NR> Vol.1 No.2, December 2010

OPEN ACCESS

Genetic Relationships between Cultivated and Wild Olive Trees (Olea Europaea L. Var. Europaea and Var. Sylvestris) Based on Nuclear and Chloroplast SSR Markers

PDF (Size:993KB) PP. 95-103 DOI: 10.4236/nr.2010.12010

Author(s)

Hedia Hannachi, Catherine Breton, Monji Msallem, Salem Ben El Hadj, Mohamed El Gazzah, Andre Berville

ABSTRACT

The olive is widely cropped in Tunisia where also oleaster trees thrive all around orchards and in natural sites. Little is known on the genetic relationships between the olive crop and oleaster trees in Tunisia. Fifty-two oleaster trees and fifteen cultivars were sampled from Tunisia. SSR genotyping was performed in polyacrylamide gels after fluorescent labeling. We used seven nuclear and two chloroplast SSR markers. AFC analyses showed close genetic relationships between cultivated and oleaster trees. Genetic relationships were also displayed in a dendrogram based on Unweighted Pair Group Method (UPGMA). Five clusters were defined mixing cultivar and oleaster trees suggesting close relationship between some cultivar and some oleaster trees. One oleaster is single in a cluster. The chlorotype SSR markers show probably three olive origins. Some cultivars have the CE chlorotype originates from the East of the Mediterranean basin, the CCK haplotype originates from Maghreb and the COM chlorotype originates from West Mediterranean. The cultivars were 1) introduced from the East; 2) selected in the West; 3) or selected in the North Africa region. The Tunisian oleaster trees carry eastern and western Mediterranean chlorotype CCK, COM and CE.

KEYWORDS

Cultivars, Oleaster, Genetic Relationship, SSR Markers, Haplotype, Origin

Cite this paper

H. Hannachi, C. Breton, M. Msallem, S. Hadj, M. Gazzah and A. Berville, "Genetic Relationships between Cultivated and Wild Olive Trees (Olea Europaea L. Var. Europaea and Var. Sylvestris) Based on Nuclear and Chloroplast SSR Markers," *Natural Resources*, Vol. 1 No. 2, 2010, pp. 95-103. doi: 10.4236/nr.2010.12010.

References

[1] A. Trigui and M. Msallem, "Oliviers de Tunisie, Catalogue des Varietes Autochtones & Types Locaux, Identification Varietale & Caracterisation Morpho-Pomologique des Ressources Genetiques Oleicoles de Tunisie," Vol. 1. (Fr) Ministère de l ' Agriculture, IRESA, Institut de l ' Olivier, Tunisia, 2002.

[2] A. Angiliollo, M. Mencuccini and L. Baldoni, "Olive Genetic Diversity Assessed Using Amplified Fragment Length Polymorphisms," Theoretical and Applied Genetics, Vol. 98, No. 3-4, 1999, pp. 411-421.

[3] G. Besnard and A. Bervillé, "Multiple Origins for Mediterranean Olive (Olea europaea L. subsp. europaea) Based upon Mitochondrial DNA Polymorphisms," Comptes Rendus Biologie de l ' Académie des Sciences, Vol. 323, No. 2, 2000, pp. 173-181.

[4] H. Hannachi, C. Breton, M. Msallem, S. Ben El Hadj, M. El Gazzah and A. Bervillé, "Differences between Native and Introduced Olive Cultivars as Revealed by Morphology of Drupes, Oil Composition and SSR Polymorphisms: A Case Study in Tunisia," Scientia Horticultural, Vol. 116, No. 3, 2008, pp. 280-290.

[5] H. Hannachi, C. Breton, M. Msallem, S. Ben El Hadj, M. El Gazzah and A. Bervillé, "Are Olive Cultivars Distin- guishable from Oleaster Trees Based on Morphology of Drupes and Pits, Oil Composition and

• Open Special Issues
• Published Special Issues
• Special Issues Guideline

NR Subscription

Most popular papers in NR

About NR News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

Microsatellite Polymorphisms?" Acta Botanica Gallica, Vol. 155, No. 4, 2008, pp. 531-545.

[6] A. Fabbri, J. I. Hormaza and V. S. Polito, "Random Am- plified Polymorphic DNA Analysis of Olive (Olea europaea L.) Cultivars," The Journal of the American Soci- ety for Horticultural Science, Vol. 120, No. 3, 1995, pp. 538-542.

[7] G. Besnard, P. Baradat, D. Chevalier, A. Tagmount and A. Bervillé, "Genetic Differentiation in the Olive Complex (Olea europaea L.) Revealed by RAPDs and RFLPs in the rRNA Genes," Genetic Resources and Crop Evolution, Vol. 48, No. 2, 2001, pp. 165-182.

[8] V. Bronzini de Caraffa, J. Maury, C. Gambotti, C. Breton, A. Bervillé and J. Giannettini, "Mitochondrial DNA Variation from Western an Eastern Mediterranean," Theoretical and Applied Genetics, Vol. 104, No. 6-7, 2002, pp. 1209-1216.

[9] G. Cipriani, M. T. Marrazzo, R. Marconi, A. Cimato and R. Testolin, "Microsatellite Markers Isolated in Olive (Olea europaea L.) are Suitable for Individual Finger- Printing and Reveal Polymorphism within Ancient Culti- vars," Theoretical and Applied Genetics, Vol. 104, No. 2- 3, 2002, pp. 223-228.

[10] P. Rallo, G. Dorado and A. Martin, "Development of Simple Sequence Repeats (SSR) in Olive Tree (Olea eu- ropaea L.)," Theoretical and Applied Genetics, Vol. 101, No. 5-6, 2000, pp. 984-989.

[11] K. M. Sefc, M. S. Lopes, A. D. Mendoc, M. Rodrigues Dos Santos, M. L. da C. Machado and A. da C. Machado, "Identification of Microsatellites Loci in Olive (Olea europaea) and Their Characterization in Italian and Iberian Trees," Molecular Ecology, Vol. 9, No. 8, 2000, pp. 1171-1173.

[12] C. Breton, G. Besnard and A. Bervillé, "Using Multiple Types of Molecular Markers to Understand Olive Phy- logeography," In: M. A. Zeder, D. Decker-Walters, D. Bradley, B. Smith, Eds., Documenting Domestication: New Genetic and Archaeological Paradigms, University of California Press, California, 2005.

[13] C. Breton, "Reconstruction de l ' Histoire De L ' Olivier (Olea europaea subsp. europaea) et de son Processus de Domestication en Region Mediterraneenne, Etudies sur des Bases Moleculaires," Ph.D. Biologie des Populations et Ecologie, Paul Cézanne France, 2006.

[14] C. Breton, M. Tersac and A. Bervillé, "SSR Genetic Diversity in Wild Olive (Oleaster, Olea europaea L.) Sug- gests Several Plio-Pleistocene Refuge Zones in the Medi- terranean Basin and Gene Flow with Olive," Journal of Biogeography, Vol. 33, No. 11, 2006, pp. 1916-1928.

[15] G. Besnard and A. Bervillé, "On Chloroplast DNA Varia- tions in the Olive (Olea europaea L.) Complex: Compareson of RFLP and PCR Polymorphisms," Theoretical and Applied Genetics, Vol. 104, No. 8, 2002, pp. 1157- 1163.

[16] G. Besnard, B. Khadari, P. Baradat and A. Bervillé, "Olea europaea (Oleaceae) Phylogeography Based on Chloroplast DNA Polymorphism," Theoretical and Applied Genetics, Vol. 104, No. 8, 2002, pp. 1353-1361.

[17] G. Besnard, P. Baradat, C. Breton, B. Khadari and A. Bervillé, "Olive Domestication from Structure of Oleas- ters and Cultivars Using Nuvlear RAPDs and Mitochondrial RFLPs," Genetics Selection Evolution, Vol. 33, Special Issue, 2001, pp. S251-S268.

[18] G. Besnard, P. Baradat and A. Bervillé, "Genetic Rela- tionship in the Olive (Ole europaea L.) Reflect Multilocal Selection of Cultivars," Theoretical and Applied Genetics, Vol. 102, No. 2-3, 2001, pp. 251-258.

[19] C. Sperisen, U. Büchler, F. Gugerli, G. Matyas, T. Gebu- rek and G. G. Vendramin, "Tandem Repeat on Plant Mitochondrial Genomes: Application to the Analysis of Population Differentiation in the Conofer Norway Spruce," Molecular Ecology, Vol. 10, No. 1, 2001, pp. 257-263.

[20] W. Powell, M. Morgante, C. Andre, J. W. McNicol, G. C. Machray, J. J. Doyle, S. V. Tingey and J. A. Rafalski, "hypervariable Chloroplast Microsatellites Provide a General Source of Polymorphic DNA Markers for the Chloroplast Genome," Current Biology, Vol. 5, No. 9, 1995, pp. 1023-1029.

[21] G. Besnard, B. Khadari, P. Villemur and A. Bervillé, "A Cytoplasmic Male Sterility in Olive Cultivars (Olea eu- ropaea L.): Phenotypic, Genetic and Molecular Ap- proaches," Theoretical and Applied Genetics, Vol. 100, No. 7, 2000, pp. 1018-1024.

[22] N. Minangoin, "L ' olivier en Tunisie," Direction de l ' Agriculture et du Commerce Imprimerie Rapide, Nicolas L., 1901.

[23] W. Taamalli, F. Geuna, S. B. Temime, D. Bassi, D. Daoud and M. Zarrouk, "Using Microsatellite

Markers to Characterise the Main Tunisian Olive Cultivars ‘Chemlali’ and ‘Chétoui’,” Journal of Horticultural Science and Biotechnology, Vol. 82, No. 1, 2007, pp. 25-28.

[24] B. Khadari, C. Breton, N. Moutier, J. P. Roger, G. Besnard and A. Bervillé, “The Use of Molecular Markers for Germplasm Management in a French Olive Collection,” Theoretical and Applied Genetics, Vol. 106, No. 3, 2003, pp. 521-529.

[25] F. Carriero, G. Fontanazza, F. Cellini and G. Giorio, “Identification of Simple Sequence Repeats SSRs (GAPU) in Olive Olea europaea L,” Theoretical and Applied Ge- netics, Vol. 104, No. 2-3, 2002, pp. 301-307.

[26] W. S. Oetting, H. K. Lee, D. J. Flanders, G. L. Wiesner, T. A. Sellers and R. A. King, “Linkage Analysis with Multi- plexed Short Tandem Repeat Polymorphisms Using Infrared Fluorescence and M13 Tailed Primers,” Genomics, Vol. 30, No. 3, 1995, pp. 450-458.

[27] M. Nei, “Genetic Distance between Populations,” The American Naturalist, Vol. 106, No. 949, 1972, pp. 283- 292.

[28] J. Felsenstein, “PHYLIP (Phylogeny Inference Package),” Version 3.5c. Department of Genetics, University of Washington, Seattle, 1993.

[29] C. Breton, C. Pinatel, F. Médail, F. Bonhomme and A. Bervillé, “Comparison between Classical and Bayesian Methods to Investigate the History of Olive Cultivars Using SSR – Polymorphisms,” Plant Science, Vol. 175, No. 4, 2008, pp. 524-532.

[30] L. Baldoni, N. Tosti, C. Ricciolini, A. Belaj, S. Arcioni, S, G. Pannelli, M. A. Germana, M. Mulas and A. Porceddu, “Genetic Structure of Wild and Cultivated Olives in the Central Mediterranean Basin,” Annals of Botany, Vol. 98, No. 5, 2006, pp. 935-942.

[31] J. Gressel, “Crop Ferality and Volunteerism,” Taylor and Francis Boca Raton, 2005.

[32] J. Ruby, “Recherche Morphologique et Biologique sur l’Olivier et sur ses Variétés Cultivées en France,” Annales des Sciences Naturelles Botanique, 1918, pp. 1-286.

[33] G. Valdeyron and P. Crossa-Raynaud, “Les Fruits de Tunisie,” Annales de Services Botanique et Agronomique de Tunisie, 1950, pp. 23-44.

[34] A. Koutsaftakis, F. Kotsifakis, E. Stefanoudaki and A. Cert, “Etude Triennale sur les Variations de Plusieurs Caractéristiques Chimiques et de Divers Composants Mineurs des Huiles d’olive Vierges Obtenues à Partir d’Olives Cueillies à Différents Degrés de Maturité,” Olivae, Vol. 80, 2000, pp. 22-27.

[35] H. Hannachi, M. Msallem, M. El Gazzah and S. Ben Elhadj, “Etude de la Variabilité Pomologique des Olives et de la Composition en Acides Gras des Huiles de 15 Variétés d’Olivier Tunisiens (Olea europaea L.),” Revue des Régions Arides, Vol. 17, No. 1, 2006, pp. 43-64.