A SOL position paper

SOL-100

The question

Solanaceae include more than 3000 species with wide adaptation, form, chemistry, and distribution. Species of the family are of great agricultural, nutritional, horticultural and medicinal importance (e.g., potato, tomato, pepper, petunia and tobacco). This enormous diversity is contrasted by high conservation of gene order and content at the macro and micro levels. Solanaceae genomes can be genetically tied on a common framework linkage map, thus facilitating the identification of genes with homologous phenotypes in the different species. These features make Solanaceae an excellent taxon with which to address a central question in biology:

> ***How can a common set of genes/proteins give rise to such a wide range of morphologically and ecologically distinct species?***

The aim

The SOL community will create a common Solanaceae-based genomic framework that includes sequences and phenotypes of 100 genomes encompassing the phylogenetic diversity of the group. Specific objectives are to:

1) Tie the emerging tomato, tobacco, potato and Asterid relatives coffee and *Mimulus* (monkey-flower) euchromatic sequences on a common SOL physical map and relate it to other Asterid taxonomic groups, such as *Antirrhinum*, sweet potato and mint.
2) Select 100 Solanaceae species and Asterid outgroups (**SOL-100**) for map construction in diversity crosses using Conserved Ortholog Markers (COSII) that represent the evolutionary tree and reflect important human uses.
3) Apply emerging novel genome sequencing technologies to **SOL-100** and overlay it on the framework BAC-by-BAC map.
4) Genetically map simple and complex phenotypes affecting chemical, morphological and fitness-related traits in the **SOL-100** species.
5) Construct bioinformatic vehicles to journey through different levels of the organization of the broad base of biological information in **SOL-100**.
6) Foster a broadly-based international community of interacting scientists interested in and committed to exploring and conserving natural biodiversity.

Who we are?

The International SOL Genome Project (SOL) is a 'virtual umbrella' aimed at promoting, coordinating and actively seeking additional scientists, countries and funding agencies to participate in an expedition into understanding, utilizing and conserving natural biodiversity (http://sgn.cornell.edu/solanaceae-project/). SOL includes scientists from more than 30 countries that are united and excited about the sustainable and equitable use of natural biodiversity in biological research and plant breeding, and in the conservation of these resources for the future. The SOL community is presently sequencing the tomato genome through grants from national funding agencies as well as through international collaborative projects.

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THE CLADES OF SOLANACEAE
Indicative list of potential target taxa for sequencing (starred taxa may prove problematic due to rarity or difficulty with cultivation); this initial list of suggestions has been chosen for ease of access to germplasm, cultivation and breadth of phylogenetic coverage.

Clade (after Knapp et al., 2004)	**Generic diversity (approx.)**	**Possible target species**
Schwenkia clade	3	*Schwenkia americana*
Schizanthus	1	*Schizanthus pinnatus*
Duckeodendron	1	**Duckeodendron cestroides*
Goetzea clade	4	*Goetzea elegans*
Petunia clade	13	*Petunia hybrida*; *Brunfelsia uniflora*; *Nierembergia scoparia*; *Calibrachoa parvifolia*
Browallia clade	2	*Browallia americana*
Cestrum clade	3	*Cestrum elegans*; *Vestia foetida*
Salpiglossis clade	2	*Salpiglossis sinuata*
Nicotiana	1	*Nicotiana tabacum* (4x – in progress); *N. sylvestris* (2x)
Anthocercis clade	7	*Duboisia hopwoodii*; *Anthocercis littorea*
Lycium clade	3	*Lycium barbarum*; *Lycium carolinense*
Nolana	1	*Nolana humifusa*; *Sclerophylax* sp.
Jaborosa	1	**Jaborosa integrifolia*
Hyoscyamus clade	5	*Hyoscyamus niger*; *Atropa belladonna*
Nicandra clade	2	*Nicandra peruviana*
Datura clade	2	*Datura stramonium*
Solandra clade	7	**Juanulloa mexicana*
Mandragora	1	**Mandragora officinarum*
Solanum clade	4 (Solanum with 13 clades, 1500 spp.)	*Discopodium penninervium*; *Solanum melongena*; *S. nudum*; *S. dulcamara*; *S. americanum*; *S. tuberosum* (in progress); *S. lycopersicum* (in progress)
Iochroma clade	5	*Iochroma fuchsioides*; *Acnistus arborescens*; *Dunalia solanacea*
Physalis clade	6	*Physalis peruviana*; *P. ixocarpa*; *Witheringia solanacea*
Withania clade	10	*Withania somnifera*; *Tubocapsicum anomalum*
Salpichroa clade	2	*Salpichroa origanifolia*
Capsicum clade	2	*Capsicum annuum*
Potential outgroup taxa from related Asterid families		
Convolvulaceae		*Convolvulus tricolor*; *Ipomoea batatas* (sweet potato)
Plantaginaceae		*Antirrhinum majus*
Phyrmaceae		*Mimulus guttatus* (in progress)
Lamiaceae		*Ocimum basilicum*; *Mentha piperita* (mint)