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PlantScienceNews

Newsletter of the Zurich-Basel Plant-Science Center

No 26, Fall 2014

Upcoming Events

PLANT FELLOWS Symposium

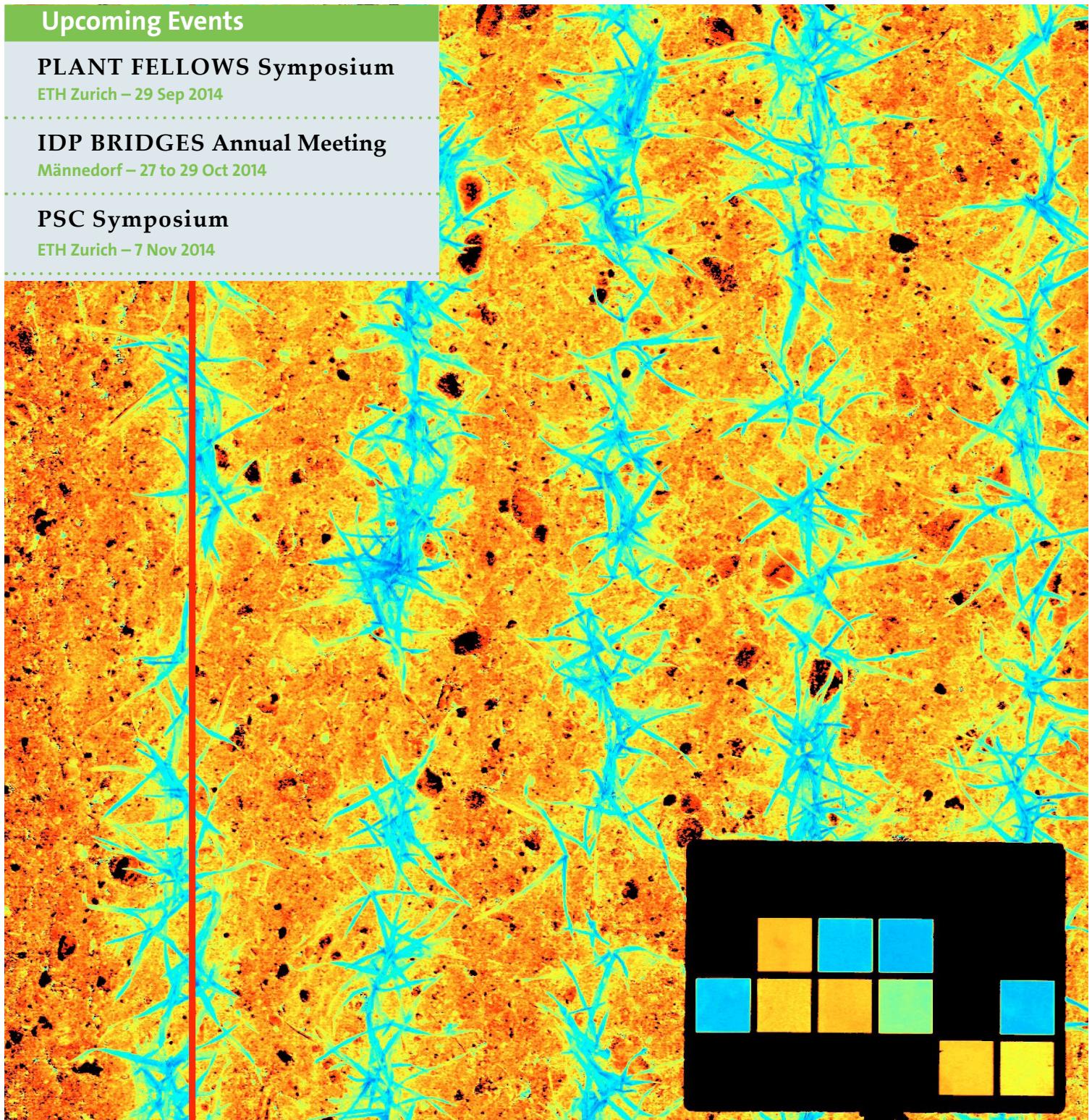
ETH Zurich – 29 Sep 2014

IDP BRIDGES Annual Meeting

Männedorf – 27 to 29 Oct 2014

PSC Symposium

ETH Zurich – 7 Nov 2014



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Newsletter No. 26, Fall 2014

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Courtesy of PSC staff, Günter Hoch

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Printing
HELLER DRUCK AG

Print run
500 copies

Paper
Lessebo bright smooth 120 gm², FSC

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Cover picture

Christoph Grieder (ETH Zurich)
Normalized difference vegetation index (NDVI)
displayed in false color of wheat, during early
development in the field

Referring to unpublished data

Editorial



The Plant Science Centre: an empowering network of excellence

The success of the PSC in the last 16 years reflects the progressive thinking, shared values and scientific excellence of its members, all underpinned by the professionalism of the PSC directors and office staff. Thanks to the PSC, our research is better funded, our students are better trained, and our achievements and knowledge are better communicated to the public and other stakeholders. Belonging to the PSC brings you into a network with impressive breadth and depth, with proven expertise in fundraising, management, mentoring and outreach. This opens doors to joint, interdisciplinary initiatives and fellowship programs that would otherwise be inaccessible. At our recent 1-day retreat, we explored the horizon of the PSC, brainstorming with our members to refine our strategies and services, increase our visibility, and identify new fundraising opportunities. As you read about it (Page 5), imagine what you could achieve within the PSC network and bring those ideas to us!

Samuel C. Zeeman
PSC President



At a Glance

Awards

Silvia Dorn (ETH Zurich)

received the Doron Prize 2014 endowed with CHF 100'000 for her seminal research work in Applied Entomology. Silvia Dorn was also elected the 2014 C.V. Riley Lecturer (University of Missouri, USA).

Lena M. Müller and Moritz Rövekamp (University of Zurich)

Lena received the H. F. Linskens Presentation Award 2014 and Moritz was awarded the M.T.M. Willemse Poster Award 2014 during the International Congress on Sexual Plant Reproduction in Porto, Portugal, held by the International Association of Sexual Plant Reproduction Research (group of Ueli Grossniklaus).



Call for Proposals

PSC-Syngenta Fellowship Program

The PSC launches a new call for proposals under the PSC-Syngenta Research Fellowship Program.

Applications of competitive research proposals for PhD and Post doc fellowships can be submitted until 1st of November 2014. The funds are intended to promote innovative research in plant sciences. In addition to the scientific quality of the projects and the scientific qualification of the applicants, research co-operation within PSC will be an important criterion in decision-making.

This call is reserved for PSC professors and group leaders. For application templates, please contact: Manuela Dahinden, mdahinden@ethz.ch

For more information on the Fellowship Program visit
<http://www.plantsciences.ch/research/fellowships/syngenta.html>

Latest IDP BRDIGES fellows

University of Basel

Silvia Turco to Mikhail Pooggin

Lukas Schütz to Thomas Boller

Michael Thieme to Etienne Bucher

Constantin Pöll to Jürg Stöcklin

ETH Zurich

Guillaume Lacavé to Eduardo Perez and Achim Walter

Devang Mehta to Hervé Vander-schuren

Young shoot of a tree-fern, Kilimanjaro, Tanzania
© Günter Hoch

Exploring the Horizon

At the PSC retreat, a cohort of PSC members met at the Uetliberg in Zurich to brainstorm on new opportunities for the PSC network.

Manuela Dahinden

The PSC has built up an impressive portfolio of research, educational programs, and outreach formats. The aim of the retreat was to discuss the maintenance and branding of successful programs, but also to identify new opportunities for the network to grow.

We agreed on developing a more robust mentorship program to equip students with the necessary skills and resources to take their projects and ideas to the next level. For new PhD supervisor faculty members there will be a lunch seminar organized by the PSC staff. The aim is to support them in understanding the processes and regulations of PhD supervision at the different universities, and to share best practices.

In the near future, the PSC wishes to facilitate even more research-driven network initiatives. Several national and international funding schemes were discussed. In the process of implementing some of the ideas born during the retreat, we will soon put out a call for members to join the following working groups:

EID – European Industrial Doctorates,

a Horizon 2020 Marie Skłodowska-Curie Action for up to 14 PhD fellowships, next call deadline is in Jan 2015.

RISE – Research and Innovation Staff Exchange

a Horizon 2020 Marie Skłodowska-Curie Action for international collaborations, next call deadline is in April 2015.

NCCR – National Centres of Competence in Research

in Switzerland funded by the SNSF, next call to be expected in 2016.

Everybody in the network is very welcome to join. The competences and services of the PSC staff will empower your ideas and help the consortia with enhancing a collaboration platform.

In 2015 several interesting meetings will be organized:

- PSC Syngenta Symposium in Stein on 27th of August
- Fachtagung zur Grünen Gentechnik on 4th of September
- PSC Symposium on 3rd of December

The participants provided a large list of potential topics and speakers which we will now start to review.

We wish to invite our members to take advantage of the PSC competencies and services in our three core areas: research, education and outreach. Together with us, embark on new initiatives, and set out a course for future growth and impact.

Thank you all for participating.

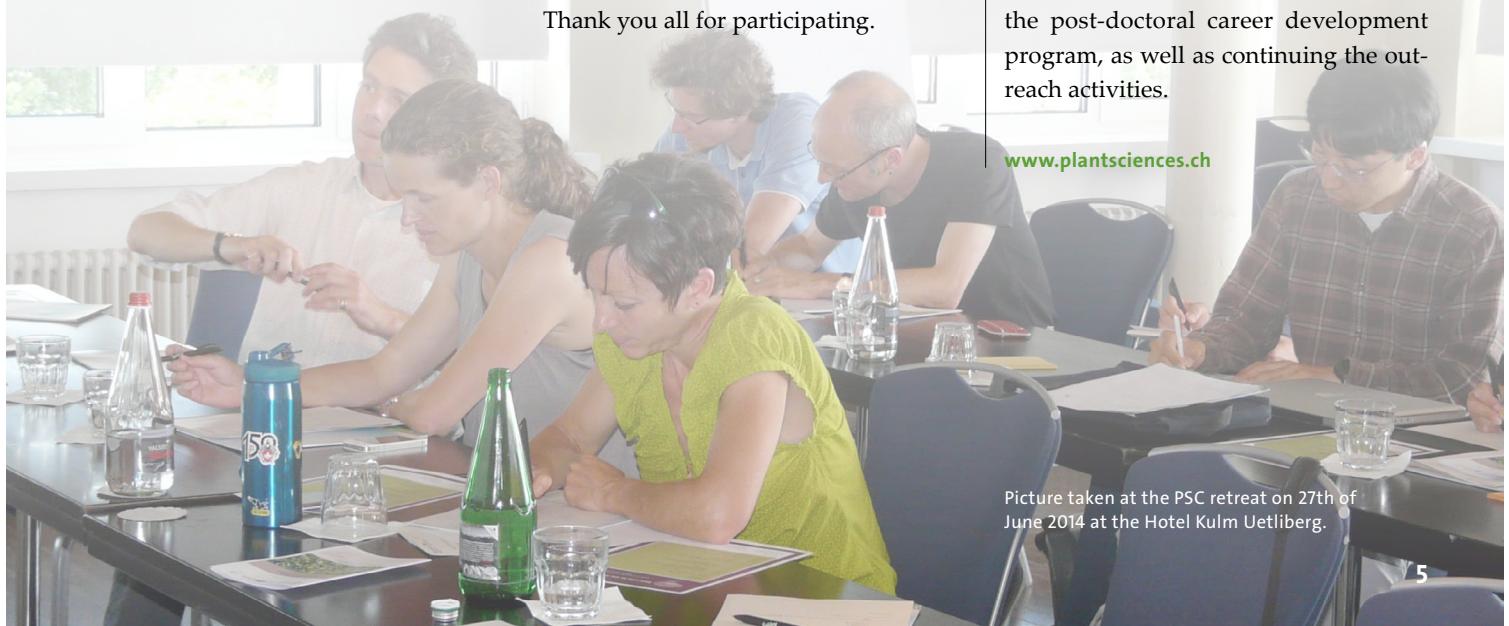
Renewal as competence center

Melanie Paschke

The PSC is currently in the process of renewing its competence center status for the period 2015-2018. PSC received positive decisions from all involved faculties/departments. The final renewal decisions from the three universities' managements are expected for September. The renewal procedure furnished evidence of the many PSC achievements of the past 16 years: e.g. its innovative fellowship programs characterized by a strong nexus of research and training, and its successful fundraising. In the last five years PSC secured more than CHF 18 Mio third-party funding and created opportunities for research, education and outreach activities. The PSC has an international visibility profile in plant sciences. As a service partner for the universities it guarantees that programs and activities in research and education are of highest quality. Researchers are supported in their research activities, their training and their career development.

In 2015, the PSC will consolidate its portfolio and focus on: continuing the fundraising efforts, promoting translational research (fundamental or basic research in plant sciences integrated in the science-policy interface), securing the high quality of PSC educational programs at the PhD level and expanding the post-doctoral career development program, as well as continuing the outreach activities.

www.plantsciences.ch



Picture taken at the PSC retreat on 27th of June 2014 at the Hotel Kulm Uetliberg.

PSC Mentoring

Melanie Paschke

In spring 2014 the PSC started its new "Mentoring for Research Impact" initiative that aims to help students tap into existing resources and optimizing their efforts in outreach, science communication, and policy impact. With 40 participants at the orientation session "Welcome to new PhD students" and in the mean 10 participants in the brown bag lunch events, this form of targeted mentoring is becoming quite popular. Some students took the opportunity for a one-to-one mentoring session. A key goal of these workshops is to present a menu of opportunities to PhD students to either gain or apply skills that will extend the reach of their research. The follow-up opportunities will be enriched with one-on-one guidance with an experienced mentor for interested students.

Registration

www.registration.ethz.ch/spsw

PSC Mentoring Services

Welcome to new PhD students at ETH Zurich and University of Zurich
2 Oct

Accessing resources to improve teaching skills; how to get meaningful experience (for PhD students)
14 Oct

Introduction to PhD Program in Science & Policy
21 Oct

Welcome to new PhD students at University of Basel
12 Nov

Frontiers in Plant Sciences New Graduate Courses

RNA Sequencing – A Practical Course for Plant Scientists
11-14 Nov
Lucy Poveda, Weihong Qi
Functional Genomics Center Zurich
ETH Zurich/ University of Zurich

For a complete list of courses offered and to enroll, visit
www.registration.ethz.ch/spsw

PhD Courses, Fall 2014

Scientific Writing Practice 1
26 Sep & 24 Oct

Challenges in Plant Sciences – mandatory PSC colloquium
30 Sep & 4 Nov

Transdisciplinary Research for Sustainable Development
1/10/22 Oct, 5/19 Nov, 3 Dec

Sciences & Policy: Stakeholder Engagement
6 Oct & 3 Nov

Genetic Diversity: Techniques
7 & 28 Nov

Introduction to Statistics for Molecular Biologists
20 & 21 Nov

Writing a Post-doctoral Grant
24 & 27 Nov

Computational Biology
3-5 Dec

Scientific Visualisations using R
8 & 9 Dec

Genetic Diversity: Analysis
13-17 Jan 2015

Parasitic plant (*Cuscuta pentagona*) growing towards a tomato plant.
Cuscuta uses volatile cues for host location © Jason Smith



Professor Consuelo De Moraes

Consuelo De Moraes

Chemistry plays a key role in mediating ecological interactions among species. Our research focuses on understanding how chemical cues and signals mediate interactions among plants, insects and microbes, with a particular focus on volatile chemistry and olfaction.

Much of our previous work has focused on understanding how plant chemistry is altered by insect feeding and other environmental influences and the implications of such changes for multi-trophic ecological interactions. For example, plants attacked by insect herbivores frequently respond by emitting volatile compounds that are attractive to predatory insects and which thereby serve as an indirect form of plant defense. Furthermore, such induced plant volatiles can exhibit a great deal of informational complexity. Some of our previous work has shown that specialist predators can distinguish the odors of plants fed on by different herbivore species and preferentially respond to the volatile blend of plants occupied by the particular species on which they prey.

Insect herbivores also utilize constitutive and induced plant volatiles as foraging cues. And plants themselves can even utilize the odors of damaged neighbors as cues to prepare their defenses against impending attack. These complex interactions have important implications for plant-insect interactions in natural and

agricultural ecosystems. Some of our current work explores how genetic and environmental variation in chemical signaling within plant populations influences community dynamics, including the regulation of herbivore populations. Pathogens and other microbes also influence plant chemistry, and another major focus of our current work explores how vector-borne pathogens alter the biochemical traits of their plant (or animal) hosts in ways that influence the frequency and nature of interactions between the host and insect vectors. We have documented virus-induced changes in host-plant odors and plant nutritional quality that alter patterns of aphid recruitment and dispersal in ways that favor virus transmission. Such interactions have important implications for understanding disease transmission in agricultural systems as well as being relevant to human medicine. Some of our recent work is exploring similar phenomena in human disease systems including malaria.

The overarching goal of our program is to bring a wide range of empirical and analytical techniques to bear on key scientific questions in ecology that have relevance to a variety of pressing societal challenges, including sustainable food production, disease emergence and transmission, and ecological sustainability in the face of rapid environmental change.



Curriculum vitae

Consuelo De Moraes, a native Brazilian, earned her B.Sc. from the Universidade Federal de Minas Gerais, Brazil. In 1998 she completed her doctorate in Entomology at the University of Georgia, USA. In 2001, she was appointed Professor of Entomology at Penn State University. In the fall 2013, she accepted a professorship at the ETH in Zurich, where she heads the Laboratory of Biocommunication and Entomology. Consuelo's research findings have been published in leading scientific journals including *Science*, *Nature*, and *PNAS*. Her research is discussed in textbooks from a variety of life-science disciplines and has also been the subject of several documentary films and of articles in major media outlets and popular science magazines that reach a broad audience. Her accomplishments have also been recognized through numerous awards and honors.



Striped cucumber beetles (*Acalymma vittatum*) feeding on wild gourd, (*Cucurbita pepo ssp. texana*). The beetle-transmitted bacterial pathogen *Erwinia tracheiphila*, which causes a fatal wilt disease that alters the foliar and floral volatile emissions of its host. © Nick Sloff

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www.swissplantscienceweb.ch/nc/research/home/portfolio/demoraes

Nature 509, 218-221 (2014)

Consequences of biodiversity loss for litter decomposition across biomes

Handa IT, Aerts R, Berendse F, Berg MP, Bruder A, Butenschoen O, Chauvet E, Gessner MO, Jabiol J, Makkonen M, McKie BG, Malmqvist B, Peeters ETHM, Scheu S, Schmid B, van Ruijven J, Vos VCA, Hättenschwiler S

The decomposition of dead organic matter is a major determinant of carbon and nutrient cycling in ecosystems, and of carbon fluxes between the biosphere and the atmosphere. Decomposition is driven by a vast diversity of organisms that are structured in complex food webs. Identifying the mechanisms underlying the effects of biodiversity on decomposition is critical given the rapid loss of species worldwide and the effects of this loss on human well-being. Yet despite comprehensive syntheses of studies on how biodiversity affects litter decomposition, key questions remain, including when, where and how biodiversity has a role, and whether general patterns and mechanisms occur across ecosystems and different functional types of organism. Here, in field experiments across five terrestrial and aquatic locations, ranging from the subarctic to the tropics, we show that reducing the functional diversity of decomposer organisms and plant litter types slowed the cycling of litter carbon and nitrogen. Moreover, we found evidence of nitrogen transfer from the litter of nitrogen-fixing plants to that of rapidly decomposing plants, but not between other plant functional types, highlighting that specific interactions in litter mixtures control carbon and nitrogen cycling during decomposition. The emergence of this general mechanism and the coherence of patterns across contrasting terrestrial and aquatic ecosystems suggest that biodiversity loss has consistent consequences for litter decomposition and the cycling of major elements on broad spatial scales.

Developmental Cell 29, 1-10 (2014)

A calcium dialog mediated by the FERONIA signal transduction pathway controls plant sperm delivery

Ngo QA, Vogler H, Litviev DS, Nestorova A, Grossniklaus U

Sperm delivery for double fertilization of flowering plants relies on interactions between the pollen tube (PT) and two synergids, leading to programmed cell death (PCD) of the PT and one synergid. The mechanisms underlying the communication among these cells during PT reception is unknown. We discovered that the synergids control this process by coordinating their distinct calcium signatures in response to the calcium dynamics and growth behavior of the PT. Induced and spontaneous aberrant calcium responses in the synergids abolish the two coordinated PCD events. Components of the FERONIA (FER) signaling pathway are required for initiating and modulating these calcium responses and for coupling the PCD events. Intriguingly, the calcium signatures are interchangeable between the two synergids, implying that their fates of death and survival are determined by reversible interactions with the PT. Thus, complex intercellular interactions involving a receptor kinase pathway and calcium mediated signaling control sperm delivery in plants.

Biotechnology Advances

32, 190-199 (2014)

Emerging technologies advancing forage and turf grass genomics

Kopecký D and Studer B

Grassland is of major importance for agricultural production and provides valuable ecosystem services. Its impact is likely to rise in changing socio-economic and climatic environments. High yielding forage grass species are major components of sustainable grassland production. Understanding the genome structure and function of grassland species provides opportunities to accelerate crop improvement and thus to mitigate the future challenges of increased feed and food demand, scarcity of natural resources such as water and nutrients, and high product qualities.

In this review, we discuss a selection of technological developments that served as main drivers to generate new insights into the structure and function of nuclear genomes. Many of these technologies were originally developed in human or animal science and are now increasingly applied in plant genomics. Our main goal is to highlight the benefits of using these technologies for forage and turf grass genome research, to discuss their potentials and limitations as well as their relevance for future applications.



Caterpillar of an Arctiidae on a verbena
© Günter Hoch

The consequences of gene flow and genetic diversity for performance and adaptive potential within populations of an invasive species

This research was part of Emily Moran's PLANT FELLOWS project in the lab of Prof. Jonathan Levine at ETH Zurich in May 2013 to June 2014.

Emily Moran

Invasive species are useful for investigating the role of genetic diversity in responses to novel environments, because they often pass through a genetic bottleneck and face a range of new selective pressures. Genetic diversity may positively impact plant populations through heterosis or sampling effects. In addition, available genetic diversity affects the potential for local adaptation. *Solidago canadensis* was introduced to Europe from North America in the 18th century. In Switzerland, it is common in disturbed habitats at low elevation, but is rarely found above 1200 m. There is evidence of local adaptation to latitudinal climate gradients in Europe, but it was not known whether this was true along elevation gradients, where gene flow is expected to be high.

We combined population genetics analyses with a common garden experiment to investigate a) whether the genetic diversity of Swiss *Solidago* populations could be explained by landscape structure b) whether genetically diverse populations perform better in marginal environments and c) whether there is evidence of local adaptation along climate-elevation gradients to local conditions. To investigate genetic diversity and isolation by distance we genotyped individuals from 43 populations at nuclear microsatellite and chloroplast loci. We then planted replicate genotypes (clones) from 13 populations in three common gardens: Within the occupied climate envelope (650 m), at the range edge (1250 m), and above the range edge

(1680 m). We measured their growth, phenology, and survival in 2013 and 2014 (ongoing).

Solidago populations exhibited non-significant isolation by distance at microsatellite loci, and most chloroplast haplotypes were widespread, suggesting extensive dispersal. This is consistent with their small, wind dispersed seeds and pollination by a variety of common insects. Patterns of genetic diversity could not be explained by elevation or by human or road density.

Within the common gardens, there was no evidence that more heterozygous individuals or more genetically diverse populations performed better, but there was evidence of local adaptation. High growth rates are needed to reach the minimum flowering height early enough to complete flowering before winter. In 2013, only plants in the lowest garden produced seed, suggesting that reproductive failure may limit spread above 1200 m. Plants from colder home locations grew faster at the highest site, and some produced flower buds, while those from warmer sites did not, suggesting that such populations have adapted to colder conditions despite high gene flow. Growth rate was negatively correlated with climate distance from the source population.

We will continue monitoring second-year flowering until autumn. We expect to publish the results of the field and population genetics studies in the spring, and will be investigating the implications of local adaptation for the future spread of *Solidago* under climate change.



Emily with plants at middle site, September 2013
© Andrea Reid

Relevant publications

Moran EV, Alexander JM (2014)

Evolutionary responses to global change: Lessons from invasive species.
Ecology Letters, 17(5):637-649.

Moran EV, Kubiske ME (2013)

Can elevated CO₂ and ozone shift the genetic composition of aspen (*Populus tremuloides*) stands?
New Phytologist, 198:466-475.

Contact

emoran5@ucmerced.edu

Online resources for formal and informal learning

Juanita Schläpfer

An online book of more than twenty experiments will be published by the PSC this autumn as the final activity in the Plant Science Expeditions Agora grant from the SNSF. This collection of experiments will document the hands-on activities done in the Family Expeditions, Fascination of Plants Day and Plant Science at School Teacher Workshops. The experiments are fully described with materials lists and step by step instructions so that they can be done by teachers or parents or out of school clubs, or other university outreach programs. Some do require considerable previous knowledge, but all experiments are categorized by difficulty and what age children they are

appropriate for. Each activity is accompanied by a list of links to materials sources and other similar or related online content.

Teachers will be able to engage their class with plant physiology, relate wheat breeding to the traits necessary for good bread and take their class on a "Neophyte walk" to identify common archeophytes and neophytes. The PSC is committed to open-access learning and hopes that this is a useful contribution to online resources in the German language. The book with the title **Experimente in den Pflanzenwissenschaften für Familien und Schulklassen** will be available under this link:

www.plantsciences.ch/outreach.html

Plant Science at School

Over the past two years, this program has become an important and well attended outreach event series and a national example of a successful interaction between researchers, teachers and regional learning centers.

In one-day workshops full of practical experiments, theoretical information and discussion, high-school teachers learn about cutting-edge research.

The workshop format allows an easy transfer of knowledge and experiments into the classroom, thus enabling teachers to become mediators between current research and high school students.

Upcoming teacher workshops

Autumn 2014

Plant Molecular Biology II in Zurich

Plant Ecophysiology in Bern

April 2015

Plant Phylogeny in Zurich

Metabolic Network in Geneva

carole.rapo@usys.ethz.ch

Intergenerational learning at ALPFOR research station

Juanita Schläpfer

After the success of the first Plant Science Family Expedition in July 2013 to the Alpine Research Station Furka (ALPFOR) on the Furkapass, we were able to run the expedition again. This year 22 children and youth, and 16 adults spent two days in August with Christian Körner, Erika Hiltbrunner and team, learning about alpine ecology, measuring microclimates and investigating plant clones. Along with the SNSF Agora funds, the expedition was co-funded by the Schweizerische Gemeinnützige Gesellschaft (SGG) a Swiss-wide foundation that aims to promote intergenerational learning. The Furka expedition is a perfect opportunity for this, as adults and children are divided into small groups and guided by a researcher in hands-on field experiments. This year a grandfather attended with his son and grand-

children for a three-generation social learning experience! Feedback surveys show that this is really an extremely positive and unique learning experience for the participants. Once again our heartfelt thanks to Christian and Erika for making this such a memorable experience for all.

www.intergeneration.ch/expeditionen-zu-den-pflanzenwissenschaften

Exciting discoveries on the Furka Family Expedition 2014 © PSC



PLANT FELLOWS Symposium

29 Sep 2014, ETH Zurich, Semper Aula

Join the largest coming together of PLANT fellows and their principal investigators presenting state of the art of plant sciences research.



PLANT FELLOWS

www.plantfellows.ch

Chair
Ortrun Mittelsten Scheid
 Gregor Mendel Institute of
 Molecular Plant Biology
 Austria

Session I: Plant growth and reproduction

- 9:15** Keynote: Urs Fischer, Umeå Plant Science Center, Sweden
title tba
- 9:45** Christian Breuer, University of Cologne, Germany
Environmental regulation of plant cell growth and differentiation processes by trihelix transcription factor networks
- 10:00** George Gavin, ETH Zurich, Switzerland
Understanding how fluxes in carbohydrate metabolism control plant growth using an integrated, cross-species analysis
- 10:15** Daniela Liebsch, Umeå Plant Science Center, Sweden
Cambial function of KNAT1 and STM
- 10:30** Tamir Klein, University of Basel, Switzerland
Tree carbon allocation dynamics using a carbon mass balance approach
- 10:45** Nina Chumak, University of Zurich, Switzerland
Identification and characterization of components of apomixis in maize

Session II: Plant environment interactions

- 11:20** Keynote: Mario Vallejo-Marin, University of Stirling, UK
Buzz-polination and the evolution of floral form
- 11:50** Pierre Liancourt, Academy of Science, Czech Republic
High and dry with cushion plants: an evolutionary and functional perspective
- 12:05** Juliana Almario, University of Cologne, Germany
*Structural and functional characterization of the *Arabis alpina* fungal microbiome*
- 12:20** Kadri Koorem, Netherlands Institute of Ecology
The dynamics of the association between plants and arbuscular mycorrhizal fungi during range expansion of the partners
- 12:35** Javier Martin, University of Zurich, Switzerland
Molecular analysis of wheat disease resistance against powdery mildew and glume blotch
- 12:50** Ben Warren, University of Zurich, Switzerland
Islands as model systems for understanding evolutionary and biogeographic patterns

Chair
Jitka Klimešová
 Academy of Science Czech Republic

Session III: Signalling and communication

- 14:15** Keynote: Ilwoo Hwang, Pohang University of Science and Technology, Korea
A secret cross-talk of peptide, auxin and brassinosteroid
- 14:45** Heather Kirk, University of Zurich, Switzerland
Evolution of floral signalling
- 15:15** Krishna Sharan, University of Basel, Switzerland
Amelioration of plant nutrients uptake mediated by AMF and PGPR's under water stress condition
- 15:30** Cornelia Eisenach, University of Zurich, Switzerland
Regulation of vacuolar anion transport in stomatal response
- 15:45** Nial Gursansky, Gregor Mendel Institute of Molecular Plant Biology, Austria
The role of MOL1 in the regulation of lateral growth
- 16:00** Aurelien Boisson-Dernier, University of Cologne, Germany
To burst or not to burst: how different receptor-like kinases coordinate cell wall integrity and growth

Chair
Marcel Bucher
 University of Cologne
 Germany



This project receives funding from the European Union's
 Seventh Framework Programme for research, technological
 development and demonstration under grant agreement no
 GA-2010-267243 – PLANT FELLOWS.

PSC Symposium

Rooted: Successful Strategies of Sessile Organisms

7 Nov 2014, ETH Zurich, organized by PSC PhD students

8:30-8:40

Opening remarks by **Prof. Samuel C. Zeeman**, ETH Zurich

8:40-11:10

Session I: Root development and evolution of land plants

Prof. John Bowman, Monash University

Prof. Liam Dolan, University of Oxford

Dr. Wolfgang Busch, Gregor Mendel Institut Wien

Coffee break with poster session

11:10-14:30

Session II: Adaptation to abiotic factors

Prof. Marc Boutry, Université catholique de Louvain

Prof. Didier Reinhardt, Université de Fribourg

Dr. Markus Schmid, Max Planck Institut Tübingen

Lunch with poster session

14:30-16:50

Session III: Cross-kingdom interactions

Dr. Delphine Chinchilla, Universität Basel

Prof. Ian T. Baldwin, Max Planck Institut Jena

Prof. Consuelo de Moraes, ETH Zurich

Closing remarks and best poster award

Apéro

For registration

www.plantsciences.ch/outreach/conferences/symposium.html

Admission is free of charge, but registration is required.

Note: A short talk from a young researcher will be included in each of the sessions.

Selection is based on submitted abstracts. Titles will be announced at a later date.

