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S.Michele all'Adige, Sunday, the 29<sup>th</sup> of August 2010

## Press release

### An Italian-led international research consortium decodes the apple genome

**Four years after releasing the complete genome sequence of grapevine, scientists based at the E. Mach Foundation, Trento (Italy) today announce another milestone in fruit science: the complete sequence of the apple genome (cv *Golden Delicious*).**

**The results of the project, lasted two years, are reported in a paper signed by 85 authors that will be published online by *Nature Genetics* today, at 19.00 (Rome time). The work is the result of collaboration between 18 research Institutions and was funded by the Autonomous Province of Trento, Italy with contributions also from WSU Agricultural Research Center, USDA-NRI USA and New Zealand Foundation for Research Science and Technology.**

**The project.** Apple DNA sequences (around 13 billion sequenced nucleotides) were produced during 2007 and 2008, and in 2009 researchers assembled and reconstructed the gene content and order into the 17 apple chromosomes. The sequences equal a 17-fold coverage of the apple genome with over 82% of the genome assembled in the chromosomes and over 90% of the genes anchored to a precise position in the chromosomes. The sequences will be available from public data-bases from Monday August 30th.

**The team.** The project was coordinated by the Foundation E. Mach – Ist. Agrario San Michele all'Adige, Research and Innovation Centre and carried out in collaboration with other international institutions: Myriad Genetics inc., Salt Lake City, Utah (USA), 454/Roche, Branford, Connecticut (USA), Amplicon Express, Pullman, Washington (USA), Washington State University, Pullman, Washington (USA), University of Washington, Seattle, Washington (USA), INRA Anger (France), Plant and Food Research (New Zealand), the University of Ghent, Ghent, (Belgium), Parco Tecnologico Padano, Lodi (Italy), the Universities of Padua and Milan (Italy).

**The discovery.** Sequencing of the apple genome has allowed new discoveries to be made and increased our knowledge of the apple plant and its history. In particular:

- the cultivated apple was domesticated 3-4000 years ago from a recent wild progenitor, *Malus sieversii*, a species that is still widespread in the forests across Kazakhstan and China;
- the apple genome underwent duplication around 50 million years ago, bringing the number of chromosomes from 9 in the old American progenitor to the current 17;
- it has the highest number of genes, 57 thousand, of any plant genome studied to date. Of these, the publication identifies the complete set of 992 genes responsible for disease resistance, a potentially useful arsenal for genetic improvement;
- a list of three million genome positions (molecular markers) is available, which may serve as an orientation reference within the genome and to discover the functions of its genes;



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- several families of genes which may be correlated with the development of the pome, the botanical name for the fruit of apple and its close relatives (e.g. pear), have been identified.

**Future applications.** The result is of worldwide interest. The data obtained will allow new varieties of apple to be developed more quickly than with conventional genetic improvement methods, resulting in plants with self-defence mechanisms against diseases and insects and which produce healthier and tastier fruits. The aim is to construct apple varieties requiring fewer agro-technical interventions, leading to more sustainable fruit cultivation, a research line that the E. Mach Foundation has been following for several years. Sequencing of the apple genome has increased a thousand-fold our knowledge of this important agricultural plant, in particular its nutritional properties, environmental impact, exploration of biodiversity, phylogenetic and evolutionary studies.

**The journal.** Nature Genetics is a high impact factor journal of the Nature group and is dedicated to genetics and genomics in all biological disciplines (IF: 34,28; 2009).

**Apple facts.** Apple is the most important fruit in temperate regions. Around ten of the 3,000 known varieties account for over 70 per cent of the world's production. Italy is the world's sixth largest producer, and Europe's second, with 2.2 million tons of apples. Golden Delicious is the second cultivated apple variety globally and the first in Trentino where around ten thousand hectares are given over to apple production. In this Province, particularly well-suited to the growing of high-quality fruit, production totals around 450 thousand tons (2009), accounting for 21 per cent of the national market (one in five apples eaten in Italy comes from Trentino). Together with Alto Adige, it provides over 60% of apple production in Italy..

**The genome in numbers.**

13 billion of nucleotides sequenced  
 $n = 17$  the chromosome number of apple  
742,3 millions of nucleotides the genome size

**More infos at:**

<http://www.applegenome.org>  
<http://genomics.research.iasma.it>  
<http://www.iasma.it>