Sol Newsletter

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Community News

The 10th Solanaceae Conference: "geno versus pheno"


Friendship Hotel, Beijing, China

Beijing, China
October 13 - 17, 2013

Dear Colleagues, it is our great pleasure to announce that the 10th Solanaceae Conference will be held at the Beijing Friendship Hotel in Beijing, China, from October 13 - 17, 2013. On behalf of the organizing committee, we cordially invite you to take part in this conference. We plan to make this conference a memorable and valuable scientific experience and communication for all the attendees.

As in past years, SOL 2013 would bring together a spectrum of scientists working on different aspects of *Solanaceae* ranging from biodiversity, genetics, development and genomics. With the availability of the high-quality genome sequence of tomato, studies of the SOL community have extended from structural genomics into virtually every aspect of functional genomics. SOL 2013 would be a forum to discuss the impact of this reference genome on different aspects of Solanaceae studies. Meanwhile, a battery of high-throughput technologies, including transcriptomics, proteomics and metabolomics, are leading the way in providing new insights into the inner workings of plant cells. Importantly, the cell biology toolbox, which is previously mainly restricted to animal and yeast cells, has finally been built up in the *Solanaceae* allowing researchers to establish the fundamental linkage between genotypes (geno) versus phenotypes (pheno). The conference would also provide a forum to sit together and create a roadmap for the future of the Solanaceae Community.

The conference website (www.sol2013.org) will provide you with up-to-date information i.e. registration, abstract submission, hotel accommodation, pre- and post-tours etc.

October is the best season to visit Beijing as well as the rest of the country. You can expect plenty of sunny weather, fairly low levels of rainfall and pleasant temperatures. We look forward to seeing you all in Beijing in October 2013.

Co-chairs SOL 2013
Jiayang Li (Institute of Genetics and Developmental Biology, CAS)
Yongbiao Xue (Institute of Genetics and Developmental Biology, CAS)
Chuanyou Li (Institute of Genetics and Developmental Biology, CAS)

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Hosted by:
Institute of Genetics and Developmental Biology, Chinese Academy of Sciences
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René Klein Lankhorst (Netherlands)
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Sandra Knapp (UK)

Scientific Sessions

Session I. Hormone Signaling and Development
Session II. Fruit Biology
Session III. Biotic Interactions
Session IV. Abiotic Interactions
Session V. Systems biology
Session VI. Metabolomics and Proteomics
Session VII. Translational Genomics and Breeding
Session VIII. Biodiversity and Evolution
Parallel Session IX. Tomato
Parallel Session IX. Pepper/Eggplant/Coffee
Parallel Session X. Potato
Parallel Session X. Tobacco

From the SOL Co-Chairs

Apart from SOL-2012 in Neuchâtel being a very successful meeting at a wonderful venue, it also marked a number of changes to the committee of the SOL organization that we call the SOL Co-Chairs. Precipitating these changes was the retirement of René Klein Lankhorst as Chairperson. In his last meeting as chairman, he implemented changes in personnel to get new people involved and to broaden the scope of the committee. As a result, we now have three new members (Alan Andrade, Christian Bachem, and Lukas Mueller) and a returning member Sandy Knapp, who has also taken on the task of chairperson. As "old hands", Mathilde Causse, Jeanne Jacobs, Glenn Bryan, and Sanwen Huang are continuing as co-chairs. Along with René, Harry Klee has also left the committee. The current co-chairs would like to thank the exiting members for their sterling work and we would also like to introduce ourselves in the form of short CVs. In the next issue of the Sol Newsletter, we plan to give you more on our tasks and vision for the future of SOL.

The Reorganized SOL-Co Chair Group 2012

CHRISTIAN BACHEM, new SOL co-chair: Christian is a German national but was born in Mexico, educated in the UK, and studied agriculture at the University of Bonn, continuing with a PhD at the MPI in Cologne under the late Jeff Schell. After a short post-doc in Edinburgh, Christian joined the Keygene Company in the Netherlands and four years later, transferred to Wageningen University where he has worked as a research scientist and university teacher at the lab of Plant Breeding since 1991. His main scientific interest is in the functional genomic analysis of potato tuber development and quality traits in *Solanaceae*. He also participates in and coordinates a number of large research projects on national, European, and international levels and is an active member of organizations such as Eucarpia, EPSO, the PGSC and now SOL.

ALAN C. ANDRADE, **new Sol co-chair**: Alan is a Brazilian plant scientist. He has a BSc in Agronomy and MSc in seed physiology from the University of Lavras (UFLA-MG). He got his PhD from Wageningen University working on fungal ABC transporters at the Department of Phytopathology. After his graduate studies, he continued working in Wageningen, as a posdoc (STW project), for three years. In 2002, he became an employee of Embrapa Genetic Resources and Biotechnology (Brasilia-DF, Brazil) and established his research group focused on coffee genomics. His main scientific interest is functional genomic analysis of drought tolerance in coffee. In addition, he aims to develop the genomic tools for applied coffee breeding and the establishment of a Genome Wide Selection program for coffee. He is also involved in teaching, taking part of the graduate program on plant biotechnology at the University of Lavras. He was the coordinator of the Coffee Biotechnology Program of the Brazilian Consortium of Coffee R&D and also took part in coordinating the Brazilian Coffee-EST project. In 2005, he was among the founding members of The International Coffee Genomics Network-ICGN and is a member of the steering committees of ICGN, The International Coffee Genome Sequencing Consortium, and the National Institute of Science and Technology of Coffee (INCT-Café).

GLENN BRYAN, **SOL co-chair since 2009**. Glenn leads the Potato Genetics group at The James Hutton Institute (JHI) in Dundee, Scotland. He obtained his BSc degree at London University in Genetics and a Masters in Applied Genetics at Birmingham University. He studied for his PhD at Washington University in St Louis, USA, where he worked on the transposable element *Mariner* in Drosophila. Before his graduate work he worked as a dairy cattle quantitative geneticist for four years. In 1992 he started working on plants, with the late Mike Gale at the John Innes Centre, where he developed molecular markers for wheat and rice. In 1996 he moved to SCRI to start a potato molecular genetics programme. In 2009 he became the leader of the Potato Genetics group at JHI, which was formed in 2011. He is also the lead contact for JHI's Centre for Research on Potato and other Solanaceous plants. He organized the SOL2010 meeting in Dundee. His main research interests are: potato breeding, the genetics of resistance and tuber traits in potato, and potato domestication and evolution.

MATHILDE CAUSSE, **Sol co-chair since 2009**. Mathilde is a French plant geneticist. She got her PhD from the University of Paris, but did all her research project in Ivory Coast on African rice genetic resources. Then she continued as a postdoc on rice mapping in Steve Tanksley's laboratory (Cornell U, USA). In 1990, she was recruited by the French research institute of Agronomy (INRA), where she first worked on maize genetics and QTL mapping in Orsay. In 1995, she moved to Avignon to develop a program on tomato fruit quality. Since 2004 she is head of the research unit on Genetics and Breeding of fruit and vegetables of Avignon (a lab with more than 100 people working on 8 species, which includes tomato, pepper, eggplant, and potato). Her main scientific interest is in plant breeding, natural genetic diversity of complex traits, and the use of molecular markers to improve breeding efficiency and answer consumer requests for better tomatoes. She has coordinated several scientific projects at the national level and was leader of the module on the organoleptic quality of the EUSOL project.

SANWEN HUANG, Sol co-chair since 2009. In 2005, Sanwen Huang obtained his Ph.D. from the Graduate School of Experimental Plant Sciences in Wageningen University and Research Centre, the Netherlands. In 2005, he established the Laboratory of Vegetable Genomics at the Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences (CAAS). Since 2007, he coordinates the International Cucumber Genome Initiative that has successfully sequenced the 367Mb genome. His team sequenced the genome of a monohaploid potato genotype, a critical contribution to the Potato Genome Sequencing Consortium. He is also on the steering committees of both the International Potato and Tomato Sequencing Consortium and a co-chair of SOL since 2009. He is now working on genomics of plant breeding, using cucumber, tomato, and potato as subjects in particular. He is the principal investigator of several national research projects, including the recent 973 project "The genomics and molecular breeding of vegetable quality traits (2012-2016)" granted by the Chinese Ministry of Science and Technology, which is a teamwork from 12 institutions nationwide.

JEANNE JACOBS, SOL co-chair since 2009. Jeanne is a plant geneticist and the team leader for Genome Analysis in the Breeding & Genomics group at The New Zealand Institute for Plant & Food Research (P&FR), based in Christchurch. She was born, raised, and educated in the Netherlands. She first started working on Solanaceae during her PhD in Plant Breeding at Wageningen University when she developed a molecular genetic map of potato. With an interruption for post-doctoral research into disease resistance in lettuce (at UC Davis) and apomixis in the weed *Hieracium* (Crop & Food Research, NZ), she has worked on Solanaceae ever since. Jeanne is the New Zealand PI for the Potato Genome Sequencing Consortium and an active member of the PGSC steering committee. In recent years, she helped instigate the joint Australia/New Zealand genome sequence project on *Nicotiana benthamiana*. Her main interests are genomics and genetics of potato, especially exploring natural allelic variation for a variety of traits, and implementing this knowledge into the P&FR breeding programme to achieve "Better cultivars faster™".

SANDY KNAPP, new chair of Co-Chairs 2012, joint SOL chair with Dani Zamir from 2005-2007. Sandy is a plant taxonomist working at the Natural History Museum in London, UK. She got her PhD at Cornell University (not working in the Tanksley Lab, but in the Bailey Hortorium on the taxonomy of a large group of South American species of Solanum!); while doing her PhD she spent much of her time collecting plants in South and Central America. She went to the Natural History Museum in 1992 to head Flora Mesoamericana – an international Spanish-language project that is describing all of the vascular plants in the region between the Isthmus of Tehuantepec in México to the Panamá/Colombia border. Mesoamerica is the last land bridge on Earth, and is home to approximately 18,000 species of flowering plants and ferns. She is an expert on the Solanaceae, and has spent her career discovering and describing the diversity of the members of this most fascinating of families. To date she has described more than 100 new species of Solanum, and there are more in the works. She is also the author of several popular books on the history of science and botanical exploration, including the award-winning Potted Histories (2004). In 2009 she was honored by the Peter Raven Outreach Award by the American Society of Plant Taxonomists and awarded the UK National Biodiversity Network's John Burnett Medal. Her current projects include Flora Mesoamericana, a world-wide taxonomic monograph of the megadiverse genus Solanum (Solanaceae), collaborative research in phylogenetics and genomic evolution of Solanaceae, and field guides for conservation in the Neotropics. She has coordinated several scientific projects in the UK and internationally and led the programme of outreach and education in the EU-SOL project.

LUKAS MUELLER, new SOL co-chair. Lukas studied biochemistry at the Federal Institute of Technology (ETH) in Zurich, Switzerland, and obtained his PhD in Biochemistry at the University of Lausanne, Switzerland, in 1997. After postdoctoral studies with Prof Virginia Walbot in Stanford, he joined the Arabidopsis database, TAIR (http://arabidopsis.org/), as a scientific curator. In 2003, he moved to Cornell University in Ithaca, NY, in the laboratory of Prof. Steven Tanksley, were he lead the SOL Genomics Network (SGN, http://solgenomics.net/), a major database for Solanaceous plants, including tomato, potato, pepper, eggplant, and petunia. In 2008, he became a group leader at the Boyce Thompson Institute for Plant Research (http://bti.cornell.edu/), where he heads a bioinformatics group, with the SGN database being a continued focus of his work. A major theme of the present database work is the genotype to phenotype problem, and its application to breeding. He has been involved with the tomato genome-sequencing project since its inception, and contributes to other genome projects from the Solanaceae and other plant families.

Afri-Sol Members Meet and Launch a New Website

Damaris Odeny, John Jagwe, Elizabeth Kizito, Martin Yeboah, Felistus Chipungu, Abdoulaye Seck, Richard Mithen, René Klein Lankhorst

Afri-Sol is a network of scientists and other stakeholders with interest in African Solanaceae species. The network was created in early 2011 and brings together a multidisciplinary team of stakeholders with the goal of unlocking the potential of African solanaceous species biodiversity for the improvement of nutrition, health and income. With funding from the Platform for African-European Partnerships in Agricultural Research and Development (PAEPARD), a representative team from Afri-Sol, together with two European partners met in Kampala, Uganda (June 11 -13, 2012) with the goal of defining the scope of Afri-Sol, as well as establishing an African – European partnership. During the meeting, Afri-Sol members highlighted the following as the major focus areas of the network:

1. **Gathering Indigenous Knowledge**: Different local communities all over Africa use plants of the Solanaceae family for various purposes. A comprehensive database on the uses, production, processing and informal market systems for the various crops will not only enhance their value, but also promote their use across different regions.
2. **Assessment of Genetic Resources**: It will be important to determine the extent of germplasm collections, explorations, and conservation that have been done in the past, or are on-going in the region. Such information will form the basis for future work on genetic resources including explorations and more exhaustive collections, characterization, establishing core collections, germplasm sharing, preliminary screening, gene mining and breeding.
3. **Basic Biology**: Due to limited research, very little is known on the basic biology of these species. There is need to undertake more comprehensive studies on the cytogenetics, biochemical and molecular components, as well as develop molecular tools and proper ontology for the future characterization of African Solanaceae.

4. **Nutrition and Health**: Unknown to many, some African nightshades, including *Solanum scabrum* and *Solanum villosum* are edible and very nutritious but also have medicinal and industrial value. The increasing concerns on narrowing food diversity and the recognition of the potential role of vegetables in combating micronutrient deficiencies, call for renewed research interest in underutilized nutritious vegetables such as those of the Solanaceae family. There is therefore a need to determine and document the micronutrient and bioactive components of these plants, as well as establish systems for human intervention and social economics studies.
5. **Seed systems**: Seed systems remain an important aspect of improving crop production and will be an invaluable component of enhancing the utilization of African solanaceous crops. There is need to identify relevant stakeholders in seed production, seed markets, quality management and regulation, as well as determine optimum seed management conditions for the benefit of the producers and consumers.
6. **Value addition and Markets**: Beyond the fact that many local communities have been utilizing these plants for a long period of time, can we also demonstrate that there is real demand for them in both formal and informal markets? Are there any known product development efforts in the region and/or elsewhere? What are the post-harvest and industrial applications of these crops? What are the consumer preferences and how can those preferences be linked to crop improvement?
7. **Capacity building**: There is generally lack of expertise in Africa for advanced research that would enhance knowledge of the African solanaceous species. There is particularly need to build capacity in taxonomy, the "*Omics*" (genomics, proteomics, metabolomics), human intervention studies, bioinformatics and biochemistry. Building infrastructure and developing relevant curriculum at various research and higher learning institutes will significantly enhance the utilization of these crops and promote their contribution to poverty alleviation and food security.

Members at the workshop also defined the network structure and appointed key leaders and regional representatives. The network currently has six international advisory board members. For more information on Afri-Sol, and to register as a member, or provide feedback, visit www.Afri-Sol.net. You can also follow us on Twitter: @AfriSolnet.

Workshop participants, from left: Richard Mithen (advisory board member), John Jagwe (private sector representative), René Klein Lankhorst (advisory board member), Damaris Odeny (chairperson), Dennis Bisase (FarmGain Africa), Elizabeth Kizito (secretary), Martin Yeboah (West African regional representative)

Research Updates

ROOTOPOWER

Empowering root-targeted strategies to minimize abiotic stress impacts on horticultural crops

ROOTOPOWER (www.rootopower.eu), a KBBE (Knowledge Based Bio-Economy) project funded under the 7th Framework Programme of the European Union (grant number 289365), is innovating in the field of root-science research in Europe. Its consortium, made up of 13 partners from countries such as Spain, United Kingdom, Germany, and Turkey, gathers top research scientists from a wide array of root-related fields.

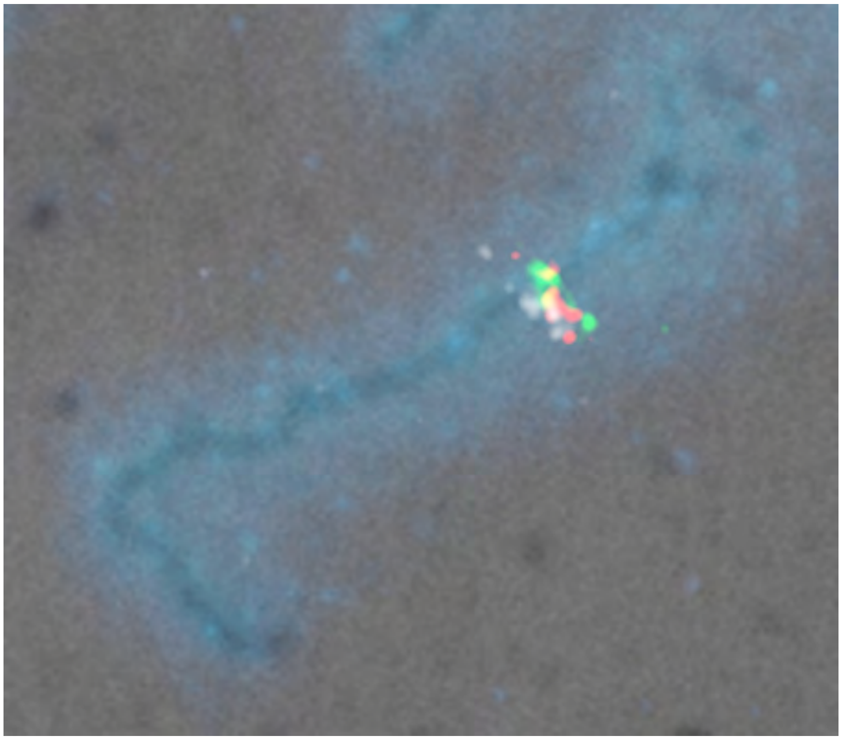
ROOTOPOWER aims to develop new tools, targeted to roots, to enhance agronomic stability and sustainability of dicotyledonous crops under multiple and combined stress conditions. Central to its approach is the use of tomato as a model species, since its genome sequence is already available and it can be very easily grafted. This surgical technique attaches histologically shoot and root systems that are genetically different, allowing precise assessment of the effect of altering root genotype on crop performance of the grafted variety. This project will analyze and exploit the natural genetic variability existing in a recombinant inbred line (RIL) population from a cross between *Solanum lycopersicum* and *S. pimpinellifolium* and other selected mutants and functional lines (used as rootstocks) for their performance under multiple abiotic stresses and for their biotic interaction with natural soil microorganisms (mycorrhiza and rhizobacteria). ROOTOPOWER will obtain genetic information and physiological understanding of mechanisms vital for high-performing root systems.

With an initial budget of circa 3,000,000M€ and a foreseen duration of 4 years, ROOTOPOWER seeks to improve crop stress resistance and develop more resource-efficient crops, thus helping producers and breeders deal with the predicted impacts of climate change and to overcome the consequences of unsustainable agricultural practices that are causing soil degradation and depleting natural resources.

Update from Steve Stack's Lab at Colorado State University

Lindsay Shearer

The Stack lab at Colorado State University has used fluorescence in situ hybridization on tomato pachytene synaptonemal complex spreads to place a total of 499 BACs on the tomato FISH map. Fifty-two of these BACs have been placed on the FISH map since the last edition of the Sol Newsletter. A majority of the new BACs are on the borders of sequenced scaffolds on chromosomes 2, 4, 7, 8, and 11. The distance between each pair of scaffolds has been estimated for each of these chromosomes.



In addition, ten of the new BACs are chromosome 0 BACs that cannot be associated with the sequence on any existing scaffolds. By FISH, we have observed that these BACs are in gaps between scaffolds. This being the case, these chromosome 0 BACs should be entrées to sequencing the gaps in which they are found. The 499 localized BACs are distributed at 509 loci among the chromosomes as follows: 1 - 108; 2 - 44; 3 – 59; 4 – 39; 5 – 28; 6 – 19; 7 –43; 8 – 31; 9 – 24; 10 – 55, 11 – 34, 12 – 25. The total number of loci reflects the fact that there are now ten BACs that have each been localized to two positions

The figure illustrates FISH labeling of three BACs on the long arm of chromosome 2. BAC SL_s0101F18 (white) and SL_EcoRI0034J17 (green) are at the borders of two adjacent scaffolds (SL2.40sc03665 and SL2.40sc03766 respectively). We have estimated the unsequenced area between these two scaffolds to be approximately 1.3 Mb. One of the chromosome 0 BACs, SL_MboI0010K24 (red), falls within the unsequenced gap between the two scaffolds.

Highlight Articles

Early history and iconography of the Solanaceae: 3. Tomato[1]

Marie-Christine Daunay[(a)] & Jules Janick[(b)]
[(a)] INRA UR1052, France; [(b)] Purdue University, Indiana, USA

[1]This SOL paper is the third in the series on the early history and iconography of the Solanaceae. The first covered mandrake (Janick & Daunay, 2007, SOL Newsletter 14), the second covered potato (Daunay & Janick, 2008, SOL Newsletter 21) and the present paper covers tomato. A more detailed treatment can be found in Daunay et al. (2007, 2008). The tomato images displayed here, as well as a few more, will be made available from SGN website. However, the use for publication of the images displayed here and originating from manuscripts requires the previous authorization from the libraries where these manuscripts are located.

Tomato (*Solanum lycopersicum*) is now one of the most important world crops and is widely consumed fresh and processed with a production of 152 millions tonnes (FAO, 2010). The ancestral form of the cultivated tomato was originally confined to the Peru-Ecuador area and spread north possibly as a weed in pre-Columbian times, but was not extensively domesticated until it reached Mexico, and from there the cultivated forms were disseminated (Jenkins, 1948). The wide genetic diversity found in Mexico in both wild and cultivated forms indicated an ancient introduction in this country. De Candolle (1890) suggests a Peruvian domestication, but Harlan (1975) assumes that the biloculed domesticated forms found in southern Mexico and Guatemala are the oldest cultivated types. The original site of domestication of cultivated tomato still remains speculative (Peralta and Spooner, 2007).

Figure 1. Colombian spindle whorl (500 - 1000 CE) reproducing tomato flower features. Source: McMeekin 1992.

First Records

In a set of decorated spindle whorls (dated 900–1500 CE), one type from Colombia dated 500 to 1000 (Fig. 1) may represent a tomato flower (McMeekin, 1992), but this interpretation is controversial. Tomato was common is Mexico at the time of the conquest by Hernán Cortés in 1521, and Estrada Lugo (1989) mentions the use of tomatoes by the Aztec as a medicinal plant in the *Florentine Codex* (Sahagun, 1540-1585). A doubtful pre-Columbian image entitled *Tomazquitl* and depicting a plant with entire leaves and bunches of five globular red fruits is present in the *Codex Badianus* (Walcott Emmart, 1940). The Spanish friar Diego Duran, describing the Aztec ways of life before 1521 from direct witnesses notes that tomato was common in religious offerings and markets (Hodge, 1994, p.64). Hernán Cortés, in a letter dated September 3, 1526, mentions tomatoes (Charnay, 1996, p.404). J. de Acosta (1589) notes that tomatoes were used for preparing sauces. All these brief mentions of tomato provide evidence that tomato was common in the New World, although it should be pointed out that there is confusion in the early literature between tomato and other solanaceous species, in particular *Physalis* spp., both being referred to by the Aztec name *tomatl*.

Tomato is first mentioned in the European literature in a chapter on mandrake (Matthioli, 1544), with the following description:

> *Another species* [of Mandrake] *has been brought to Italy in our time, flattened like the melerose* [a type of pink apple] *and segmented, green at first and when ripe of a golden colour, which is eaten in the same manner* [as the eggplant—fried in oil with salt and pepper, like mushrooms].

The association of tomato to mandrake by Matthioli can be explained by the similarity of their globular golden berries, since the tomato fruits observed in 1544 were yellow. In his later 1554 publication, Matthioli adds that the Italian name for tomato is *Pomi d'oro*, and its Latin equivalent *Mala aurea*, and takes note of a red type.

The precise date of the first European image of tomato is unknown because contemporary images were produced by several Renaissance herbalists, some being published mid-16th century, and the others unpublished for centuries until their "discovery" during the 20th century. Dodoens (1553) is the first to have published a woodcut of tomato, but the image is mediocre and the fruits barely visible (Fig. 2). In the Oellinger manuscript which was completed before 1553 and only published in microfiches in 1996, two tomato drawings show fruits in clusters; the fruits are large, deeply ribbed, and turning from green to either red, folio 541 (Fig. 3, left) or orange, folio 543 (Fig. 3, middle). The third drawing displays a plant with small globular light yellowish fruits, folio 545 (Fig. 3, right). In Vienna codex, Fuchs provides an image that was published by Baumann et al. in 2001. This image, painted by Albrecht Meyer between 1549 and 1556 (Fig. 4) displays single erect fruits of various shapes (globular, globular, and flattened, with or without ribs), sizes (small and large), green, yellow, or red. Gesner's images (Fig. 5 and Fig. 6), respectively, dated 1553 and 1565, display details of flowers and fruit.

Figure 2. First published tomato image. Source: Dodoens 1553. Courtesy: Library of Missouri Botanical Garden.

Dodoens (1557) describes the fruits as large apples, flat, ribbed, of red, whitish, or yellow color, and the woodcut, the same as in the 1553 edition, shows small ribbed and flattened fruits. In his later publications (1574, 1608), Dodoens used another more realistic woodcut with lateral shoots and clustered large flat and ribbed fruits. A colored illustration in the Camerarius' Florilegium (*MS 2764*) dated 1576-1589, represents a branch with leaves, a truss of flowers, and globular slightly flattened green and red fruits.

In 1585, Durante published a stylized drawing, with globular flattened and ribbed fruits. Matthioli (1586) displayed on a single woodcut several fruit types (small or large, globular or flattened, ribbed or smooth. The simplified painted image by Aldrovandi (second half of the 16th century) represents only a branch with two flattened, ribbed, reddish and green fruits, one inflorescence and four leaves. A tomato illustration dating to the close of the 16th century can be found in *The Drake Manuscript* written by an anonymous Frenchman (Fig.7) (Janick, 2012). Realistic tomato fruits (still large, globular, flattened and ribbed) as well as clearly recognizable leaves, are found on a bronze door of the Pisa cathedral (Fig. 8) dated to 1601. The texts by Gerard (1597) and Parkinson (1629) describe fruits of sizes varying between a goose egg and a large apple, bright shining red, pale reddish, yellow or pale yellow. Several authors mention the "foul" odor of tomato vegetation.

Names

The name *tomate* (Spanish, French) and *tomato* (English) derive from *tomatl*, *tomates,* or *miltomates* in the Nahuatl language (Estrada-Lugo, 1989). However, this name was applied to different solanaceous plants, including species of *Solanum* (*Lycopersicon*), *Physalis,* and *Saracha*.

There were many names for tomato in 16th century Europe. Some authors thought that the plant was the *Lykopersikon* mentioned by the Greek physician Galen (131–ca. 200), or the *Glaucium* of Dioscorides. *Solanum pomiferum* and other similar denominations are found in various herbals, such as *Pomum amoris*, *Poma amoris*, *Pomum aureum*, *Pomum aureiium*, *Solanum pomiferum vel amoris*, *Solanum pomiferum aureum*, *Mala aurea*, *Aurea Apffelkraut*, *Gulden Appelen* (High and Low German); and *Golden Apples, mala, Lycopersicum* (Latin); *Pomi d'oro* (Italian); *Pommes d'amours* and *Pommes dorées* (French); *Gold Oppffel*, *Goldt Apffelkraut*, *Gulden Appelen* (High and Low German); and *Golden Apples, Amorous apples, Apples of love*, *Love apples* (English).

Figure 3. Tomato, Oellinger 1553, Manuscript 2362: (Left) folio 541; (Center) folio 543; (Right) folio 545. Source: Erlangen, University library.

The name *Lycopersicon*, also spelled *Lycopersicum*, means peach (*persikon*) of wolf (*lykos*) and indicates some distrust toward this plant. The name was taken from the Galen's *Lykopersikon* which designated a plant from Egypt whose sap was malodorous. In the 18th century, the species was named *Solanum lycopersicum* by Linnaeus, and then as *Lycopersicon esculentum* by Miller, but modern taxonomy has brought tomato back to the genus *Solanum* (Spooner et al. 1993).

While the majority of tomato fruits cultivated at present are red, the appellation *gold* or *yellow* which was commonly used in the past, indicates that many of the early tomatoes introduced were yellow. Why it was named *Love apple* is unclear. This popular name could be linked to the red color, which is associated with the flush of passion. Parkinson (1629) reported that he had tomatoes in his garden only for curiosity and for the amorous aspect or beauty of the fruit.

Figure 4. Tomato, Fuchs' Vienna Codex 11 122, 2(3), folio 161, painted by A. Meyer 1549–1556. Source: Meyer et al. 1996. Copyright: Austrian National Library, picture archive, Vienna.

Uses

Tomatoes are described as medicinal plants in the *Florentine Codex*. Dodoens (1557) noticed that the plant was found only in the gardens of some herbalists; flowered in July and August, and ripe in August and September. Gerard (1597) stated that the *Apples of love* grew in Spain, Italy, and such hot countries. Dodoens (1557) and Gerard (1597) considered tomato of a "cold" nature and quite different from the dangerous mandrake.

Gerard (1597) believed that the fruits brought very little nourishment to the body, while Dalechamps (1653) affirms that this food was bad and corrupted. In 1600 Olivier de Serres suggested that the fruits, although not good for eating, were appropriate as medicine and were pleasant to handle and smell.

Despite some negative opinions, tomatoes clearly were consumed from the beginning of their presence in Europe, first in sauces, according to Olivier de Serres (1600, ed. 1804). Matthioli (1544) as well as Gerard (1597) and Dalechamps (1653) noted that they were commonly fried in or boiled with oil, salt, and pepper. They were eaten in Spain and Italy with oil, vinegar, and pepper as a sauce for meat (Gerard, 1633).

Figure 5. Tomato, Gesner, Ms 2386, folio 42, dated 1553. Source: Erlangen, University Library.

Conclusion

The tomato was well known by the Aztecs, but it is difficult, in the absence of New World iconography, to ascertain when tomato is involved in the textual sources, given that the common Nahuatl word *tomatl* was used for several solanaceous plants, including tomato. The first European description of tomato is by Matthioli (1544), while the first published illustration is by Dodoens and dates to 1553. Renaissance iconography shows that a great diversity of fruit shapes, sizes, and colors was early available in Europe, with a dominance of large multiloculate, ribbed fruits. The common use of names involving "gold" suggests that many early introductions had yellow fruits. The early naturalists clearly knew that tomato was related to the European nightshades, and hence they considered it with some suspicion in view of the European antipathy toward these plants. The many tinted early tomato illustrations, such as those of Oellinger, Fuchs, and Gesner demonstrate that botanists were eager to include this new species into their medico-botanical treatises. Soon after, tomato was rapidly adopted as a food crop in southern European countries where it well adapted.

Figure 6. Tomato. Gesner, Ms 2386, folio 37v, dated 1565. Source: Erlangen, University Library.

Figure 7. Illustration of tomato in the Drake manuscript (end of 16th century). Source: The Drake manuscript.

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Towards a better interaction between European Solanaceae germplasm holders and Solanaceae Omics researchers

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In Europe, the collaboration between germplasm holders of agricultural and industrial crops has been organized and coordinated by the European Cooperative Programme for Plant Genetic Resources (ECPGR, www.ecpgr.cgiar.org) for over 30 years. ECPGR has also established the European Genebank Integrated System (AEGIS) initiative (http://aegis.cgiar.org/), which is formalizing the long-term commitment of the European countries for conservation and management of crop germplasm. For each crop, including solanaceous crops, the AEGIS initiative is creating a decentralized "European collection" consisting of unique accessions in the public domain, being held by any of the germplasm holders accepting the commitment for long-term conservation on behalf of AEGIS.

ECPGR is structured into crop and thematic groups, including the Solanaceae Working Group (www.ecpgr.cgiar.org/networks/vegetables/solanaceae.html) and the Potato Working Group (www.ecpgr.cgiar.org/networks/sugar_starch_fibre_crops/potato.html), which set up work plans and meet periodically. ECPGR products are accessible on-line (e.g. for cultivated potato and wild potato, tomato, capsicum peppers, eggplant, pepino, tree tomato, and ground cherry), including centralized crop databases, that are progressively completed. Key activities include the creation of guidelines for seed regeneration and storage, and identification of key (minimum) phenotypic descriptors to be used by the genetic resources community and entered into the European Central Crop Databases. These agreed minimum lists of descriptors have been selected from the full descriptor lists (www.bioversityinternational.org/publications/search.html) of Bioversity International (formerly IBPGR, IPGRI) which, for solanaceous crops, were published in 1977 (cultivated potato), 1985 (potato variety descriptors), 1990 (eggplant), 1995 (pepper), 1996 (tomato), and 2004 (pepino). The descriptor list for Tree tomato is in press.

Many European public germplasm holders get insufficient national support for the maintenance, characterization and long-term security of the collections, with damaging consequences in some cases, such as aging seeds, no safety duplication, or even loss of accessions. As a way to remedy to this situation, INRA and CGN organized cooperation between breeding companies for the evaluation and regeneration of germplasm accessions held respectively in France and The Netherlands. This model may also be considered by other germplasm holders. Furthermore, better interactions with the scientific research community are important for determining the value of the germplasm. Possibly also the cost of germplasm maintenance and use in research and breeding can be shared.

On the side of research, the structuring of the international scientific community investigating Solanaceae genetics and "omics", is more recent. The *International Solanaceae Initiative* was initiated by Cornell University in the early 2000s, and under its supervision the consortium *Solanaceae Genomics Network* –SGN- works at enhancing international collaboration and at facilitating exchange of information between scientists working on solanaceous crops, in particular via its website and the annual workshops organized since 2004. While research was anchored in only one or a few genotypes until recently, the capacity of the high throughput and next generation technologies now allow working at the level of germplasm collections. For instance, allele diversity can now be characterized at the species level and new alleles of specific traits can be discovered via association genetics. Hence, in the coming years, access to and characterization of germplasm are going to be strategic steps, and from the research standpoint, there is clearly a need to strengthen interaction with the community of Solanaceae germplasm holders.

During the SOL 2011 meeting held in Kobe, Japan, it was pointed out that there is a discrepancy between sequencing experiments across species and platforms, which share fundamental data and similar analysis tools, whereas phenotyping experiments have few common standards. The existence of standardized solanaceous crops descriptors set up by Bioversity International (see above) deserves to be promoted among the communities of researchers and germplasm holders. Conversely, germplasm holders need to be made aware of the phenotypic traits that are most needed by "omics" research. In the last few years, the SGN project (http://solgenomics.net) has developed vocabularies for the description of phenotypes [Solanaceae Phenotype ontology (SP)], and to allow interfacing with the larger initiatives of the database community [Gene Ontology (GO), http://geneontology.org], Plant Ontology (PO, http://plantontology.org/) and Phenotype and Trait Ontology (PATO). Some of the Bioversity vocabularies have been mapped to the SP ontology. SGN could therefore play a central role in coordinating phenotypic descriptors and data, and collaboration via common projects would be beneficial to both germplasm and research communities, and contribute solving the post-genomic era problem of linking the phenome (a wide set of phenotypic data) to the genome.

A minimal step towards a better interaction between European Solanaceae germplasm holders and "omicians" is to provide links between the ECPGR Solanaceae Working Group and SGN websites (already available at www.ecpgr.cgiar.org/networks/vegetables/solanaceae.html), between the Potato Working Group and SGN, and conversely. Beyond this first step, there is a need to establish a dialogue between the ECPGR Solanaceae Working Group, the Potato Working Group and the ECPGR Documentation and Information Network on one hand, and SGN on the other hand, in order to start building fruitful and sustainable interactions, including improved germplasm access and phenotyping. This could be initiated for instance via a round table to be organized at the 2013 SOL conference in Beijing, involving representatives of all sides.

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Job Announcements

SENIOR Tomato Breeder

SEMILLAS FITO is a multinational seed company established in 1880 and family owned. It is organized in four divisions: Vegetables, Field Crops, Hobby and Turf. We believe in Innovation, Research and Development as our main pillars and drivers of our growth.

We are currently looking to recruit a competent and confident professional into the position of ***Senior Tomato Breeder*** to be based in California close to Mexico.

Position Summary

University graduate in Agriculture or similar with a large experience in breeding (15 years) ready to join an international seed company and lead our tomato breeding programs for Mexico and Brasil.

Main Responsibilities:

- Proposes and implements breeding programs in Culiacan for Saladette and Bolas types for Mexican and Brazil markets.
- Develop and supervise tomato breeding programs in Culiacan and probably in California.
- Set up tomato trials in Mexico and Brazil. Work jointly with Development team in both countries.
- To be the R&D antenna in US and create contacts and synergies with Universities, research centers and Germplasm Banks.
- Report to R& Director and Tomato Crop Manager

Education, Skills, and Experience Required

- University degree (Agriculture or Plant Breeding).
- A track record in vegetables breeding
- Readiness to travel across the area
- Ability to build effective relationships with all levels of management.
- Proficiency in MS Office applications.
- Fluency in English, Spanish will be a plus

To apply:

Send your CV's to rrhh@semillasfito.com
Last application date is 10/31/12

POST-DOCTORAL POSITION IN PLANT BIOLOGY AT COLD SPRING HARBOR LABORATORY

A post-doctoral position is available in Zach Lippman's group at Cold Spring Harbor Laboratory to study inflorescence development and evolution in tomato and related Solanaceae. The project will integrate classical and quantitative genetic, transgenic, and transcriptomic/bioinformatics techniques to dissect regulatory mechanisms underlying meristem maintenance and maturation as they relate to the transition to flowering and inflorescence architecture.

A Ph.D. in genetics, developmental biology, or related fields is required. Individuals with appropriate skills from non-plant model systems are also encouraged to apply. Applicants should be highly motivated, creative, enthusiastic, and be willing and able to contribute intellectually in a team environment. Excellent communication skills are required and a strong publication record is a plus.

To apply, please send a single PDF document to lippman@cshl.edu including: 1) a cover letter describing your previous experience, summary of research accomplishments, and interest in this position; 2) your CV, and 3) the names of three referees.

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Conferences and Workshops

21st International Pepper Conference
November 4 - 6, 2012
Naples, Florida, USA
http://www.conference.ifas.ufl.edu/pepper2012/

ASIC 2012
24th International Conference on Coffee Science
November 11 - 16, 2012
San José, Costa Rica
http://www.asic2012costarica.org/

Tomato Breeder's Roundtable
February 6 - 8, 2013
Chiang Mai, Thailand
http://www.tbrt2013.com/

2013 97th Annual Meeting
"100th Anniversary of the Potato Association of America"
July 28 – August 1, 2013
Quebec City, Quebec, Canada
http://www.paa2013.com/

EUCARPIA: Capsicum and Eggplant Working Group Meeting
September 2 - 4, 2013
University of Turin, Turin, Italy
http://e20.unito.it/XVth_EUCARPIA/

Plant Breeding Academies

Plant Breeding Academy at University of California, Davis
February 4 - 9, 2013
June 3 - 8, 2013
http://pba.ucdavis.edu/Programs/PBA_in_Davis_Class_IV/

Plant Breeding Academy in Europe
The schedule for October 2012 to June 2013 is available at
http://pba.ucdavis.edu/PBA_in_Europe/PBA_in_Europe_Class_II/

The Asian Plant Breeding Academy
November 26 - December 1, 2012
April 1 – 6, 2013
July 22 – 27, 2013
Chiang Mai, Thailand
http://pba.ucdavis.edu/PBA_in_Asia/Asian_Plant_Breeding_Academy_Class_I/

Plant Breeding Academy in Africa
For information, visit
http://pba.ucdavis.edu/PBA_in_Africa/

Solanaceae Recipes

Beer and Coffee Chili

http://allrecipes.com/recipe/chili-i-2/

Coffee, chocolate, and beer give this thick and spicy chili a unique and dynamite flavor. Garnish with shredded cheese and diced chile peppers. 8 servings about 1 cup each; prep time: 20 minutes; cooking time: 2 hours; total time: 2 hours 20 minutes.

Ingredients

2 T vegetable oil
2 onions, chopped
3 garlic cloves, minced
1 pound ground beef
3/4 pound beef sirloin, cubed
4 fresh hot chili peppers, seeded and chopped
1 (12 fluid ounce) can or bottle dark beer
1 cup strong brewed coffee
1 T unsweetened cocoa powder
1 (14.5 ounce) can peeled and diced tomatoes with juice
2 (6 ounce) cans tomato paste
1 (14 ounce) can beef broth
1/2 cup packed brown sugar
3 1/2 T chili powder
1 T cumin seeds
1 tsp dried oregano
1 tsp ground cayenne pepper
1 tsp ground coriander
1 tsp salt
4 (15 ounce) cans kidney beans

Note: This chili is better the next day when flavors have fully developed and deepened.

Directions

- Heat oil in a large saucepan over medium heat. Cook onions, garlic, ground beef and cubed sirloin in oil for 10 minutes, or until the meat is well browned and the onions are tender.
- Mix in the diced tomatoes with juice, dark beer, coffee, tomato paste and beef broth. Season with brown sugar, chili powder, cumin cocoa powder, oregano, cayenne pepper, coriander and salt. Stir in 2 cans of the beans and hot chili peppers. Reduce heat to low, and simmer for 1 ½ hours.
- Stir in the 2 remaining cans of beans, and simmer for another 30 minutes.

Nutrition, per serving: 532 calories; 16.1 g fat; 57 mg cholesterol; 65.3 g carbohydrates; 32.4 g protein; 17.6 g fiber; 1414 mg sodium.

Red Pepper Eggplant Chili

http://www.meatlessmonday.com/red-pepper-eggplant-chili/

This is a spicy, meatless chili made with eggplant, red peppers, and cannellini beans. Garnish with sour cream and sliced black olives if desired. Serve with cornbread for a great combination. See recipe below.

Ingredients

1 medium onion, coarsely chopped
2 large red bell peppers, seeded and chopped
2 large eggplants, peeled and cubed
1 16 oz can low-salt stewed tomatoes, undrained
1 4.25 oz can chopped black olives, drained
1 8 oz can low-salt tomato sauce
2 T red chili powder
Red pepper flakes, to taste
2 T dark molasses
1 tsp salt
½ tsp garlic powder
2 19 oz cans cannellini beans (white kidney beans), undrained
Garnish: Sour cream and sliced black olives, if desired

Directions

- In a Dutch oven, sauté onions, red peppers, and eggplants over medium-high heat, stirring constantly, until tender, about 4-5 minutes.
- Add remaining ingredients except cannellini beans. Mix well. Cover, reduce heat to low, and simmer 1 hour, stirring occasionally.
- After 1 hour, stir in cannellini beans. Cover and continue cooking 30 minutes, stirring occasionally.
- Serve hot with a dollop of sour cream and garnish with sliced olives sprinkled on top, if desired.

Nutrition, per serving: 319 calories; 4 g fat (0 g sat.); 0 mg cholesterol; 65 g carbohydrates; 13 g protein; 16 g fiber; 1972 mg sodium.

Texas-Style Skillet Cornbread

http://homesicktexan.blogspot.com/2007/01/iron-pan-perfect-cornbread.html

Here's a classic Texan cornbread recipe, baked in a cast iron skillet, of course. Be sure and get the cast iron good and hot, as that's what sears the batter and makes for a crispy, crunchy crust. Add peppers for a spicy nod to Mexico. Pairs great with chili.

Ingredients

2 cups cornmeal (yellow or white)
½ cup sifted flour
1 tsp baking powder
1 tsp salt
1 egg, lightly beaten
2 cups buttermilk
2 T bacon drippings, shortening, lard, or vegetable oil

Optional (add one or both):
2 jalapeno peppers, seeded, and chopped or sliced (or to taste)
½ - 1 cup red bell pepper. roasted, seeded, and diced.
Other options: ½ cup chopped onion or ½ cup frozen corn, thawed.

Directions

- Preheat oven to 450°F.
- Put the drippings or oil in a large (10-inch) cast-iron skillet and place it in the oven for a few minutes until it's sizzling.
- Mix together the dry ingredients (add optional ingredients with dry mix if desired). Set aside.
- Whisk egg and buttermilk. Mix with dry ingredients.
- Take cast iron skillet out of the oven; pour hot oil into batter, and mix. Pour batter into cast iron skillet and bake in oven for 20 minutes. Cornbread should be golden-brown on top and pulling away from the sides of the skillet when done. Serves 12.