

Lotus activities:

Background and present research

[Juan Ramón Acebes Ginovés](#)

[Shinji Akada](#)

[Said Amrani](#)

[David P. Belesky](#)

[Ana María Castro](#)

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[Jeremy Murray](#)

[P.S. Nagar](#)

[Nazhat-Ezzamane Noureddine](#)

[Felicia Oliva Tejera](#)

[Graeme Sandral](#)

[Dmitry Sokoloff](#)

[Juan Ramón Acebes Ginovés](#)

SPAIN

I am involved, together with my colleagues Felicia Oliva Tejera, J. Caujape-Castell, and D. Bramwell in relation to the genetic variation (iso-enzymes) and the taxonomy of *Lotus spartioides* Webb & Berthel., *Lotus holosericeus* Webb & Berthel, *Lotus campylocladus* Webb & Berthel and *Lotus hillebrandii* Christ, endemic of the Canary Islands.

[Shinji Akada](#)

JAPAN

We are interested in functional characterization of some members of *MYB* superfamily from *Lotus* and soybean, which may be involved in flavonoid biosynthesis and some physiological aspects, such as nodulation, nitrogen metabolism, and UV-B response.

[Said Amrani](#)

ALGERIA

I am studying “Survey of nodulation and Nitrogen fixation among legumes of Algeria”. My interest is in the phylogenetic aspects of this symbiosis and coevolution threads of the two symbionts. Even if I have a soil microbiology background I'm very interested by the taxonomy and breeding of *Lotus*.

[David P. Belesky](#)

U.S.A.

Earned degrees at Pennsylvania State University (B. Sc., 1973; & M. Sc., 1975) in Agronomy, and West Virginia University (Ph. D., 1978) in Plant Sciences with strong multidisciplinary training in grazing livestock nutrition. Employed as Research Agronomist with USDA-ARS Research Agronomist for 26 years with 10 at Southern Piedmont Conservation Research Center,

Watkinsville, Georgia and the past 16 at Appalachian Farming Systems Research Center, Beaver, West Virginia. Research interests and experience address tall fescue-endophyte relationships in terms of forage production and ecology of tall fescue-endophyte associations. Current interests address management of forages in silvopastoral systems and forage resources to extend the spatial and temporal availability of herbage. Currently serve as Research Leader of the USDA-ARS, Appalachian Farming Systems Research Center, Beaver, West Virginia, with a strong multidisciplinary research program addressing issues in the soil-plant-grazing animal continuum of pasture in the Appalachian Region.

Ana María Castro
ARGENTINA

Lotus glaber is a naturalized species in the Salad River (Buenos Aires province). It is the unique legume forage that grows in soils with saline restrictions, becoming of great importance for animal production. Selection of genotypes with tolerance to saline stress will enable to spread out the sowing of *Lotus glaber* in those soils with low fertility, improving the quality of cow food. We found molecular markers associated with genotypes tolerant to saline conditions. These findings will enable the marker assisted selection of germplasm better adapted to these limiting conditions. Our group also has determined the prevalent mechanism of tolerance to saline stress in this species (Barragán *et al.*, 2004).

Emmanouil Flemetakis
GREECE

Dr. Flemetakis is a lecturer in the Department of Agricultural Biotechnology

in the Agricultural University of Athens. During the last years his research has been focused in the molecular mechanisms governing the legume nodule organogenesis and function. To this purpose the model legume *Lotus japonicus* has been used as it accumulates several advantages including a diploid relatively small genome size, short life cycle, and it is amenable to forward and reverse genetics. Special attention has been given in the identification of genes involved in carbon and nitrogen metabolism during nodule development and function. Several cDNA clones coding for nodule-enhanced isoforms of sucrose cleaving enzymes (Sucrose synthase and Invertase), sugar metabolizing enzymes, isoforms of carbonic anhydrase (CA), sugar transporters, trehalose biosynthesis and breakdown enzymes, polyamine biosynthesis enzymes, and ammonia assimilation enzymes have been isolated and characterized from *L. japonicus* nodule specific cDNA libraries. Real-Time quantitative RT-PCR and *in situ* RNA-RNA hybridization techniques have been used to study the temporal and spatial expression patterns of these genes. This research has provided us with new insights into the temporal and spatial organization of carbon and nitrogen metabolism within the nodule. As the Molecular Biology research was entered a post-genomic phase, the current work is aimed towards the elucidation of the biochemical and physiological role of these enzymes during the process of the symbiotic nitrogen fixation. To this effort, we are employing novel experimental approaches, including reverse and forward genetics, high throughput metabolite analysis and protein function and structure analysis.

Ana María de Haro

ARGENTINA

The project “Genetic Improvement of an induced tetraploid population of *Lotus glaber* Mill. (= *Lotus tenuis*)” is based at the Faculty of Agronomy, National University of the Centre of the Province of Buenos Aires. A colchicine-induced autotetraploid population was generated with the objective of carrying out genetic, cytogenetical, physiological, microbiological (symbiotic associations), agronomical and biochemical studies. Furthermore, this germplasm will be evaluated with the aim of obtaining an improved population that contemplates the possibility of obtaining tetraploid cultivars, selected for the pastureland conditions of the Depressed Pampa of the Province of Buenos Aires. We will investigate the arthropod species that feed on *Lotus glaber*. We will identify the species, study their habits and describe the damage they cause.

Pedro Insausti

ARGENTINA

We study the impacts of stressors on *Lotus glaber* and *Lotus corniculatus* and on grassland functioning. At the physiological level we seek to understand the mechanisms whereby *Lotus* plants respond to one or more stress factors like flooding, grazing, trampling and water stress. At the ecological level the research interests are the study of *Lotus* in a natural grassland and its responses to variations in disturbance regimes on grasslands of the flooding Pampa, in Argentina.

Sangho Jeong

U.S.A.

During my Ph.D., I studied *Arabidopsis* meristem development using molecular,

genetic and biochemical tools. Now I am a postdoc in Dr. Yanofsky’s lab at UCSD. Our lab has been working on flower and fruit development using primarily *Arabidopsis*. I am interested in expanding our work into legume fruit development. Pod characters such as size, shattering, shape and fiber content are not only economically important but also interesting in developmental point of view. While genetic diversity for the characters already exist in peas and beans, they are difficult to study. Therefore I have decided to use the *Lotus* as a model system. As part of our studies, our lab has identified some of the major regulators of pod development in *Arabidopsis*. I have initiated a project to determine the possible roles that these genes may play during pod development in legumes, using reverse genetic approaches. EMS mutagenesis screens using *Lotus japonicus* are also in progress. Interesting mutations will be mapped and the corresponding genes will be cloned. I believe that this work will provide valuable insights into legume pod development, and allow us to compare development/patterning of two dry dehiscent fruit types, pods and siliques.

Richard H. Leep

U.S.A.

I have been from 1976 to 1996 Research and Extension Specialist and Professor at the Upper Peninsula Experiment Station, Department of Crop and Soil Sciences, Michigan State University. At the present time, I am Professor and Extension Specialist, Professor at the Department of Crop and Soil Sciences, Michigan State University. Research programs include: 1. Managed rotational grazing, 2. Forage management, 3. Alfalfa persistence, and 4. Dairy-forage cropping systems. Extension

programs include: 1. Providing education and learning experiences to extension staff and producers, 2. Sustainable forage systems, 3. Co-chair of Michigan State University Forage Area of Expertise team. Teaching consists of Forage Crops 201 and advising 5 graduate students and advisory committee of 6 graduate students.

[Gabriela Martinoia](#)

ARGENTINA

The project "Genetic Improvement of an induced tetraploid population of *Lotus glaber* Mill. (= *Lotus tenuis*)" is based at the Faculty of Agronomy, National University of the Centre of the Province of Buenos Aires. A colchicine-induced autotetraploid population was generated with the objective of carrying out genetic, cytogenetical, physiological, microbiological (symbiotic associations), agronomical and biochemical studies. Furthermore, this germplasm will be evaluated with the aim of obtaining an improved population that contemplates the possibility of obtaining tetraploid cultivars, selected for the pastureland conditions of the Depressed Pampa of the Province of Buenos Aires. We will investigate the arthropod species that feed on *Lotus glaber*. We will identify the species, study their habits and describe the damage they cause.

[Rodolfo Mendoza](#)

ARGENTINA

We studied seasonal variation in population attributes of AM fungi over two years in four sites of temperate grasslands of the Argentinean Flooding Pampas. The sites represent a wide range in soil conditions, hydrologic gradient, and floristic composition. *Lotus glaber*, a perennial herbaceous legume naturalised in the Flooding Pampas, was dominant at the four

plant community sites. Its roots were highly colonised by AM fungi. Temporal variations in spore density, spore type, AM root colonisation, floristic composition and soil chemical characteristics occurred in each site and were different among sites. The period over which the soil site was subjected to flooding influenced the dynamic of the fungal community. Eleven different types of spores were recognized and four were identified. Two species dominated at the four sites: *Glomus fasciculatum* and *Glomus intraradices*. Spore density was highest in summer (dry season) and lowest in winter (wet season) with intermediate values in autumn and spring. Colonization of *Lotus glaber* roots was highest in summer or spring and lowest in winter or autumn. The duration of flooding was associated with decreases in spore density and in root colonization of *Lotus glaber*, but the main change was in the relative density of different spore types. The relative density of *Glomus fasciculatum* and *Glomus intraradices* versus *Glomus* sp. and *Acaulospora* sp. had distinctive seasonal peaks. These seasonal peaks occurred at the four sites, suggesting differences among AM fungus species with respect to the seasonality of sporulation. Spore density and AM root colonization when measured at one time were poorly related to each other. However, spore density was significantly correlated with root colonization three month prior suggesting that high colonization in one season precedes high sporulation in the next season.

[Jeremy Murray](#)

CANADA

I am currently a member of Krzysztof Szczyglowski's laboratory. Our work involves mapping and characterization of nodulation mutants in *Lotus japonicus*. In

particular we are looking at mutants defective in nodulation that were identified in the har1 mutant supernodulating background. We intend to positionally clone the genes responsible for selected mutations in order to better understand the molecular processes underlying nodule development and autoregulation of nodulation. In addition, we are interested in exploring *Lotus japonicus* as a model system for studies in crop species. Towards this end we are studying the inheritance of quantitative trait loci that effect the protein content in seeds and leaves using recombinant inbred lines derived from a *Lotus japonicus* and *Lotus filicaulis* cross which were created by Niels Sandal at the University of Aarhus in Denmark as a resource for the *Lotus* community. Ultimately we hope to clone the genes underlying the identified QTL which will subsequently allow us to extend these studies to important legume crop species such as soybean and alfalfa.

[P.S. Nagar](#)
INDIA

I worked as Principal investigator for the studies of “Floristic Diversity the Barda Sanctuary, Saurashtra”, 2000-2001, GEER Foundation, Gandhinagar, “Medicinal plants of Saurashtra”, 2001-2002, GEER Foundation, Gandhinagar (with prior permission and instructions of the Vice chancellor, Saurashtra University, Rajkot), “Threatened trees of Gujarat”, 2002-2003, GEER Foundation, Gandhinagar (with prior permission of the Vice chancellor, Saurashtra University, Rajkot).

[Nazhat-Ezzamane Noureddine](#)

ALGERIA

I am studying taxonomy of rhizobia associated to Algerian legumes including the genus *Lotus*. This study is done by a numerical taxonomy and biomolecular means. Even if I have a soil microbiology background, I am very interested by the taxonomy and breeding of *Lotus*.

[Felicia Oliva Tejera](#)

SPAIN

I am involved in the studies carried out by the group formed by Dr. J. Caujape-Castell, Juan Ramón Acebes Ginovés and D. Bramwell in relation to the genetic variation (iso-enzymes) and the taxonomy of *Lotus spartioides* Webb & Berthel., *Lotus holosericeus* Webb & Berthel, *Lotus campylocladus* Webb & Berthel and *Lotus hillebrandii* Christ, endemic of the Canary Islands.

[Graeme Sandra](#)

AUSTRALIA

I along with Dr [Daniel Real](#) have funding from Australian Wool Innovation and the Rural Research and Development Corporation to develop commercial cultivar of *Lotus* suitable for environments that experience up to 11 to 13 hours day lengths and summer droughts of 5 to 7 months where the growing season rainfall is 450 to 650 mm and winter dominant. The primary target species for this activity are *Lotus corniculatus* for slightly acid soils and *Lotus glaber* for slightly saline waterlogged soils. This program has linkages to another in Glen Innes, New South Wales, Australia, run by Dr [John Ayres](#). Primarily our linkage is to provide early prolific flowering populations of *Lotus corniculatus* to John's

program which is focused on summer dominant rainfall environments that receive greater than 650 mm and experience short day lengths. Other important linkages have been established with Dr [John Howieson](#) from the Centre for Rhizobium Studies, Murdoch University, Western Australia, Australia. The aim of this activity is to ensure that commercial inoculants released for *Lotus* have a broad and effective host range across species and life forms. We are also keen to develop linkages with other breeding programs where it can be identified that benefits will exist for both programs. The breeding programs described are apart of the CRC for Plant Based Management of Dryland Salinity. They are aimed at reducing soil water recharge (drainage) which if effective will reduce the movement of soil stored salts to lower parts of the landscape.

[*Dmitry Sokoloff*](#)
RUSSIA

I study, together with Dr. Tatiana Kramina, sectional delimitation in the genus *Lotus* as well as generic limits of *Lotus*. We suggest to exclude all New World species from *Lotus*. In the Old World, we accept segregate genera *Podolotus*, *Pseudolotus*, and *Kebirita*. We treat *Dorycnium* and *Tetragonolobus* as synonyms of *Lotus*. I am involved also in study of some groups of white and red-flowered *Lotus* species.