

# European "Corylus avellana" L. Germoplasm Collections

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## Abstract

L'obiettivo principale della ricerca era di raccogliere informazioni relative al germoplasma di nocciolo presente nelle collezioni varietali europee e di armonizzare i descrittori specifici per una caratterizzazione comune delle cultivar.

Lo ricerca, condotta nel corso del triennio 2008-2010, ha interessato 13 collezioni europee di *Corylus avellana* L.. La stesura di una prima lista completa comprendeva 291 accessioni di nocciolo. Il materiale genetico è stato quindi caratterizzato tramite appositi descrittori armonizzati per il nocciolo, successivamente standardizzati tra i partner del progetto di ricerca. La caratterizzazione ha compreso un totale di 50 caratteri suddivisi in: origine e caratteristiche generali (sinonimie, zone di coltivazione, etc.); tratti riguardanti la pianta (vigoria, habitus, attitudine pollonifera, ripresa vegetativa, produttività, etc.); tratti relativi la fioritura (quantità di amenti, dicogamia, incompatibilità allelica, etc.); caratteristiche del frutto (maturità della nocciola, lunghezza dell'involucro, dimensioni, colore, indice di rotondità, etc.). Nel complesso sono state caratterizzate 197 cultivar e 58 selezioni. Le varie cultivar provengono dai seguenti Paesi: Albania (1 cultivar), Balcani (2), Belgio (1), Francia (8), Germania (6), Grecia (1), Inghilterra (11), Italia (47), Olanda (1), Portogallo (3), Romania (4), Slovenia (3), Spagna (84), Stati Uniti (9), Turchia (7) e Ungheria (1). Inoltre, sono state identificate otto cultivar di origine sconosciuta e sono stati riscontrati sei casi di sinonimia. Di queste ultime accessioni una proviene dall'Inghilterra, quattro dall'Italia e una è di origine ignota.

La caratterizzazione completa (morfologica, fenologica, biochimica e molecolare) del materiale reperito e studiato consentirà la costituzione di un campo collezione di piante madri, quale importante fonte di biodiversità per il nocciolo in Europa, con sede presso i campi sperimentali dell'IRTA - Mas de Bover (Spagna).

*The main aim of this work was to gather the maximum information on hazelnut germplasm existing in different European collections. Each Research Centre keeps its hazelnut material according to its own*

interest: native varieties, suitable material from abroad and promoting the exchange of plant material among research centers from all over the world.

At first, a complete list of 291 hazelnut accessions existing in 13 different collections was elaborated: one collection in France and Greece, two in Slovenia and Spain, three in Portugal and four in Italy. The material of each collection was accurately observed, morphologically characterized and also identified by molecular markers (SSR). Some mistakes on cultivar spelling have been noticed. Characterization of hazelnut collections allowed to detect some synonyms in the germplasm studied and correct the spelling mistakes. A final list of 197 cultivars and 58 selections, growing in 13 European hazelnut collections, was elaborated. Cultivars were originated from the following countries: Albania (1 cultivar), Balkan area (2 cvs.), Belgium (1 cv.), England (11 cvs.), France (8 cvs.), Germany (6 cvs.), Greece (1 cv.), Hungary (1 cv.), Italy (47 cvs.), Netherlands (1 cv.), Portugal (3 cvs.), Romania (4 cvs.), Slovenia (3 cvs.), Spain (84 cvs.), Turkey (7 cvs.) and USA (9 cvs.). Eight cultivars from unknown origin were listed.

## 1. INTRODUCTION

This work has been carried out in the frame of the SAFENUT Project: “Safeguard of almond and hazelnut genetic resources: from traditional uses to novel agro industries opportunities”. A survey of National and European *Corylus avellana* L. collections has been realised. Hazelnut collections existing in different countries are gathering material from European countries as France, Greece, Italy, Portugal, Romania, Slovenia and Spain; also, Turkish and American material is represented. Each Research Center keeps its hazelnut material according to its own interest: native varieties, relevant cultivars from abroad, promoting the exchange of plant material among researchers worldwide. A comprehensive list of all the accessions kept in the European collections is needed to know the existing material in European collections and it is essential to observe and characterize this material accurately to verify the type of different accessions, to detect possible erroneous spelling in any of the cultivars or references and remove synonyms. Different descriptors are used in some Research Centers to characterize the material (Thompson et al., 1978; UPOV, 1979 and Koksal and Tuna Gunes, 2008), and sometimes hazelnut characterization in different centers does not follow the same criteria.

The main objective of this study was to gather the maximum information on hazelnut germplasm existing in European collections and to harmonize the standard descriptors for a common characterization of cultivars. The knowledge of this material and its valorization will enable us to conserve these genetic resources.

## 2. MATERIAL AND METHODS

The study has been carried out during three years, since 2008 to 2010, and data were collected from 13 European hazelnut collections (Tab. 1 and 3; Figure 1). At the beginning a complete list of 291 hazelnut accessions has been elaborated. A chart with the specific descriptors for hazelnut, following hazelnut descriptors (Thompson et al., 1978, UPOV, 1979; Koksal and Tuna Gunes, 2008), has been harmonized and standardized among partners, to characterize hazelnut material. With this chart, a same criterion to describe the material has been achieved among different researchers. The characterization includes: general characteristics (synonymies, origin, areas of growing) tree traits (vigor, habit, suckering, leafing out, productivity, etc.) flowering traits (time of pistillate and staminate anthesis, amount of catkins, dicogamy, incompatibility alleles, etc.) and nut and kernel traits (nut maturity, husk length, size, color, shell attractiveness, nut roundness

Number of collections	Countries
1	France: Montesquieu (Conservatoire Végétal régional d'Aquitaine) Greece : NAGREF-Pomology Institute (Naoussa)
2	Slovenia: National collection (Ljubljana) and ex-situ collection (Maribor) Spain: IRTA-Constantí (Catalonia), SERIDA-V illaviciosa (Asturias)
3	Portugal: Vila Real, Felgueiras (North), Viseu (Centre)
4	Italy: Cravanzana (Cuneo), Chieri (Torino), Le Cese (Viterbo), Caserta (Campania)

Tab. 1 Number of hazelnut collections studied in European countries.

index, shell striping, percent blanks, double kernels, pellicle removal after blanching, etc.). In total, 50 characters have been established. During the study, the material of each collection was accurately observed and morphologically characterized.

Hazelnut material from different collections (young leaves in spring and/or immature catkins in September-October) were collected to identify the accessions by molecular markers (10 SSR loci), following the methodology proposed by Bassil et al. (2005) and Bocacci et al. (2005 and 2006).

### 3. RESULTS

Characterisation of hazelnut collections (morphologically and molecularly) allowed detecting some homonymous and synonymous cultivars in the germplasm studied and correcting the spelling mistakes that have been noticed in the study. Nevertheless for some material presenting the same DNA profile, more years of morphological studies needs to be realised in order to confirm or not possible synonymies. Finally, a list of 197 cultivars and 58 selections, from the 291 accessions compiled at the beginning of the work in 2008, was elaborated. Cultivars come from the following countries: Albania (1 cultivar), Balcany area (2 cvs.), Belgium (1 cv.), England (11 cvs.), cvs.), France (8 cvs.), Germany (6 cvs.), Greece (1 cvs.), Hungary (1 cvs.), Italy (47 cvs.), Netherlands (1 cv.), Portugal (3 cvs.), Romania



Fig. 1 European hazelnut collections where cultivars are maintained.

(4 cvs.), Slovenia (3 cvs.), Spain (84 cvs.), Turkey (7 cvs.) and USA (9 cvs.). Eight cultivars from unknown origin were also listed (Tab. 2). One cultivar from England, four from Italy and one from unknown origin, are also in the final list of hazelnut material in European collections, but they has not been counted since it has been confirmed by molecular markers that they correspond to synonymies.

The complete characterization (morphologically, phenologically, biochemically and by molecular markers) of hazelnut material from European collections, will allow us to create a core collection, representing the maximum genetic diversity of European hazelnut. This core collection will be established in orchards at IRTA - Mas de Bover.



*“Corilicoltura viterbese: dalla realtà locale alla dinamica europea”*



**Maribor** (Slovenia)



**Vila Real** (Portugal)



**Cravanzana** (Italy)



**Le Cese** (Italy)



**Viseu** (Portugal)



**IRTA-Mas de Bover** (Spain)

	France	Greece	Slovenia		Spain		Portugal			Italy			
	Montesquieu	NAGREF	Nat. Collection	Maribor	IRTA	SERIDA	Via Real	Viseu	Felgueiras	Le Cesse	Cravanzana	Chieri	Caserta
Cultivars	14	8	31	15	116	13	19	15	26	44	53	29	75
Selections	-	-	14	-	24	-	-	-	-	-	12	-	2

**Tab. 3** Number of cultivars and selections, present in different European hazelnut collections.

Tab. 2 List of hazelnut accessions in 13 different European collections

CULTIVARS		
A fruttogrosso (I)	Culplà (S)	Istrska okrogloplodna leska (Slo)
A pellicola Bianca (I)	Curcia (S)	Jann's (?)
Apolda (I) <sup>(3)</sup>	Da Veiga (P)	Jardinera (S)
Alcover (S)	Daria (I)	Jemstegaard-5 (USA)
Amandi (S)	Daviana (England)	Kalinkara (T)
Ametllenca (S)	David (S)	Karidaty (T)
Ametllenca-T (S)	Del Norte (S)	Lansing (USA)
Apegalós (S)	Del país (S)	Laureà (S)
Araba (S)	Downton (England)	Landsberg (Germany)
Artell de Palma (S)	Ennis (USA)	Lambertski beli (?)
Artellet (S)	Espinaredo (S)	Lewis (USA)
Arutela (Ro)	Extra Giaghli (Greece)	Llargueta (S)
Avellana (I)	Falset (S)	Lluenta Aleixar (S)
Avellana speciale (I)	Febró dreta (S)	Locale di Piazza Armerina (I)
Aveline Barcelona (I)	Febró esquerra (S)	Longue d'Espagne (England)
Bandnuss (England) <sup>(3)</sup>	Feliuet (S)	Macrocarpa (F)
Barbarella (I)	Feriale (F)	Mansa (I) <sup>(1)</sup>
Barcelona (S)	Ferrotta-3 (S)	Martinet (S)
Bard (England)	Fertile de Coutard (F)	Martorella (S)
Badem (T)	Ferwiler (F)	Marxant-1 (S)
Barrettona (I)	Francolí (S)	Marxant-2 (S)
Bearn (I)	Fructo Albo (Balcany)	Merveille de Bolwiler (F)
Belar (S)	Fructo Rubro (Balcany) <sup>(2)</sup>	Minnolara (I)
Belle de Giubilino (I)	Frutto Grosso (I)	Mogul (England)
Belli Larbert (?) <sup>(2)</sup>	Garibaldi (Germany)	Molari (?)
Bergeri (Belgium)	Garrofi (S)	Moll (S)
Bianca (I)	Gem (USA)	Montebelo (I) <sup>(1)</sup>
Butler (USA)	Ghiara (I)	Morell (S)
Campanica (S)	Gironell (S)	Mortarella (I)
Camponica (I)	Grada de Viseu (P)	Napoletana (I)
Capello di Prete (I)	Grande (S)	Napoletanedda I (I)
Carrello (I)	Grifoll (S)	Napoletanedda II (I)
Casina (S)	Grossa de Espanha (?)	Negret (S)
Castanyera (S)	Grossa di Biglini (I)	Negret LM 27 (S)
Ceret (S)	Grossal (S)	Negret Capellut (S)
Clark (USA)	Grosse Longue (England)	Negret Primerenc (S)
Clon La Masó-V (S)	Gunslebert (Germany)	Negret Primerenc Cort (S)
Clon La Masó-N (S)	Hall's Giant (F)	Neue Riesennuss (Germany)
Closca Molla (S)	Heynich's Zellernuss (Germany)	Nochia Rosa (I)
Colldejou (S)	Henneman-3 (USA)	Nocchione (I) <sup>(1)</sup>
Comen (I)	Ianussa Racinante (I)	Nocciolino di San Grato (I)
Común Alava (S)	Ingliterra (?)	Nociara (I)
Comun (P)	Imperatrice Eugenie (England)	Northamptonshire (England)
Comune de Sicilia (I) <sup>(1)</sup>	Imperiale de Trebizonda (T)	Nothingam (England)
Corabel (F)	Ince Kara (T)	Nostrale (I) <sup>(1)</sup>
Cosford (England)	Istry Dugi (Slo)	Ordu (I)
Cozia (Ro)	Istrska dolgoplodna leska (Slo)	Pallagrossa (I)
Pallaz (T)	Romai (Hungary)	Sugranyes (S)
Panser (S)	Romavei (Ro)	Tomasina (S)
Pauetet (S)	Romische Zellernuss (?)	Tombul (T)
Payrone (I)	Ronde Piemont (I)	Tonda Bianca (I)
Pere Mas (S)	Ros (S)	Tonda Rossa (I)
P.G. La Selva (S)	Rosset (S)	T.G.D.L. (I)
Pinyolenc (S)	Rotblaftrige Lambertnuss (D)	Tonda di Biglini (I)
Pirineu (S)	Rote Zellernuss (Netherlands)	Tonda di Giffoni (I)
Planeta (S)	Royal (England)	Tonda Gentile di Viterbo (I)
Provence (?)	Roziers (F)	Tonda Gentile Romana (I)

Puntxenc (S)	San Giovanni (I)	Tonnolella (I)
Queixal de Llop (S)	Sant Jaume (S)	Trenet (S)
Queixal de Ruc (S)	Sant Joan (S)	Valcea (Ro)
Quirós (S)	Sant Pere (S)	Valls (S)
Rancinante (I)	Santa M. Gesu (I)	Vermellet (S)
Ratllada (S)	Savall (S)	Víctor (S)
Ratolí (S)	Segorbe (S)	Villamette (USA)
Ribet (S)	Selvatà (S)	Vimbodí (S)
Riccia di Talanico (I)	Siciliana (I)	Visoka (Albania)
Roca (S)	Simó (S)	Xato (S)
Roig (S)	Sodlinger (?)	
SELECTIONS		
N-497 (F)	N-681 (F)	OSU 166-034 (USA)
N-549 (F)	N-686 (F)	OSU 167-002 (USA)
N-593 (F)	H-302-35 (F)	OSU 168-26 (USA)
N-37-22 (F)	H-295-37 (F)	OSU 219-133 (USA)
N-547 (F)	J-59 (S)	OSU 228-125 (USA)
N-508 (F)	J-87 (S)	OSU 244-001 (USA)
N-650 (F)	AA-43 (S)	3E (I)
N-481 (F)	0-131 (S)	RL-3 Romisondo (I)
N-532 (F)	OSU 20-58 (USA)	T.G.D.L. x B36 (I)
N-535 (F)	OSU 23-017 (USA)	T.G.D.L. x Barcelona 16 (I)
N-587 (F)	OSU 28-23 (USA)	T.G.D.L. x Lansing (I)
N-164 (F)	OSU 28-91 (USA)	T.G.D.L. x Lansing 26 (I)
N-608 (F)	OSU 92-43 (USA)	T.G.D.L. x 119 64 (I)
N-652 (F)	OSU 287-008 (USA)	T.G.D.L. x 3L 23 (I)
N-638 (F)	OSU 185-017 (USA)	101 (I)
N-644 (F)	OSU 350-091 (USA)	E-104 (I)
N-646 (F)	OSU 350-089 (USA)	F-104 (I)
N-651 (F)	OSU 267-140 (USA)	G-1 (I)
N-653 (F)	OSU 252-146 (USA)	119 (I)
		F 123 (I)

I: Italy, S: Spain, F: France, Ro: Romania, P: Portugal, T: Turkey, Slo: Slovenia; ?: unknown origin  
(1) (2) (3), cultivars with the same letter are synonymies confirmed by molecular markers

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