

Our monthly newsletter features a variety of information, highlighting current domestic and international issues concerning bioresources.

Introduction to Resource Center No.27

## National BioResource Project "Lotus/Glycine"

Ryo Akashi Professor  
(Frontier Science Research Center, University of Miyazaki)



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### Announcements (Details are available at <http://www.nbrp.jp/index.jsp>)

- Invitation to participate in a Technical Training for the Use of Latest Bioresources (Training in the use of recombinant adenoviruses)
  - Training Period: October 22(Wed) - October 24(Fri), 2008
  - Place: RIKEN Tsukuba Institute
- Invitation to participate in a Technical Training for the Use of Latest Bioresources (Training in methods for the cryopreservation of mouse sperm and embryos)
  - Training Period: October 20(Mon) - October 23(Thu), 2008
  - Place: RIKEN Tsukuba Institute
- The 79th annual meeting of the Zoological Society of Japan "Symposium and Panel Exhibition"
  - Date: 9/5 (Fri) - 9/7 (Sun), 2008
  - Place: Fukuoka University
- The 80th Annual Meeting of the Genetics Society of Japan "Booth Exhibition"
  - Date: 9/3 (Wed) - 9/5 (Fri), 2008
  - Place: IB Electronic Information Hall, School of Engineering, Nagoya University

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Leguminous plants are broadly classified into those that produce edible beans such as soybean, red beans, pinto beans, and peas; oil-yielding beans such as peanuts; forage beans such as alfalfa and clovers; medicinal beans such as licorice and kudzu; and beans used in fertilizers, such as lotus, lupine, and sesbania. Therefore, legumes are considered an extremely important plant species that have a variety of uses.

*Lotus japonicus* is a perennial legume that grows widely in the country and is extensively used as a model legume species on account of its small genome size and short life cycle. *Glycine max* has long been cultivated as an important crop and has been used widely in fundamental research. Collection of information and the development of resources related to *L. japonicus* are crucial for promoting large-scale research on *G. max*, for example, studies on improving the yield performance and those on the nutritional functions altered by symbiosis with rhizobia.

Our project is aimed at developing an infrastructure for studies on legumes by collecting and supplying resources that can be used widely for both basic research (e.g., research on *L. japonicus*) and applied research (e.g., research on *G. max*) pertaining to legumes.

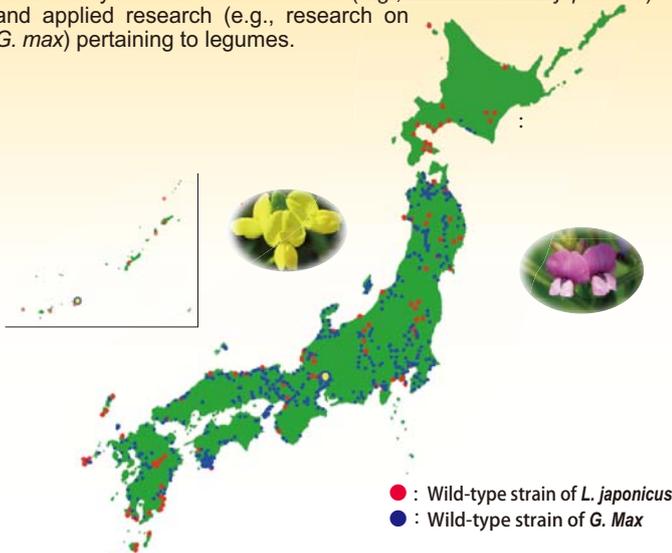


Figure: Sampling sites for *L. japonicus* and wild-type soybean

### 1 A novel experimental strain of *L. japonicus*, designated as *Lotus burtii* B-303

Currently, 2 *L. japonicus* strains (Miyakojima MG-20 and Gifu B-129) are widely used as experimental strains. In May 2008, *L. burtii* B-303 was included on our website as a novel strain. This strain produces faint yellow flowers that turn pink as they mature. It is precocious, similar to Miyakojima MG-20; exhibits a short generation interval; and is easy to cultivate in the laboratory. In addition, *L. burtii* B-303 pods exhibit high resistance to shattering; thus, the results of quantitative trait locus (QTL) analysis in relation to the resistance to shattering is expectedly applied in the breeding of *G. max*.



Figure: Characteristics of *L. burtii* B-303

※ Pod-shattering resistance: The phenomenon of pods being split open for seed dispersal is termed pod shattering and the ability of pods to withstand this is termed pod-shattering resistance.

### 2 Genome sequencing of *L. japonicus*

On May 29, 2008, the Kazusa DNA Research Institute reported the genome sequence of *L. japonicus*—the first legume species whose genome was sequenced (<http://www.kazusa.or.jp/j/information/news20080529.html>). Owing to this accomplishment, the importance of *L. japonicus* resources has increased dramatically. Further information in this regard is available on the Miyakogusa.jp website (<http://www.kazusa.or.jp/lotus/>), and *L. japonicus* DNA clones are distributed at NBRP Legume Base.



- [miyakogusa.jp](http://www.miyakogusa.jp) -  
<http://www.kazusa.or.jp/lotus/>



- NBRP Legume Base -  
<http://www.legumebase.agr.miyazaki-u.ac.jp/>

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## QTLs related to the agricultural traits of *L. japonicus* and genome synteny\*1 among legume species

*L. japonicus* is a model leguminous plant, and its genetic information is expected to facilitate advancements in the breeding of leguminous crops such as soybean. Important traits of leguminous crops include flowerage, plant height, plant type, pod characteristics, seed weight, and seed components, and 13 QTLs\*2 related to essential agricultural traits have been identified thus far (Fig. 1). In addition, efforts to elucidate the genome synteny between *L. japonicus* and other leguminous crops are underway. The identification of QTLs related to agriculturally important traits of *L. japonicus* facilitates the prediction of the corresponding QTL domains in other leguminous crops. In particular, 4 out of 5 seed weight-related QTLs identified in *L. japonicus* have been found to correspond to known QTLs in *G. max*, and they have been found to exhibit high sequence homology to QTLs of other leguminous crops. Thus, it is likely that these QTLs related to the seed weight are homoeologous among leguminous crops.

\*1 Genome synteny is defined as similarity in genome structure, for example, with regard to the gene distribution, among different species.

\*2 QTLs: Properties such as height and yield that can be represented as continuous numbers are termed quantitative traits and the loci that affect these properties are called QTLs.

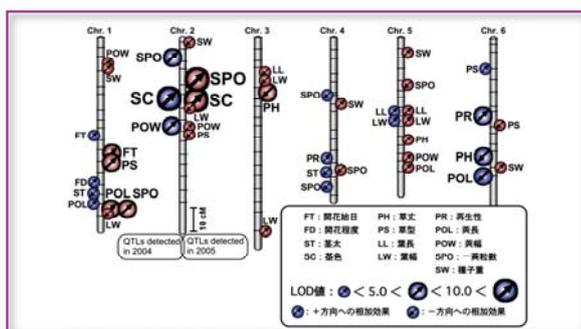


Fig. 1: 13 QTLs related to agricultural traits of *L. japonicus* (Genome 50: 627-37, 2007)

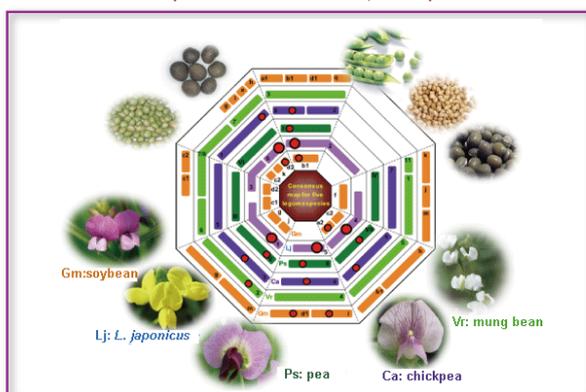


Fig. 2: Comparison of QTLs related to seed weight among legumes by genome synteny analysis (Genome 50: 627-37, 2007)

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## Applications of *L. japonicus* in educational projects

### 1. *L. japonicus* in space

The Japan Aerospace Exploration Agency (JAXA) conducts the "Sample Return Mission" to educate Japanese youths about various fields of research related to "space and life" and the scientific mentality through experiments and observation.

Moreover, Leave a nest Co. Ltd. conducts the "Space Education Project" that aims to arouse children's interests in science through the shipping of seeds to the Japanese experiment module "KIBO," of the International Space Station (ISS).

Under this project, seeds are shipped to ISS, stored at the KIBO repository for approximately half a year, and subsequently returned to Earth. The soundness of the seed samples is then verified, and they are distributed to participating elementary, junior-high, and high schools and scientific museums for use in educational projects. The core institute for NBRP Lotus/Glycine and the University of Miyazaki provide *L. japonicus* seeds for these educational projects.



## 2. *Lotus japonicus* will appear on "10 min. box," a TV program hosted by NHK!

The TV program "10-min. box" concisely introduces topics of biological science that are taught at the junior-high and high-school levels. Using Hi-Vision, this program presents vivid images of scientific observations and experiments that are related to familiar events in our everyday lives and basic principles. NHK and the University of Miyazaki are currently filming and editing the programs to be broadcast next year.



Figure: Filming at the University of Miyazaki



## Feedback provided by participants of the NBRP database seminar

We organized a seminar targeted at *L. japonicus* and *G. max* researchers at the NBRP Information Center during July 22-24.

Since this was the first time we organized such an event, we asked for comments from 2 of the participants. Their comments were as follows.



I participated in the NBRP database seminar hosted by the National Institute of Genetics from July 22 to July 24. At the start of the lectures, I had no basic knowledge regarding websites and databases (DBs); however, the facilitators provided in-depth information regarding the structure of DBs and the process of DB development. Through this seminar, I recognized the roles (or capabilities) of the core institute of resources in the development and management of websites and DBs, and I was familiarized with methods to organize data. I think that this seminar will enhance our cooperation with the NBRP Information Center and also promote efficient workflows in future. Although each institute will differ in their server administrative skills, I strongly recommend that all personnel of the core institute of resources attend this seminar. Even by just knowing more about the structure of DBs, they will be able to recognize the importance of a core information center and feel more dedicated to the website that they are moderating. I would like to thank the organizers for this beneficial seminar. (Masatsugu Hashiguchi, Frontier Science Research Center, University of Miyazaki)

A part of the NBRP Lotus/Glycine website is hosted on the servers installed at the University of Miyazaki. Just around the time when I became curious about the roles of these two perennially running servers, I was invited to participate in the database seminar, for which I stayed at the National Institute of Genetics for 3 days and 2 nights. Thanks to the detailed explanations provided in the lectures, I can now comprehend jargon such as JAVA, PERL, and SQL, which I had frequently heard of but did not entirely understand. Thus, it was a very productive seminar. As soon as I returned to Miyazaki, I installed MySQL and Perl on the computers in our laboratory, and so far I am enjoying developing some useless programs for my own satisfaction.

I would like to sincerely thank the staff members involved in organizing this seminar. (Hidenori Tanaka, Frontier Science Research Center, University of Miyazaki)

**Editor's Note** This month, Professor Akashi delivered an impassioned discourse concerning the potential applications of *L. japonicus* as a resource for research. Meanwhile, the database seminar, conducted for the first time, was extremely effective, and it fostered mutual understanding between personnel dealing with materials (resources) and those handling computerized information (data). Ideally, resources and data should function as one but there is a huge difference in the technologies required to handle them. This emphasizes the importance of specialized roles and mutual understanding (Y.Y.).

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