the other for bacteria. Bacteria belonging to the genus *Erwinia* were most frequently isolated from the panicles at heading time. Among the fungi, *Nigrospora*, *Aureobasidium*, and *Alternaria* were predominant (Fig. 1).

We also analyzed the production of cell–cell communication-related signal molecules (quorum sensing-related signal molecules, QSRM) in the bacteria isolated from rice plants (Fig. 2). (S. Tsushima)