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Melon genome sequenced

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Barcelona and Madrid, Spain
July 2, 2012

- It is formed of 27.427 genes and 450 millions of base pairs
- The study, that is published in PNAS, has been lead by scientists at the Spanish National Research Council (CSIC) and at the Institute for Research and Technology in Food and Agriculture (IRTA)
- The Melonomics project, launched by the Spanish Genome foundation, has been developed by 9 research centres

A consortium of nine research centres has obtained the melon genome, a horticultural specie with high economic value around the world. It is the first time that a Spanish initiative that unites private and state-run centres has obtained the complete genome of a higher organism, in this case a plant, which produces flowers and seeds. Also, it has been done by applying massive sequencing technologies.



Besides the complete melon genome, scientists have obtained the particular genomes of seven melon varieties. The study is published in the magazine Proceedings of the National Academy of Sciences (PNAS).

The scientific Project has been lead by Pere Puigdomènech, at the Spanish National Research Council (CSIC), and Jordi Garcia Mas, at the Institute for Research and Technology in Food and Agriculture (IRTA). Both scientists work at the Center for Research in Agricultural Genomics (CRAG), in Barcelona. Also, the team lead by Roderic Guigó, at the Genomic Regulation Center has made an important contribution to the project.

The Melonomics project was launched by the Spanish Genome Foundation. Nine research centres have been involved in it, having the support of 5 companies and of five Spanish autonomous communities.

Results have shown that the melon genome has 450 millions of base pairs and 27.427 genes. It is much bigger than the genome of its nearest "relative", the cucumber that has 360 millions base pairs. "This difference is due mainly to the amplification of transposable elements. We didn't find recent duplications within the genome, which are very common in plant species", highlights Puigdomènech.

"We have identified 411 genes that can be related in disease resistance. They are few but, nevertheless, the melon has a high capacity of adaptation to different environments", explains the CSIC scientist. During the work, when comparing this genome with others that are near phylogenetically, they have observed how changes occur to the genome of this species, which is known for its high variability.

Another question of interest is that related to the ripening of the fruit, a process which determines fruit characteristics such as taste and flavour. Scientists have identified up to 89 genes related with some aspects of this process: 26 genes related to the carotenoid accumulation -which gives the colour to the melon flesh- and 63 related to the sugar accumulation and the taste of melon. 21 genes out of the last 63 had never been described before.

"Knowing the genome and the genes related to the characteristics of value for agriculture will allow us to improve this species for obtaining more disease resistant varieties and with better organoleptic properties", points out the IRTA scientist Jordi Garcia Mas.

Melon, cucumber, watermelon and squashes
Melon belongs to the family of cucurbits, that also includes species such as cucumbers, watermelons and squashes. Cucurbits have relatively small genomes. "These are species of high financial interest, especially in the Mediterranean, Asian and African countries. Diseases that affect them, such as the mosaic virus in the case of cucumber or fungi can cause high financial losses. Therefore, we hope the genome sequentiation will have an important impact on improving this crop", says Pere Puigdomènech.

According to figures of 2009 from the Food and Agriculture Organizations (FAO) of the United Nations, the production of melon worldwide is 26 million tones every year. Spain is the fifth biggest producer in the world. Approximately a third part of the production is exported, which makes Spain the biggest exporter of melon.

A collaborative project of many partner institutions

The melon genome project has been lead by the Center for Research in Agricultural Genomics (CRAG)*, which is a consortium of different institutions and universities, where they have done the sequencing and assembling of the genome. The Center of Genomic Regulation has annotated the genome.

Also, the project has had teams working on it at different centres and universities: the Pompeu Fabra University (Barcelona), the Centro de Edafología y Biología Aplicada del Segura of the CSIC (Murcia), the Centro Nacional de Análisis Genómico (Barcelona), the Universidad Politécnica de Valencia and the University of Wisconsin(U.S.). Furthermore, the company Roche Diagnostics has facilitated technologies in order to help the genome assembling.

The project, with a budget over 4 millions Euros, has received the financial support of the Spanish Genome Foundation, of five Autonomous Communities -Andalucía, Castilla La Mancha, Catalonia, Madrid and Murcia - and the companies: Semillas Fitó, Syngenta Seeds, Roche Diagnostics, Savia Biotech and Sistemas Genómicos.

* The Center for Research in Agricultural Genomics (CRAG) is a consortium of four different institutions: the Spanish National Research Council (CSIC), the Institute for Research and Technology in Food and Agriculture (IRTA), the Universitat Autònoma de Barcelona (UAB) and the Universitat de Barcelona (UB)

Jordi Garcia-Mas, Andrej Benjak, Walter Sansverino, Michael Bourgeois, Gisela Mira, Victor M. González, Elizabeth Hénaff, Francisco Cámara, Luca Cozzuto, Ernesto Lowy, Tyler Alioto, Salvador Capella-Gutiérrez, Jose Blanca, Joaquín Cañizares, Pello Ziarsolo, Daniel Gonzalez-Ibeas, Luis Rodríguez-Moreno, Marcus Droege, Lei Du, Miguel Alvarez-Tejado, Belen Lorente-Galdos, Marta Melé, Luming Yang, Yiqun Weng, Arcadi Navarro Tomas Marques-Bonet Miguel A. Arandaf, Fernando Nuez, Belén Picó, Toni Gabaldón, Guglielmo Roma, Roderic Guigó, Josep M. Casacuberta, Pere Arús, and Pere Puigdomènech. The genome of melon (Cucumis melo L.). PNAS. DOI:10.1073/pnas.1205415109.

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. CRAG - Center for Research in Agricultural Genomics
. University of Barcelona (Universitat Autònoma de Barcelona)

Website: <http://www.cragenomica.es>

Published: July 6, 2012

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