Sorghum Molecular Genetics

TIGR Plant Genome Annotation Workshop
May 2007

Sorghum Agronomy

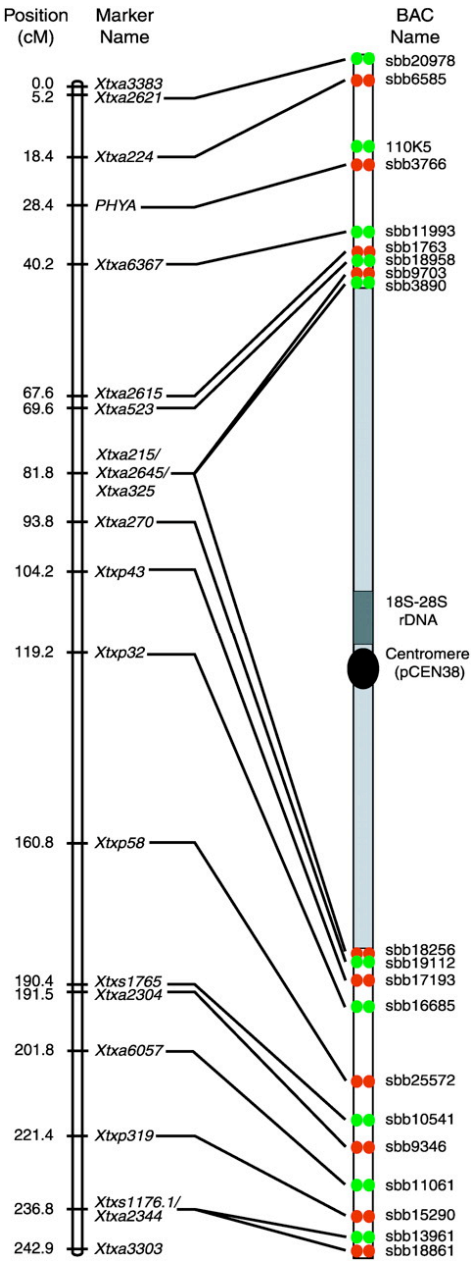
- Sorghum is the fifth most important cereal.
- Originated in sub-saharan Africa.
- Sorghum is maize's drought tolerant cousin.
- Maize and sorghum diverged ~12 Myr ago.
- Sorghum has 10 chromosome pairs (740 Mb).
- Maize has 10 chromosome pairs (2500 Mb)
- Human food stuff in Africa and Asia.
- Animal feed in the United States.
- Grain used feedstock for ethanol production.

Sorghum Genetic Maps

- Many genetic maps.
- Crosses are easily made.
- High degree of molecular genetic diversity.
- Genetic markers are abundant.
- RFLPs, AFLPs, SSRs.
- Common grass markers.

Sorghum Physical Maps

- Several BAC libraries.
- Several labs develop genetic markers in conjunction with placing markers on BACs.
- Physical and genetic map linkages.
- Strong cytogenetic mapping efforts.


Position (cM)
Marker Name
BAC Name
0.0
5.2
Xtxa3383
Xtxa2621
18.4
Xtxa224
28.4
PHYA
40.2
Xtxa6367
67.6
69.6
Xtxa2615
Xtxa523
81.8
Xtxa215/
Xtxa2645/
Xtxa325
93.8
Xtxa270
104.2
Xtxp43
119.2
Xtxp32
160.8
Xtxp58
190.4
191.5
Xtxs1765
Xtxa2304
201.8
Xtxa6057
221.4
Xtxp319
236.8
Xtxs1176.1/
Xtxa2344
242.9
Xtxa3303
sbb20978
sbb6585
110K5
sbb3766
sbb11993
sbb1763
sbb18958
sbb9703
sbb3890
18S-28S rDNA
Centromere (pCEN38)
sbb18256
sbb19112
sbb17193
sbb16685
sbb25572
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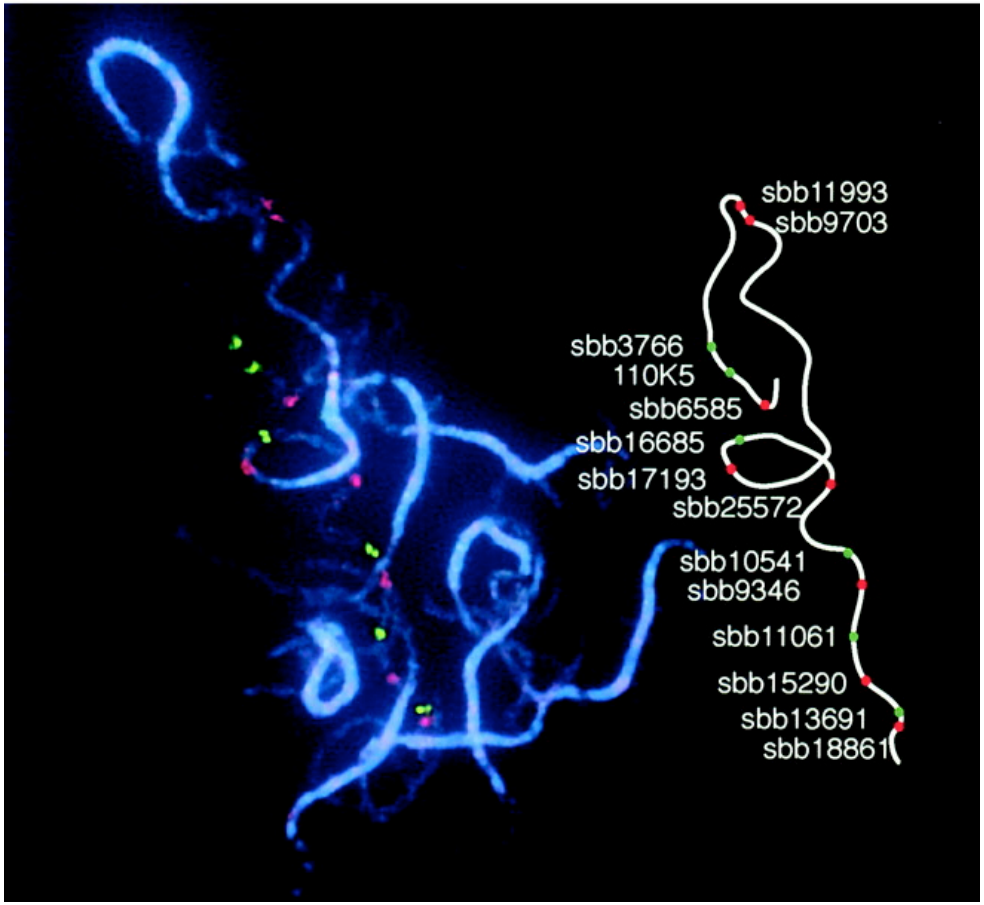
sbb9346
sbb11061
sbb15290
sbb13961
sbb18861


sbb11993
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sbb3766
110K5
sbb6585
sbb16685
sbb17193
sbb25572
sbb10541
sbb9346
sbb11061
sbb15290
sbb13691
sbb18861

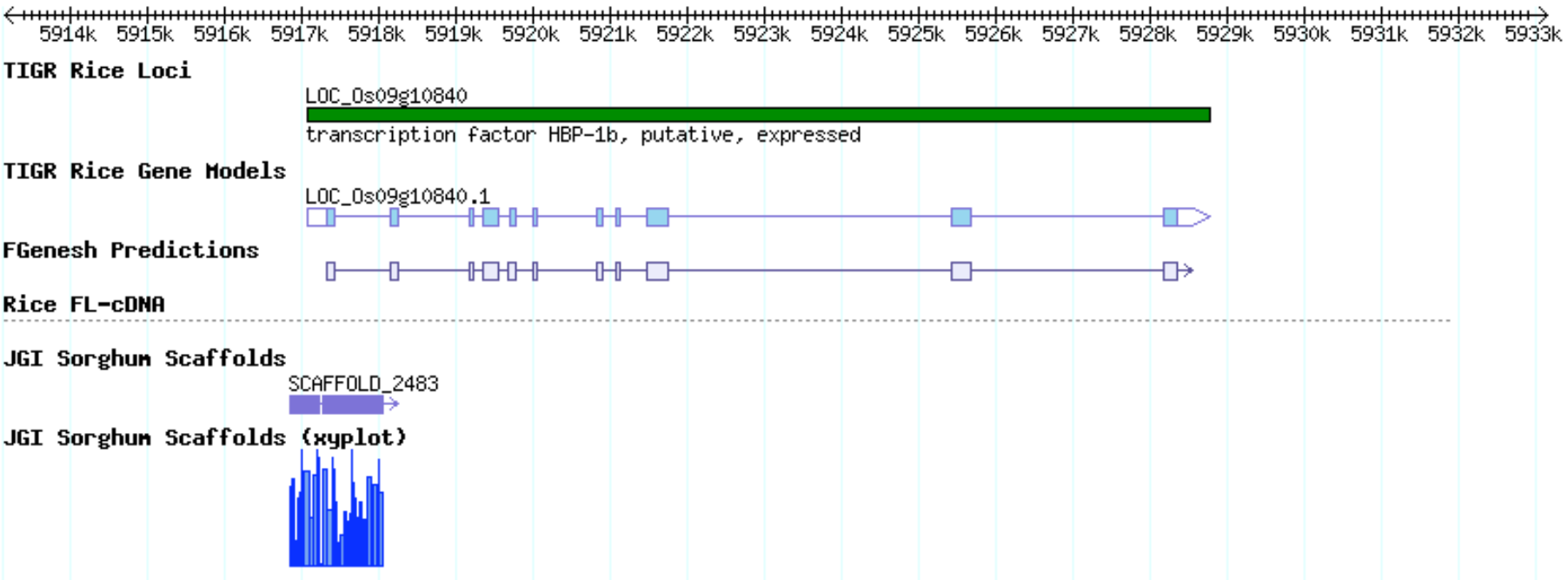
EST Resources

- ESTs from nine tissue libraries.
- 203,000 EST sequences.
- Rice - 1,178,000
- Maize - 1,014,000

Sequencing Efforts

- Shotgun sequencing of methyl-filtrated DNA, 300Mb, 96% genes partially sequenced.
- Shotgun sequencing of high-Cot DNA by JGI.
- Rice genome was sequenced using the BAC by BAC approach and full genome shotgun sequencing.
- Maize genome has been analyzed by sequencing methyl-filtrated DNA and will be sequenced using high-Cot DNA.
- Sorghum genome sequence is incomplete and must be interpreted in the context of a fully sequenced genome.

Sorghum Sequence in Context of the Rice Genome



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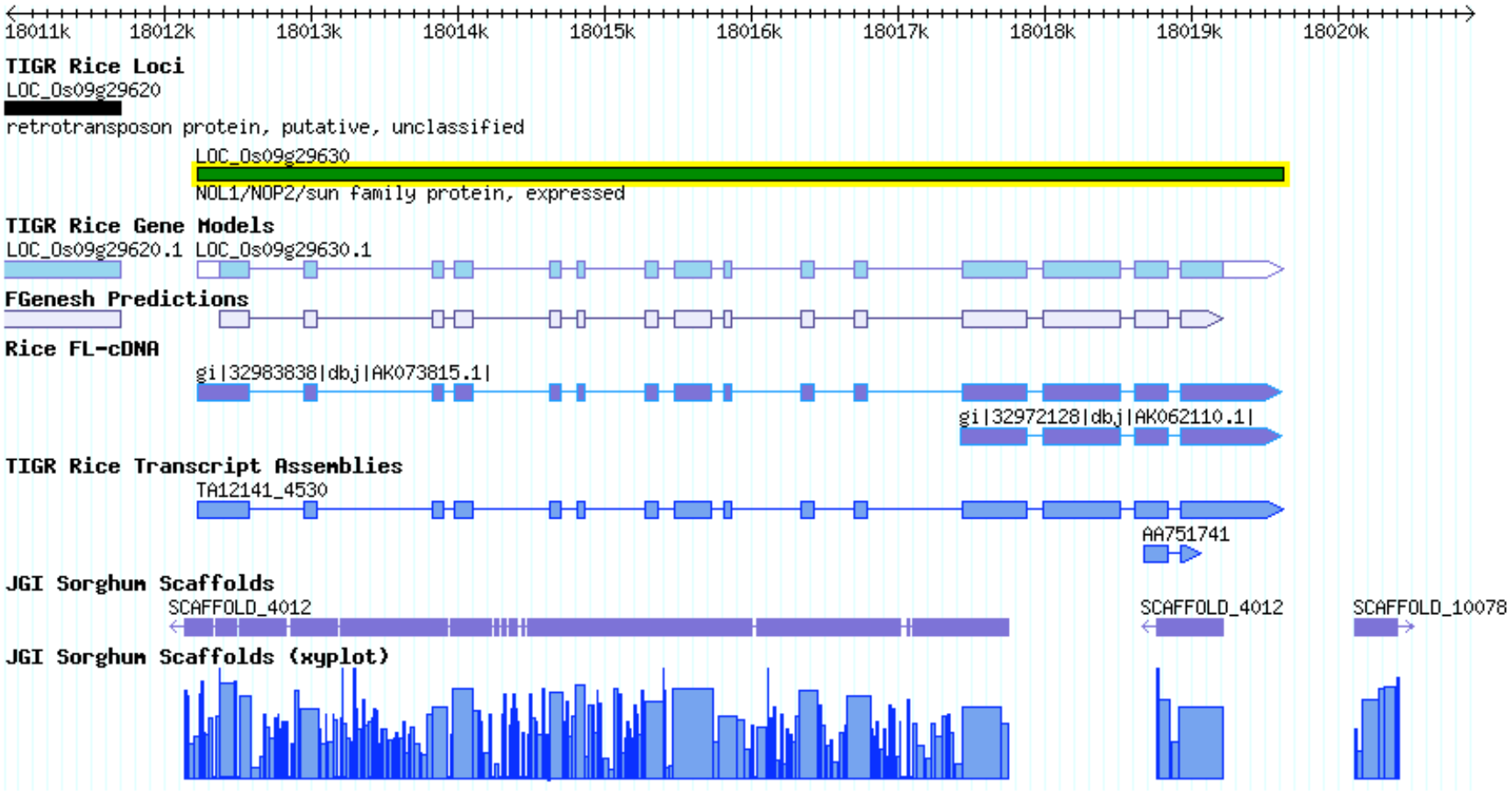

Transformation/Gene Disruption

- Agrobacterium-mediate gene transformation
- Projectile bombardment.
- Transformation of cell cultures requires screening and regeneration.
- Characterized Transposon System (RescueMu, Ac/Ds)
- Vidus Induced Gene Silencing
- None of this is possible in sorghum.
- Transient transformation is the norm.

Characteristics of the Ideal Plant for Molecular Genetics

- Large amount of characterized genetic diversity.
- Large community of molecular genetic researchers.
- Easily transformable or some method for disrupting expression.
- Pre-sequenced genome.

Requirements for Molecular Genetic Research in Non-Ideal Species

- Genetically diverse germplasm.
- Ability to generate segregating population.
- Cooperative research community
- Funding agency interest.

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