Bioversity International

Descriptors for Hazelnut (*Corylus avellana* L.)

CIHEAM

FAO FIAT PANIS

List of Descriptors

Allium (E, S)	2001
Almond (revised)* (E)	1985
Apple* (E)	1982
Apricot* (E)	1984
Avocado (E/S)	1995
Bambara groundnut (E, F)	2000
Banana (E, S, F)	1996
Barley (E)	1994
Beta (E)	1991
Black pepper (E/S)	1995
Brassica and *Raphanus* (E)	1990
Brassica campestris L. (E)	1987
Buckwheat (E)	1994
Cañahua (S)	2005
Capsicum (E/S)	1995
Cardamom (E)	1994
Carrot (E, S, F)	1998
Cashew* (E)	1986
Cherry* (E)	1985
Chickpea (E)	1993
Citrus (E, F, S)	1999
Coconut (E)	1995
Coffee (E, S, F)	1996
Cotton (revised)* (E)	1985
Cowpea (E, P)*	1983
Cultivated potato* (E)	1977
Date Palm (F)	2005
Durian (E)	2007
Echinochloa millet* (E)	1983
Eggplant (E/F)	1990
Faba bean* (E)	1985
Fig (E)	2003
Finger millet* (E)	1985
Forage grass* (E)	1985
Forage legume* (E)	1984
Grapevine (E, S, F)	1997
Groundnut (E/S/F)	1992
Jackfruit (E)	2000
Kodo millet* (E)	1983
Lathyrus spp. (E)	2000
Lentil* (E)	1985
Lima bean* (E)	1982
Litchi (E)	2002
Lupin* (E/S)	1981
Maize (E/S/F, P)	1991
Mango (revised) (E)	2006
Mangosteen (E)	2003
Medicago (annual)* (E/F)	1991
Melon (E)	2003
Mung bean* (E)	1980
Oat* (E)	1985
Oca* (S)	2001
Oil palm (E)	1989
Panicum miliaceum and *P. sumatrense* (E)	1985
Papaya (E)	1988
Peach* (E)	1985
Pear* (E)	1983
Pearl millet (E/F)	1993
Pepino (E)	2004
Phaseolus acutifolius (E)	1985
*Phaseolus coccineus** (E)	1983
Phaseolus lunatus (P)	2001
*Phaseolus vulgaris** (E, P)	1982
Pigeonpea (E)	1993
Pineapple (E)	1991
Pistachio (A, R, E, F)	1997
Pistacia (excluding *Pistacia vera*) (E)	1998
Plum* (E)	1985
Potato variety* (E)	1985
Quinua* (E)	1981
Rambutan	2003
Rice* (E)	2007
Rocket (E, I)	1999
Rye and Triticale* (E)	1985
Safflower* (E)	1983
Sesame (E)	2004
Setaria italica and *S. pumilia* (E)	1985
Shea tree (E)	2006
Sorghum (E/F)	1993
Soyabean* (E/C)	1984
Strawberry (E)	1986
Sunflower* (E)	1985
Sweet potato (E/S/F)	1991
Taro (E, F, S)	1999
Tea (E, S, F)	1997
Tomato (E, S, F)	1996
Tropical fruit (revised)* (E)	1980
Ulluco (S)	2003
Vigna aconitifolia and *V. trilobata* (E)	1985
Vigna mungo and *V. radiata** (E)	1985
Walnut (E)	1994
Wheat (revised)* (E)	1985
Wheat and *Aegilops** (E)	1978
White Clover (E)	1992
Winged Bean* (E)	1979
*Xanthosoma** (E)	1989
Yam (E, S, F)	1997

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Descriptors for

Hazelnut

(*Corylus avellana* L.)

Bioversity International is an independent international scientific organization that seeks to improve the well-being of present and future generations of people by enhancing conservation and the deployment of agricultural biodiversity on farms and in forests. It is one of 15 centres supported by the Consultative Group on International Agricultural Research (CGIAR), an association of public and private members who support efforts to mobilize cutting-edge science to reduce hunger and poverty, improve human nutrition and health, and protect the environment. Bioversity has its headquarters in Maccarese, near Rome, Italy, with offices in more than 20 other countries worldwide. The Institute operates through four programmes: Diversity for Livelihoods, Understanding and Managing Biodiversity, Global Partnerships, and Commodities for Livelihoods.

The international status of Bioversity is conferred under an Establishment Agreement which, by January 2008, had been signed by the Governments of Algeria, Australia, Belgium, Benin, Bolivia, Brazil, Burkina Faso, Cameroon, Chile, P.R. China, Congo, Costa Rica, Côte d'Ivoire, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Ethiopia, Ghana, Greece, Guinea, Hungary, India, Indonesia, Iran, Israel, Italy, Jordan, Kenya, Malaysia, Mali, Mauritania, Mauritius, Morocco, Norway, Oman, Pakistan, Panama, Peru, Poland, Portugal, Romania, Russia, Senegal, Slovakia, Sudan, Switzerland, Syria, Tunisia, Turkey, Uganda and Ukraine.

Financial support for Bioversity's research is provided by more than 150 donors, including governments, private foundations and international organizations. For details of donors and research activities please see Bioversity's Annual Reports, which are available in printed form on request from bioversity-publications@cgiar.org or from Bioversity's Web site (www.bioversityinternational.org).

CIHEAM is an intergovernmental organization comprising thirteen Mediterranean countries from the South, East and North Mediterranean (Albania, Algeria, Egypt, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Spain, Tunisia and Turkey), whose objective is to promote cooperation in the Mediterranean region through training and research in the area of agriculture and natural resources. To accomplish its objectives, the Centre organizes specialized post-graduate training and short courses targeted towards professionals. Furthermore, it promotes and coordinates research networks and projects on issues relevant to the Mediterranean region. The Centre has four Mediterranean Agronomic Institutes: at Montpellier (France), Bari (Italy), Chania (Greece) and Zaragoza (Spain).

Within the scope of fruit culture and in the field of education, the Mediterranean Agronomic Institute of Zaragoza performs a great deal of activity in the area of plant production in general and plant breeding in particular, with a Master of Science Programme in Plant Breeding, which has held its 16th course this year and which has now become an official Masters Degree in the State of Spain and consequently in the European Union, thanks to the equivalence granted by the Spanish Ministry of Education and Science. Furthermore, the Institute offers short-duration courses related to Fruit Culture, lasting from 1 to 2 weeks. These courses include Nut Production and Economics, and Enhancing Breeding Processes of Fruit and Forest Woody Species.

Concerning the promotion of cooperation in research and development, most activities in this context have been developed through the promotion and support of research networks and

through the management of projects financed by the European Union. Nut production is the sector where there is most activity, with the well-known GREMPA group and with the FAO-CIHEAM Interregional Cooperative Research Network on Nut trees jointly coordinated by FAO and CIHEAM. The descriptors have been elaborated within the framework of this Network. Apricot and the so-called underutilized fruits—fig, pomegranate, Japanese persimmon, loquat and Barbary fig—are other species in which activities are related to research and technology transfer.

The **FAO Interregional Cooperative Research Network on Nuts** was established in Yalova (Turkey) in 1990 to work on the area of nut trees. In 1996, an agreement between FAO and CIHEAM was reached to jointly operate this Research Network, which from then on has been supported by FAO-CIHEAM. The Coordination Centre is IRTA (Institut de Recerca i Tecnologia Agroalimentàries), Mas de Bover, Constanti, Spain, since the start.

The main objectives are the promotion of exchange of information among different Mediterranean partners, establishment of joint research programmes, exchange of germplasm, establishment of close links between researchers, thus fostering a spirit of cooperation.

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CONTENTS

PREFACE

Descriptors for hazelnut, or filbert, (*Corylus avellana* L.) were developed by Professor Dr A. Ilhami Koksal and Dr Nurdan Tuna Gunes. An advanced draft was subsequently prepared by a group of experts within the FAO-CIHEAM Interregional Cooperative Research Network on Nut trees, coordinated by Dr Ignasi Batlle. The document was harmonized as far as possible with descriptors developed by the International Union for the Protection of New Varieties of Plants (UPOV, 1979). This revised document was subsequently sent to a number of experts for their comments. A full list of the names and addresses of those involved is given in the 'Contributors' Section.

Bioversity International (formerly known as IPGRI), encourages the collecting of data for all five types of descriptors (see Definitions and Use of Descriptors). However data from the first four categories—*Passport*; *Management*; *Environment and Site*; and *Characterization*—should be available for any accession. The number of descriptors selected in each of the categories will depend on the crop and their importance to the crop's description. Descriptors listed under *Evaluation* allow for a more extensive description of the accession, but generally require replicated trials over time, often several growing seasons.

Although the suggested coding should not be regarded as the definitive scheme, this format represents an important tool for a standardized characterization system and it is promoted by Bioversity throughout the world.

This descriptor list provides an international format and thereby produces a universally understood 'language' for plant genetic resources data. The adoption of this scheme for data encoding, or at least the production of a transformation method to convert other schemes into the Bioversity format, will produce a rapid, reliable and efficient means for information storage, retrieval and communication, and will assist with the utilization of germplasm. It is recommended, therefore, that information should be produced by closely following the descriptor list with regard to ordering and numbering descriptors, using the descriptors specified, and using the descriptor states recommended.

This descriptor list is intended to be comprehensive for the descriptors that it contains. This approach assists with the standardization of descriptor definitions. Bioversity does not, however, assume that curators will characterize accessions of their collection utilizing all descriptors given. Descriptors should be used when they are useful to the curator for the management and maintenance of the collection or to the users of the plant genetic resources, or both. To this end, highly discriminating descriptors are highlighted in the text to facilitate selection of descriptors.

The List of Multi-crop Passport Descriptors (FAO/IPGRI, 2001) was developed to provide consistent coding schemes for common passport descriptors across crops. They are marked in the text as [MCPD]. Owing to the generic nature of the multi-crop passport descriptors, not all descriptor states for a particular descriptor will be relevant to a specific crop. In Annex I, the reader will find a collecting form for hazelnut that will facilitate data collecting.

Any suggestions for the improvement of the *Descriptors for Hazelnut* will be highly appreciated by Bioversity, FAO and CIHEAM.

DEFINITIONS AND USE OF THE DESCRIPTORS

Bioversity uses the following definitions in genetic resources documentation:

Passport descriptors: These provide the basic information used for the general management of the accession (including registration at the genebank and other identification information) and describe parameters that should be observed when the accession is originally collected.

Management descriptors: These provide the basis for the management of accessions in the genebank and assist with their multiplication and regeneration.

Environment and site descriptors: These describe the environmental and site-specific parameters that are important in characterization and evaluation trials. They can be important for the interpretation of the results of those trials. Site descriptors for germplasm collecting are also included here.

Characterization descriptors: These enable an easy and quick discrimination between phenotypes. They are generally highly heritable, can be easily seen by eye and are equally expressed in all environments. In addition, these may include a limited number of additional traits thought desirable by a consensus of users of the particular crop.

Evaluation descriptors: The expression of many of the descriptors in this category will depend on the environment and, consequently, special experimental designs and techniques are needed to assess them. Their assessment may also require complex biochemical or molecular characterization methods. These types of descriptors include characters such as yield, agronomic performance, stress susceptibilities and biochemical and cytological traits. They are generally the most interesting traits in crop improvement.

Characterization will normally be the responsibility of genebank curators, while evaluation will typically be carried out elsewhere (possibly by a multidisciplinary team of scientists). The evaluation data should be fed back to the genebank, which will maintain a data file.

Highly discriminating descriptors are highlighted in the text.

The following internationally accepted norms for the scoring, coding and recording of descriptor states should be followed:

(a) the Système International d'Unités (SI) is used;

(b) the units to be applied are given in square brackets following the descriptor name;

(c) standard colour charts, e.g. Royal Horticultural Society Colour Chart (RHS, 1966, 1986, 1995), Methuen Handbook of Colour (Kornerup and Wanscher, 1984), or Munsell Colour Chart for Plant Tissues (Munsell Color, 1977), are strongly recommended for all colour characters (the precise chart used should be specified in the section where it is used);

(d) the three-letter abbreviations from the *International Standard (ISO) Codes for the representation of names of countries* are used (http://unstats.un.org/unsd/methods/m49/m49alpha.htm);

(e) quantitative characters, i.e. those that are continuously variable, should preferably be measured quantitatively. Alternatively, in cases where it is difficult to measure quantitatively, it is acceptable to score instead on a 1–9 scale, where:

1	Very low	6	Intermediate to high
2	Very low to low	7	High
3	Low	8	High to very high
4	Low to intermediate	9	Very high
5	Intermediate		

The authors of this list have sometimes described only a selection of the states, e.g. 3, 5 and 7, for such descriptors. Where this has occurred, the full range of codes is available for use by extension of the codes given or by interpolation between them, e.g. in Section 9 (Biotic stress susceptibility), 1 = very low susceptibility and 9 = very high susceptibility;

(f) when a descriptor is scored using a 1–9 scale, such as in (e), '0' would be scored when (i) the character is not expressed; or (ii) when a descriptor is not applicable. In the following example, '0' will be recorded if an accession does not have an internal cavity:

Kernel: internal cavity size

0	Absent
1	Very small
3	Small
5	Medium
7	Large
9	Very large

(g) absence or presence of characters is scored as in the following example:

Absence/presence of involucre constriction

0	Absent
1	Present

(h) blanks are used for information not yet available;

(i) for accessions that are not generally uniform for a descriptor (e.g. mixed collection, genetic segregation), the mean and standard deviation could be reported where the descriptor is continuous. Where the descriptor is discontinuous, several codes in the order of frequency could be recorded; or other publicized methods can be utilized, such as Rana et al. (1991) or van Hintum (1993), that clearly state a method for scoring heterogeneous accessions; and

(j) dates should be expressed numerically in the format YYYYMMDD, where
YYYY - 4 digits to represent the year
MM - 2 digits to represent the month (with leading zero when single digit)
DD - 2 digits to represent the day (with leading zero when single digit).

PASSPORT

All descriptors listed under Passport belonging to the multi-crop passport descriptors category are indicated in the text as [MCPD].

1. Accession descriptors

1.1 Institute code [MCPD]

Code of the institute where the accession is maintained. The codes consist of the three-letter ISO 3166 code of the country where the institute is located, plus a number. The current set of institute codes is available from the FAO Web site (http://apps3.fao.org/wiews/institute_query.htm?i_l=EN).

1.1.1 Site where maintained

Name of institution in which collection is maintained.

1.1.2 Curator's name

Name of officer responsible for maintaining the genetic resources material held at the site specified in **1.1.1 Site where maintained**.

1.2 Accession number [MCPD]

This number serves as a unique identifier for accessions within a genebank collection, and is assigned when a sample is entered into the genebank collection. Once assigned, this number should never be reassigned to another accession in the collection. Even if an accession is lost, its assigned number should never be reused. Letters should be used before the number to identify the genebank or national system (e.g. CGN indicates an accession from the genebank at Wageningen, The Netherlands; PI indicates an accession within the U.S. system).

1.2.1 Local plant number

This identifies a single plant within a plant population having the same accession number. It may be any combination of plot identity, row number, or tree position within the row.

1.3 Donor name

Name of institution or individual responsible for donating the germplasm.

1.4 Donor institute code [MCPD]

Code for the donor institute (see instructions under **1.1 Institute code**).

1.5 Donor accession number [MCPD]

Number assigned to an accession by the donor (see instructions under **1.2 Accession number**).

1.6 Other identification number(s) associated with the accession [MCPD]

Any other identification (numbers) known to exist in other collections for this accession. Use the following system: INSTCODE:ACCENUMB;INSTCODE:ACCENUMB; … INSTCODE and ACCENUMB follow the standard described above and are separated by a colon. INSTCODE and ACCENUMB pairs are separated by a semicolon without space. When the institute is not known, the number should be preceded by a colon.

1.7 Scientific name

1.7.1 Genus [MCPD]

Genus name for taxon. Initial uppercase letter required.

1.7.2 Species [MCPD]

Specific epithet portion of the scientific name in lowercase letters. The abbreviation 'sp.' is used if the species is unknown. (For interspecific hybrids, the species should be designated as 'hybrid' and the parentage indicated in **1.9 Ancestral data**.)

1.7.2.1 Species authority [MCPD]

Provide the authority for the species name.

1.7.3 Subtaxa [MCPD]

Subtaxa can be used to store any additional taxonomic identifier.

1.7.3.1 Rank name

The rank of the subtaxon name. The following abbreviations are allowed: 'subsp.' (for subspecies); 'convar.' (for convariety); 'var.' (for botanical variety); 'f.' (for form).

1.7.3.2 Subtaxon name

The infraspecific epithet of the scientific name (i.e. the epithet following the indication of the infraspecific rank in the name string).

1.7.3.3 Subtaxon authority

Provide the subtaxon authority at the most detailed taxonomic level.

1.8 Genetic origin

1 Open pollination
2 Artificial pollination
3 Clonal selection

1.9 Ancestral data [MCPD]

Information about pedigree or other description of ancestral information (e.g. parent cultivar in case of mutant or selection). For example, a pedigree 'Hanna/7*Atlas//Turk/8*Atlas' or a description 'mutation found in Hanna', 'selection from Irene' or 'cross involving, among others, Hanna and Irene'.

1.9.1 Female parent

1.9.2 Male parent

1.10 Accession

1.10.1 Accession name [MCPD]

Either a registered or other formal designation given to the accession. First letter uppercase. Multiple names separated with semicolon without space. For example: Rheinische Vorgebirgstrauben;Emma;Avlon.

1.10.2 Local language

Language in which the accession name is given.

1.10.3 Translation or transliteration

Provide translation of the local cultivar name into English.

1.10.4 Year of release of the accession or year of registration [YYYY]

1.10.5 Synonyms

Include here any previous identification other than the current name. Collecting number or newly assigned station names are frequently used as identifiers.

1.10.6 Common crop name [MCPD]

Name of the crop in colloquial language, preferably in English (i.e. 'malting barley', 'cauliflower' or 'white cabbage').

1.11 Acquisition date [YYYYMMDD] [MCPD]

Date on which the accession entered the collection, where YYYY is the year, MM is the month and DD is the day. Missing data (MM or DD) should be indicated with hyphens. Leading zeros are required.

1.12 Type of material received

1 *In vitro* plant
2 Cutting
3 Seed
4 Scion
5 Sucker or layer
99 Other (e.g. more than one type, specify in **1.14 Notes**)

1.13 Accession size

Number of trees or shrubs of an accession, or approximate number of seeds (if artificially pollinated) of an accession in the genebank.

1.14 Notes

This field is used to add notes or to elaborate on descriptors with value '99' or '999' (= Other).

2. Collecting Descriptors

2.1 Collecting institute code [MCPD]

Code of the institute collecting the sample. If the holding institute has collected the material, the collecting institute code should be the same as the holding institute code (see instructions under **1.1 Institute Code**).

2.1.1 Site number

Number assigned to the physical site by the collector.

2.2 Collecting number [MCPD]

Original number assigned by the collector(s) of the sample, normally composed of the name or initials of the collector(s) followed by a number. This item is essential for identifying duplicates held in different collections. It should be unique and always accompany subsamples wherever they are sent.

2.3 Collecting date of original sample [YYYYMMDD] [MCPD]

Collecting date of the sample, where YYYY is the year, MM is the month and DD is the day. Missing data (MM or DD) should be indicated with hyphens. Leading zeros are required.

2.4 Country of origin [MCPD]

Code of the country in which the sample was originally collected. Use the three-letter abbreviation from the *International Standard (ISO) Codes for the representation of names of countries.* The ISO 3166-1 Code List can be found at http://unstats.un.org/unsd/methods/

m49/m49alpha.htm. Country or area numerical codes added or changed are available online at http://unstats.un.org/unsd/methods/m49/m49chang.htm

2.5 Province/State

Name of the primary administrative subdivision of the country in which the sample was collected.

2.6 Department/County

Name of the secondary administrative subdivision (within a Province/State) of the country in which the sample was collected.

2.7 Location of collecting site [MCPD]

Location information below the country level that describes where the accession was collected. This might include the distance in kilometres and direction from the nearest town, village or map grid reference point, e.g. 7 km south of Curitiba in the state of Parana.

2.7.1 Nearest named place

Name of nearest place to site. This also refers to places that may not have proper names (i.e. road junctions).

2.7.2 Distance in km

Distance from nearest named place to site.

2.7.3 Direction from nearest place

Direction of site from nearest named place in degrees relative to north.

2.8 Latitude of collecting site[1] [MCPD]

Degrees, minutes and seconds followed by N (north) or S (south) (e.g. 103015S). Missing data (minutes or seconds) should be indicated with hyphens. Leading zeros are required (e.g. 10----S; 011530N; 4531--S).

2.9 Longitude of collecting site[1] [MCPD]

Degrees, minutes and seconds followed by E (east) or W (west) (e.g. 0762552W). Missing data (minutes or seconds) should be indicated with hyphen. Leading zeros are required (e.g. 076----W).

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[1] To convert from longitude and latitude in degrees (º), minutes (‘), seconds (‘’), and a hemisphere (North or South, and East or West) to decimal degrees, the following formula should be used:

d° m’ s” = h * (d + m/60 + s/3600)

where h = 1 for the Northern and Eastern hemispheres and -1 for the Southern and Western hemispheres. E.g. 30°30’0” S = -30.5, and 30°15’55” N = 30.265.

2.10 Elevation of collecting site [m asl] [MCPD]

2.11 Collecting source [MCPD]

10 Wild habitat
- 11 Forest/woodland
- 12 Shrubland
- 13 Grasslands
- 14 Desert/tundra

20 Farm or cultivated habitat
- 21 Field
- 22 Orchard
- 23 Garden
- 24 Fallow land
- 25 Pasture
- 26 Store

30 Market or shop
- 31 Town
- 32 Village
- 33 Urban area (around city)
- 34 Other exchange system

40 Institute/research organization/experimental station/genebank

50 Seed company

60 Weedy, disturbed or ruderal habitat

99 Other (specify in **2.23 Collector's notes**)

2.12 Breeding institute code [MCPD]

Institute code of the institute that has bred the material. If the holding institute has bred the material, the breeding institute code should be the same as the holding institute code. It follows the Institute code standard.

2.13 Number of samples collected

2.14 Type of sample

Type of sample collected. If different types of material were collected from the same source, each sample type should be designated with a unique collecting number and a corresponding unique accession number

1 Vegetative (budsticks, suckers)

2 Tissue culture

3 Seeds

4 Pollen

2.15 Biological status of accession [MCPD]

100 Wild
200 Weedy
300 Traditional cultivar/landrace
400 Breeding/research material
  410 Breeder's line
  420 Mutant/genetic stock
500 Advanced/improved cultivar
999 Other (specify in **2.23 Collector's notes**)

2.16 Ethnobotanical data

2.16.1 Ethnic group

Name of the ethnic group of the donor of the sample or of the people living in the area of collecting.

2.16.2 Local vernacular name

Name given by farmer to crop, cultivar, landrace, clone or wild form.

2.16.2.1 Language of local vernacular name

Specify local language and/or dialect of the name.

2.16.2.2 Meaning of local vernacular name

Provide a literal translation or an interpretation of the local vernacular name.

2.16.3 Use of samples collected

1 Nut production
2 Clonal rootstock
3 Seedling rootstock
4 Pollinator
5 Ornamental
6 Medicinal
7 Wood/timber
99 Other (specify in **2.23 Collector's notes**)

2.16.4 Prevailing stresses

Information on main associated biotic (pests and diseases) and abiotic (drought) stresses.

2.17 Collecting site population structure

2.17.1 Number of trees sampled

2.17.2 Frequency of the species at collecting site

1 Rare
2 Occasional
3 Frequent
4 Abundant
5 Very abundant

2.17.3 Associated flora

Other dominant crop or plant species found in and around the collecting site.

2.17.4 Associated mycorrhizal fungi

Were root samples collected? If so, specify which fungi were identified in the laboratory, in **2.23 Collector's notes**.

0 No
1 Yes

2.18 Herbarium specimen

Was a herbarium specimen collected? If so, provide an identification number and indicate in which place (herbarium) the hazelnut specimen was deposited.

0 No
1 Yes

2.18.1 Specimen identification number

2.18.2 Herbarium name

2.19 Photograph

Was a photograph(s) taken of the accession or habitat at the time of collecting? If so, provide an identification number(s)

0 No
1 Yes

2.19.1 Photograph identification number

2.20 Collecting source environment

Use descriptors 5.1.1 to 5.1.22 in Section 5.

2.21 Cultural methods

2.21.1 Cropping system

1 Monoculture (specify spacing)
2 Intercropping (specify spacing and type of intercrop)
3 Agropastoralism (specify type of animals)
4 Natural cropping (i.e. wild *Corylus* species top worked with cultivar)

2.21.2 Propagation method

Method used to produce trees/shrubs.

1 Seed
2 Grafted (specify species, hybrids and/or clone used as rootstock)
3 Tissue culture
4 Rooted cutting
5 Sucker or layer

2.21.3 Irrigation

1 Rainfed
2 Irrigated (specify average annual amount of water supplied per hectare)
3 Run-off
4 River banks
99 Other (Specify in **2.23 Collector's notes**)

2.22 Plant population density

Quantify plants by hectare.

2.23 Collector's notes

Additional information recorded by the collector (e.g. assessment of genetic erosion) or any specific information on any state in any of the above descriptors.

MANAGEMENT

3. Orchard management descriptors

3.1 Accession number [Passport 1.1]

3.1.1 Local plant number [Passport 1.1.1]

This identifies a single plant within a plant population having the same accession number. It may be any combination of plot identity, row number or tree position within the row.

3.2 Accession orchard location

Enter separate block designations, row numbers and tree numbers within the row for each duplicate tree of each accession if each tree is not identified with a unique local plant number (see **3.1.1 Local plant number**).

3.2.1 Block designation

3.2.2 Row number

3.2.3 Tree number within the row

3.3 Propagation method

Method used to produce tree or shrubs.

1 Seed
2 Grafted
3 Rooted cutting
4 Tissue culture
5 Sucker or layer

3.4 Rootstock name

Indicate the name of the rootstock used.

3.5 Grafting establishment [%]

Percentage of grafts successful.

3.6 Planting year [YYYY]

Specify year tree was planted in the orchard.

3.7 Regeneration year [YYYY]

Year (estimate) tree should be propagated for regeneration.

3.8 Date of last regeneration or multiplication [YYYYMMDD]

Primary method of regeneration is propagation of clonal material.

3.9 Number of times accession regenerated

Since the date of acquisition.

3.10 Type of germplasm storage [MCPD]

If germplasm is maintained under different types of storage, multiple choices are allowed, separated by a semicolon (e.g. 20; 30). (Refer to FAO/ Bioversity Genebank Standards, 1994, for details on storage type.) Available at: http://www.bioversityinternational.org/Publications/pubfile.asp?ID_PUB=424.

- 10 Seed collection
  - 11 Short term
  - 12 Medium term
  - 13 Long term
- 20 Field collection
- 30 In vitro collection (slow growth)
- 40 Cryopreserved collection
- 99 Other (Specify in **3.12 Notes**)

3.11 Location of safety duplicates [MCPD]

Code of the institute(s) where a safety duplicate of the accession is maintained. It follows the institute code standard. See instructions under **1.1 Institute code**.

3.12 Notes

Any additional information may be specified here.

ENVIRONMENT AND SITE

4. Characterization and/or evaluation site descriptors

4.1 Country of characterization and/or evaluation

(See instructions in **2.4 Country of origin**.)

4.2 Site (research institute)

4.2.1 Latitude

(See format under **2.8 Latitude of collecting site**.)

4.2.2 Longitude

(See format under **2.9 Longitude of collecting site)**

4.2.3 Elevation [m asl]

4.2.4 Name of farm or institute

4.3 Evaluator's name and address

4.4 Sowing or grafting date [YYYYMMDD]

4.5 Evaluation environment

Environment in which characterization/evaluation was carried out.

1 Field
2 Screenhouse
3 Glasshouse
4 Laboratory
99 Other (specify in **4.15 Notes**)

4.6 Condition of tree

Choose the one condition that best fits the accession at the time of characterization or evaluation:

1 Dying
2 Old, declining
3 Mature, diseased
4 Mature, non-vigorous
5 Mature, vigorous
6 Young, bearing
7 Young, not bearing

4.7 Seed germination

4.7.1 Number of days
Specify number of days over which germination is measured.

4.7.2 Germination percentage [%]
Percentage of germinated seeds after 60 days.

4.8 Field establishment

4.8.1 Number of days
Specify number of days over which establishment is measured.

4.9 Sowing site in the field
Give block, strip and/or row/plot numbers as applicable, plants per plot, and replication.

4.10 Field spacing

4.10.1 Distance between trees in a row [m]

4.10.2 Distance between rows [m]

4.11 Training system
1 Bush
2 Tree

4.12 Fertilizers
Specify types, doses, frequency of each and method of application.

4.13 Plant protection
Specify pesticides used, doses, frequency of each and method of application.

4.14 Environmental characteristics of site
Use descriptors 5.1.1 to 5.1.22 in Section 5.

4.15 Notes
Any other site-specific information.

5. Collecting and/or characterization/evaluation site environment descriptors
Descriptors indicated with stars (★) in this category are those more relevant for hazelnut.

5.1 Site environment

✶5.1.1 Topography

This refers to the profile in elevation of the land surface on a broad scale (adapted from FAO, 1990).

1	Flat	0–0.5%
2	Almost flat	0.6–2.9%
3	Gently undulating	3.0–5.9%
4	Undulating	5.0–10.9%
5	Rolling	11.0–15.9%
6	Hilly	16.0–30.0%
7	Steeply dissected	>30%, moderate elevation range
8	Mountainous	>30%, great elevation range (>300 m)
99	Other (specify in the appropriate section's notes)	

5.1.2 Higher-level landform (general physiographic features)

The landform refers to the shape of the land surface in the area in which the collecting site is located (adapted from FAO, 1990).

1 Plain
2 Basin
3 Valley
4 Plateau
5 Upland
6 Hill
7 Mountain

5.1.3 Land element and position

(Adapted from FAO, 1990)

Description of the geomorphology of the immediate surroundings of the collecting site (See Fig. 1).

1	Plain, level	17	Interdunal depression
2	Escarpment	18	Mangrove
3	Interfluve	19	Upper slope
4	Valley	20	Mid-slope
5	Valley floor	21	Lower slope
6	Channel	22	Ridge
7	Levee	23	Beach
8	Terrace	24	Beach ridge
9	Floodplain	25	Rounded summit
10	Lagoon	26	Summit
11	Pan	27	Coral atoll
12	Caldera	28	Drainage line (bottom position in flat or almost-flat terrain)
13	Open depression		
14	Closed depression	29	Coral reef
15	Dune	99	Other (specify in appropriate section's notes)
16	Longitudinal dune		

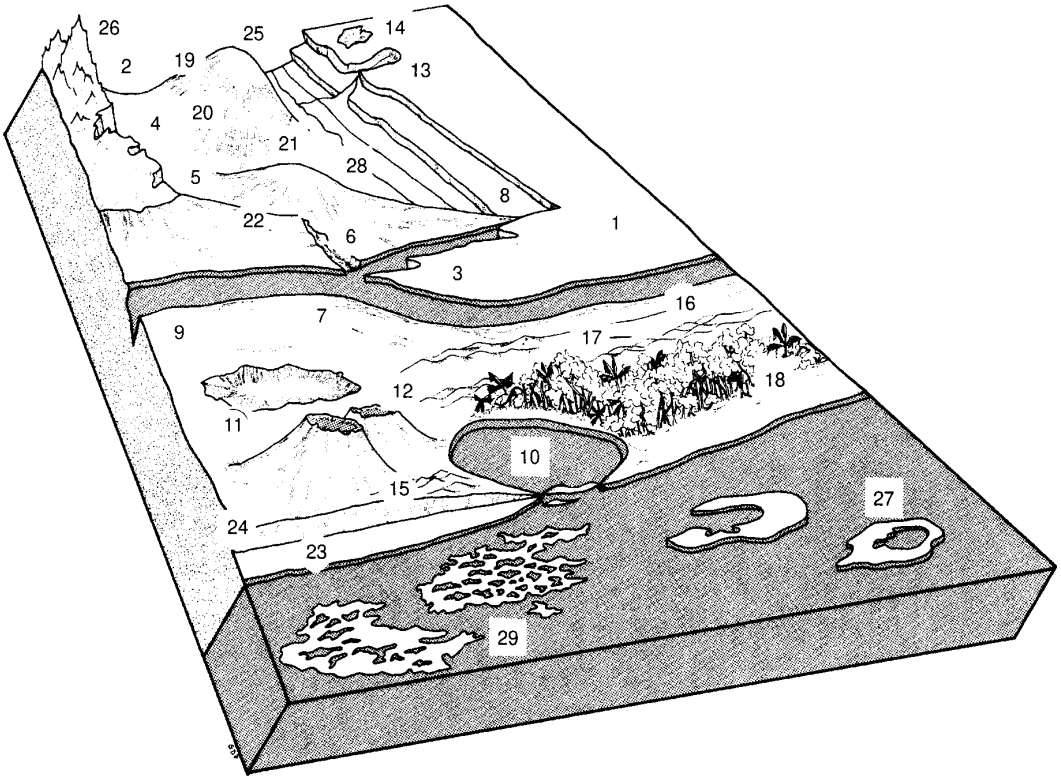

Fig. 1. Land element and position.

★5.1.4 Slope [°]

Estimated slope of the collecting site in degrees.

5.1.4.1 Slope aspect

The direction that the slope on which the accession was collected faces. Describe the direction with symbols N, S, E, W (e.g. a slope that faces a south-western direction has an aspect of SW).

5.1.5 Crop agriculture

(Adapted from FAO, 1990)

1 Annual Field cropping
2 Perennial field cropping
3 Tree and shrub cropping

5.1.6 Overall vegetation surrounding the collecting site

(Adapted from FAO, 1990)

10 Herbaceous
- 11 Grassland
- 12 Forb land

20 Closed forest (continuous tree layer, crowns overlapping, large number of tree and shrub species in distinct layers)

30 Woodland (continuous tree layer, crowns usually not touching, understorey may be present)

40 Shrub
- 41 Normal/Average height
- 42 Dwarf

99 Other (specify in appropriate section's notes)

5.1.7 Stoniness/rockiness/hardpan/cementation

1 Tillage unaffected
2 Tillage affected
3 Tillage difficult
4 Tillage impossible
5 Essentially paved

5.1.8 Soil drainage

(Adapted from FAO, 1990)

3 Poorly drained
5 Moderately drained
7 Well drained

5.1.9 Soil salinity

5.1.9.1 Dissolved salts

1 <160 ppm
2 160–240 ppm
3 241–480 ppm
4 481–800 ppm
5 >800 ppm

5.1.9.2 Electro-conductivity (EC)

1	0–2	Salinity effects are usually minimal
2	>2–4	Yield of very salt-sensitive plants may be restricted
3	>4–8	Yield of salt-sensitive plants restricted
4	>8–16	Only salt-tolerant plants yield satisfactorily
5	>16	Few salt tolerant-plants yield satisfactorily

5.1.10 Groundwater quality

1 Saline
2 Brackish
3 Fresh
4 Polluted
5 Oxygenated
6 Stagnating

5.1.11 Soil depth to groundwater table

(Adapted from FAO, 1990)

The depth to the groundwater table, if present, as well as an estimate of the approximate annual fluctuation, should be given. The maximum rise of the groundwater table can be inferred approximately from changes in profile colour in many, but not all, soils.

1 0–25 cm
2 25.1–50 cm
3 50.1–100 cm
4 100.1–150 cm
5 >150 cm

5.1.12 Soil moisture

(Adapted from FAO, 1990)

Moisture conditions prevailing in the soil at the time of collecting should be given, together with the depth. Attention should be paid to unusual moisture conditions caused by unseasonal weather, prolonged exposure of the profile, flooding, etc.

3 Dry
5 Slightly moist
7 Moist
9 Wet

5.1.13 Soil matrix colour

(Adapted from FAO, 1990)

The colour of the soil matrix material in the root zone around the accession is recorded in the moist condition (or both dry and moist condition, if possible) using the notation for hue, value and chroma as given in the Munsell Soil Colour Charts (Munsell Colour 1975). If there is no dominant soil matrix colour, the horizon is described as mottled and two or more colours are given and should be registered under uniform conditions. Early morning and late evening readings are not accurate. Provide depth of measurement [cm]. If colour chart is not available, the following states may be used:

1 White
2 Red
3 Reddish
4 Yellowish red
5 Brown
6 Brownish
7 Reddish brown
8 Yellowish brown
9 Yellow
10 Reddish yellow
11 Greenish, green
12 Grey
13 Greyish
14 Blue
15 Bluish black
16 Black

✶5.1.14 Soil organic matter content

1 Nil (as in arid zones)
3 Low (as in long-term cultivation in a tropical setting)
5 Medium (as in recently cultivated but not yet much depleted)
7 High (as in never cultivated, and in recently cleared forest)
9 Peaty

5.1.15 Soil pH

Actual pH value of the soil around the accession.

5.1.15.1 Root depth [cm]

Indicate the root depth at which the soil pH is being measured.

✶5.1.16 Soil erosion

3 Low
5 Intermediate
7 High

✶5.1.17 Soil texture classes

(Adapted from FAO, 1990)

For convenience in determining the texture classes of the following list, particle size classes are given for each of the fine earth fractions listed below (see Fig. 2).

1 Clay
2 Loam
3 Clay loam
4 Silt
5 Silt clay
6 Silt clay loam
7 Silt loam
8 Sandy clay
9 Sandy clay loam
10 Sandy loam
11 Fine sandy loam
12 Coarse sandy loam
13 Loamy sand
14 Loamy very fine sand
15 Loamy fine sand
16 Loamy coarse sand
17 Very fine sand
18 Fine sand
19 Medium sand
20 Coarse sand
21 Sand, unsorted
22 Sand, unspecified

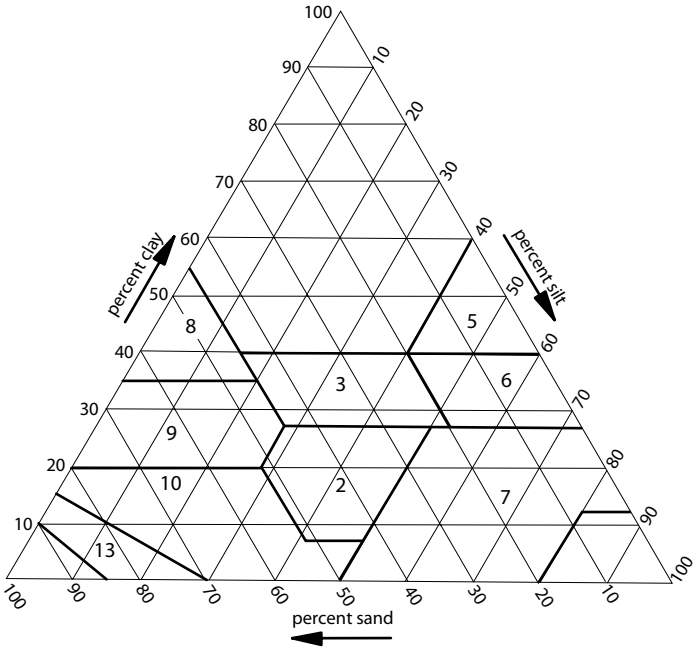

Fig. 2. Soil texture classes (FAO, 1990).

5.1.17.1 Soil particle size classes

(Adapted from FAO, 1990)

1	Clay	<2 µm
2	Fine silt	3–20 µm
3	Coarse silt	21–63 µm
4	Very fine sand	64–125 µm
5	Fine sand	126–200 µm
6	Medium sand	201–630 µm
7	Coarse sand	631–1250 µm
8	Very coarse sand	1251–2000 µm

✶5.1.18 Soil taxonomic classification

As detailed a classification as possible should be given. This may be taken from a soil survey map. State class (Alfisols, Spodosols, Vertisols, etc.).

✶5.1.19 Water availability

1 Rainfed
2 Irrigated
3 Flooded
4 River banks
5 Sea coast
99 Other (specify in appropriate section's Notes)

★5.1.20 Soil fertility

General assessment of the soil fertility based on existing vegetation.

3 Low
5 Moderate
7 High

★5.1.21 Climate of the site

Should be assessed as close to the site as possible (state number of recorded years).

★5.1.21.1 Temperature [°C]

Provide either the monthly or the annual mean.

★5.1.21.2 Rainfall [mm]

Provide either monthly/annual mean (state number of recorded years).

5.1.21.3 Wind [m/s]

Annual average (state number of years recorded).

5.1.21.3.1 Annual maximum wind velocity [m/s]

5.1.21.4 Frost

5.1.21.4.1 Date of most recent frost [YYYYMMDD]

5.1.21.4.2 Minimum temperature [°C]

Specify seasonal average and minimum survival temperature.

5.1.21.4.3 Duration of temperature below 0°C [days]

5.1.21.5 Relative humidity

5.1.21.5.1 Relative humidity diurnal range [%]

5.1.21.5.2 Relative humidity seasonal range [%]

5.1.21.6 Light

1 Shady
2 Sunny

5.1.21.7 Day length [hours]

Provide either the monthly (mean, maximum, minimum) or the seasonal (mean, maximum, minimum).

5.1.22 Remarks

Any other site-specific information can be listed here.

CHARACTERIZATION

6. Plant descriptors

Average of at least two 'on-years' (production years) data, unless otherwise stated. These characters were adapted from UPOV (1979), Ayfer et al. (1986) and Thompson et al. (1978).

Minimum set of characterization and evaluation descriptors

6.5.1	Flowering precocity
6.6.16	Shape of nut apex
6.6.17	Nut apex prominence
6.6.19	Hairiness of nut apex
6.6.20	Size of nut basal scar in relation to nut size
6.6.22	Blank production
6.6.23	Double (twin) kernels
6.6.26	100-Nut weight
6.6.27	100-Kernel weight
6.6.28	Kernel dry weight/nut dry weight × 100
6.7.2	Date of vegetative budbreak
6.7.3	Blooming reference standard
6.7.3.1	Days before (-) or after (+) reference standard
6.7.4	First male bloom date
6.7.5	Male peak bloom date
6.7.5.1	Days before (-) or after (+) reference standard
6.7.6	Last male bloom date
6.7.7	First female bloom date
6.7.8	Female peak bloom date
6.7.8.1	Days before (-) or after (+) reference standard
6.7.9	Last female bloom date
6.7.10	Dichogamy
6.8.1	Years from sucker planting graft or seed to first yield
6.8.2	Nut maturity date
6.8.2.1	Days before (-) or after (+) reference standard
6.8.3	Homogeneity of nut ripening
6.8.4	Nut falling
6.9.1	Beginning of defoliation
6.9.2	Defoliation date
7.2.2	Estimated yield
7.3.1	Chemical composition
7.3.2	Storage quality
7.3.2.1	Kernel rancidity potential

6.1 Growth descriptors

6.1.1 Tree vigour

		Reference cultivars
1	Very low	Impériale de Trébizonde
3	Low	Negret, Tombul, Tonda Gentile Romana
5	Intermediate	Ennis, Tonda di Giffoni, Tonda Gentile delle Langhe
7	High	Fertile de Coutard, Merveille de Bollwiller, Nocchione, Pauetet
9	Very high	Butler, Corabel, San Giovanni, Segorbe

6.1.2 Tree growth habit

		Reference cultivars
1	Very erect	Daviana, Sant Pere
2	Erect	Butler, Kalinkara, San Giovanni, Pauetet, Segorbe
3	Semi-erect	Corabel, Ennis, Fertile de Coutard, Foşa, Merveille de Bollwiller, Mincane, Negret, Tonda di Giffoni, Tonda Gentile delle Langhe, Tonda Gentile Romana
4	Spreading	Istarski duguljasti, Morell, Tombul
5	Drooping	Impériale de Trébizonde, Palaz, *Corylus avellana* var. *pendula*
6	Contorted	*Corylus avellana* var. *contorta*

6.1.3 Branching density

		Reference cultivars
3	Sparse	Butler, Tonda Gentile Romana
5	Intermediate	Fertile de Coutard, Negret, Segorbe, Tonda Gentile delle Langhe, Tonda di Giffoni
7	Dense	Bergeri, Cosford, Ennis

6.1.4 Suckering

		Reference cultivars
0	Absent	Dundee, Newberg (*C. avellana* × *C. colurna*, clonal rootstocks)
1	Very weak	Butler, Tonda Bianca
3	Weak	Corabel, Cosford, Daviana, Ennis, Merveille de Bollwiller, San Giovanni
5	Medium	Pauetet, Segorbe,Tonda Gentile Romana
7	Strong	Fertile de Coutard, Negret, Tonda di Giffoni, Tonda Gentile delle Langhe
9	Very Strong	Impériale de Trébizonde, Palaz, Tombul

6.2 Bud descriptors

Observe 20 healthy representative buds collected during the winter and record the average.

6.2.1 Bud colour

		Reference cultivars
1	Green	Du Chilly, Segorbe, Tonda Gentile delle Langhe
2	Brown green	Fertile de Coutard, Negret, Segorbe
3	Reddish	Merveille de Bollwiller

6.2.2 Bud shape

(See Fig. 3.)

		Reference cultivars
1	Conical/pointed	Merveille de Bollwiller
2	Ovoid	Fertile de Coutard, Negret
3	Globular	Du Chilly, Segorbe, Tonda Gentile delle Langhe

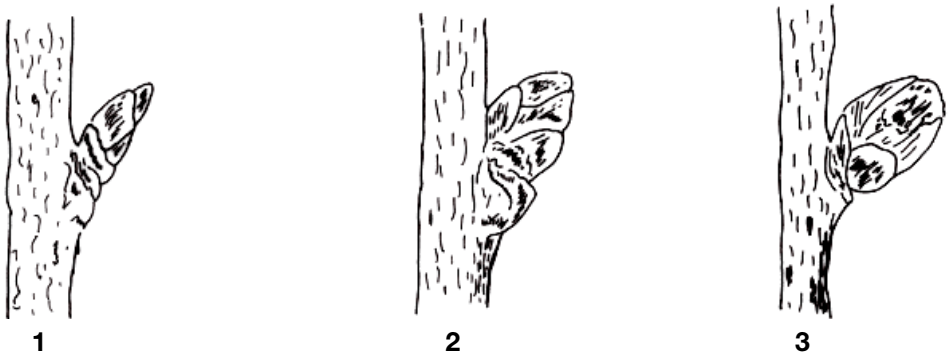

Fig. 3. Bud shape (UPOV, 1979).

6.3 Leaf descriptors

Record average of 20 fully expanded representative leaves, collected from different trees when shoots are lignified. Do not select leaves that are out of the ordinary due to disease, nutritional imbalances or excessive vigour. For qualitative characteristics, indicate the predominant one.

6.3.1 Leaf length [cm]

Measured from the base to the tip of the leaf blade (see Fig. 4).

6.3.2 Leaf width [cm]

Measured at the widest part (see Fig. 4).

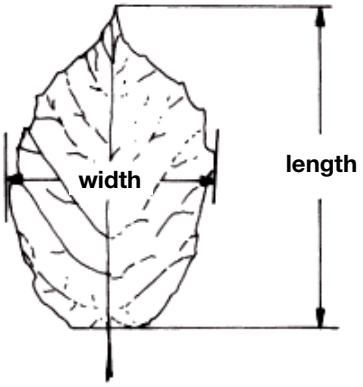

Fig. 4. Leaf length and width.

6.3.3 Leaf blade shape

(See Fig. 5.)

		Reference cultivars
1	Elliptic	Merveille de Bollwiller
2	Ovate	Du Chilly
3	Rounded	Fertile de Coutard, Negret, Segorbe, Tonda di Giffoni

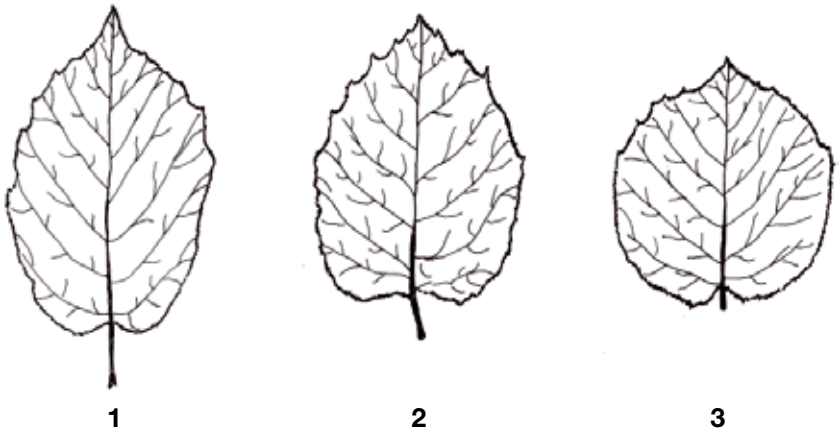

Fig. 5. Leaf blade shape (UPOV, 1979).

6.3.4 Leaf colour

Evaluated at adaxial side, when shoot is woody, before harvest time.

1 Yellow
2 Light green
3 Green
4 Dark green
5 Red green
6 Red

6.4 Shoot descriptors

6.4.1 One-year-old-shoot thickness

		Reference cultivars
3	Thin	Bergeri, Cosford, Negret
5	Medium	Tonda Gentile delle Langhe
7	Thick	Fertile de Coutard, Tonda Gentile Romana

6.4.2 One-year-old-shoot hairiness

		Reference cultivars
3	Weak	Mortarella, Segorbe
5	Medium	Tonda Gentile delle Langhe, Fertile de Coutard
7	Strong	Tonda di Giffoni

6.4.3 One-year-old-shoot density of lenticels

		Reference cultivars
3	Low	Fertile de Coutard, Negret, Segorbe
7	High	Mortarella
9	Very high	San Giovanni, Tonda Gentile delle Langhe

6.5 Inflorescence

Record average of at least two 'on-years' (see **6.2 Bud descriptors**). Inflorescence descriptors are evaluated at peak bloom period.

6.5.1 Flowering precocity

Specify number of years from sucker planting, graft or seed to first flower (i.e. 4G indicates first flower produced 4 years after graft establishment).

6.5.1.1 Years before (-) or after (+) reference standard

6.5.2 Inflorescence bud dry weight [DW g]

Average of 20 buds during off years for female[2]

[2] Weight of buds as well as weight of kernels and nuts in the following descriptors should always be calculated using material dried in a ventilated oven at 60°C for 24 hours.

6.5.3 Stigma colour of young flowers

		Reference cultivars
1	Pale yellow	OSU 899.010 (selection)
2	Pink	San Giovanni
3	Red	Fertile de Coutard, Ennis, Tonda Gentile delle Langhe, Tonda di Giffoni
4	Purple red	Merveille de Bolwiller, Negret

6.5.4 Female flower abundance

Rate in relation to age and volume of tree.

3 Sparse
5 Intermediate
7 Dense

6.5.5 Catkin abundance

Rate in relation to age and volume of tree.

3 Sparse
5 Intermediate
7 Dense

6.6 Nut and kernel

Descriptors within this section should be used on healthy nuts at harvest time, unless otherwise specified.

6.6.1 Involucre constriction

		Reference cultivars
0	Absent	Ennis, Fertile de Coutard, Negret, Pauetet, Segorbe, Tonda Gentile delle Langhe
1	Present	Impériale de Trébizonde, Istarski duguljasti, Tombul

6.6.2 Involucre length compared to nut length

		Reference cultivars
3	Shorter	Jemtegaard 5, Tonda Bianca
5	Equal	Cosford, Ennis, Fertile de Coutard, Merveille de Bollwiller, Negret
7	Longer	Du Chilly, Imperiale de Trébizonde, Istarski duguljasti, Segorbe, Tonda Gentile delle Langhe, Tombul

6.6.3 Involucre indentation

(See Fig. 6.)

		Reference cultivars
3	Weak	Du Chilly, Ennis, Tombul
5	Medium	Fertile de Coutard, Negret, Tonda Gentile delle Langhe
7	Strong	Gunslebert, Istarski duguljasti

Fig. 6. Involucre indentation (Padulosi, S.).

6.6.4 Serration of indentations on the involucre

(See Fig. 7.)

		Reference cultivars
3	Weak	Du Chilly, Ennis, Segorbe, Tombul
5	Medium	Fertile de Coutard, Tonda Gentile delle Langhe
7	Strong	Gunslebert, Istarski duguljasti, Negret

Fig. 7. Serration of indentations on the involucre (Padulosi, S.).

6.6.5 Involucre thickness at base of involucre

		Reference cultivars
3	Thin	Cosford
5	Medium	Merveille de Bollwiller, Segorbe
7	Thick	Fertile de Coutard, Pauetet, Tonda di Giffoni

6.6.6 Involucre hairiness density

		Reference cultivars
0	Absent	Tonda Bianca
3	Low	Cosford, Du Chilly, Ennis, Segorbe
5	High	Fertile de Coutard, Tonda Gentile delle Langhe
7	Very high	Pauetet, Tonda di Giffoni

6.6.7 Jointing of bracts on involucre

		Reference cultivars
0	Absent	Tonda Gentile delle Langhe
1	On one side	Fertile de Coutard, Negret, Segorbe
2	On both sides	Du Chilly, Impériale de Trébizonde,Tombul

6.6.8 Predominant nut number per cluster

This observation should be made on 50 clusters.

		Reference cultivars
1	One	Daviana
2	One to two	Cosford, Merveille de Bolwiler
3	Two to three	Fertile de Coutard, Tonda di Giffoni, Tonda Gentile Romana
4	Three to four	Negret, Segorbe
5	More than four	Tombul

6.6.9 Nut length [mm]

Average of at least 25 nuts, measured from the most distant points along main seed axis (see Fig. 8).

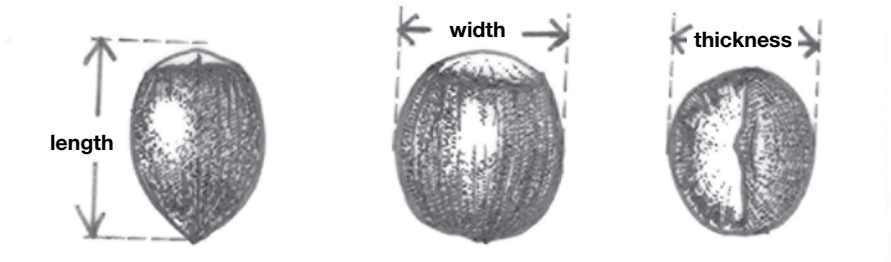

Fig. 8. Nut length, width and thickness (Padulosi, S.).

6.6.10 Nut width [mm]
Average of at least 25 nuts, measured from the widest point perpendicular to main seed axis (see Fig. 8).

6.6.11 Nut thickness [mm]
Average of at least 25 nuts, measured at widest part perpendicular to suture (see Figure 8).

6.6.12 Nut shape
(See Fig. 9.)

		Reference cultivars
1	Oblate	Impériale de Trébizonde
2	Globular	Fertile de Coutard, Tonda Gentile delle Langhe, Tonda Gentile Romana
3	Conical	Merveille de Bollwiller, Tombul
4	Ovoid	Istarski duguljasti, Negret, Pauetet
5	Short subcylindrical	Butler
6	Long subcylindirical	Cosford, Du Chilly, Pallagrossa

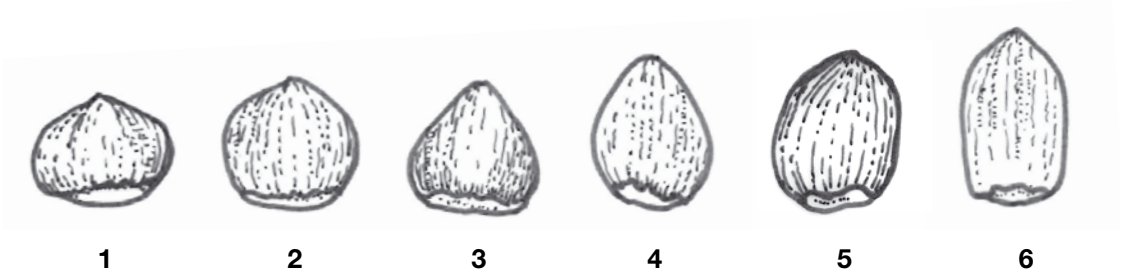

Fig. 9. Nut shape (UPOV, 1979).

6.6.13 Nut – shape of cross section
(See Fig. 10.)

		Reference cultivars
1	Transversally elliptical	Du Chilly, Negret
2	Circular	Ennis, Merveille de Bollwiller, Pauetet
3	Triangular	Tonda Gentile delle Langhe
4	Rectangular	Gunslebert

Fig. 10. Nut – shape of cross-section (UPOV, 1979).

6.6.14 Nut shell colour

		Reference cultivars
1	Almost white	Gasaway
2	Greenish yellow	Tonda Bianca
3	Light brown	Butler, Ennis, Tonda Gentile delle Langhe
4	Brown	Corabel, Fertile de Coutard, Tonda di Giffoni, Tonda Gentile Romana, Tombul
5	Dark brown	Negret

6.6.15 Shell striping

		Reference cultivars
0	Absent	Fertile de Coutard, Negret
3	Few	Impériale de Trébizonde, Segorbe
5	Medium	Cosford, Tonda Gentile Romana
7	Many	Campanica, Ennis

6.6.16 Shape of nut apex

(See Fig. 11.)

		Reference cultivars
1	Flat	Impériale de Trébizonde
2	Obtuse	Fertile de Coutard, Tonda Gentile delle Langhe, Tonda di Giffoni, Tonda Gentile Romana
3	Broad acute	Istarski duguljasti, Merveille de Bollwiller, Tombul
4	Narrow acute	Bergeri

Fig. 11. Shape of nut apex.

6.6.17 Nut apex prominence

		Reference cultivars
3	Slight	Cosford, Fertile de Coutard, Tonda di Giffoni
5	Medium	Negret, Pauetet
7	Strong	Istarski duguljasti, Tonda Gentile Romana

6.6.18 Size of pistil scar

		Reference cultivars
3	Small	Ennis, Fertile de Coutard, Negret, Pauetet, Tonda Gentile delle Langhe, Tombul
5	Medium	Tonda di Giffoni, Tonda Gentile Romana
7	Large	Cosford, Impériale de Trébizonde, Nocchione, San Giovanni

6.6.19 Hairiness of nut apex

		Reference cultivars
3	Weak	Corabel, Cosford, Ennis, Impériale de Trébizonde, Istarski duguljasti, Tonda Gentile delle Langhe
5	Medium	Fertile de Coutard, Negret, Pauetet
7	Strong	Du Chilly

6.6.20 Size of nut basal scar in relation to nut size

		Reference cultivars
3	Small	Segorbe, Tonda Gentile delle Langhe
5	Medium	Ennis, Fertile de Coutard
7	Large	Cosford, Istarski duguljasti, Merveille de Bollwiller, Tombul

6.6.21 Curvature of nut basal scar

(See Fig. 12.)

		Reference cultivars
1	Concave	
2	Plane	Impériale de Trébizonde, Tonda Gentile Romana
3	Convex	Istarski duguljasti, Negret, Pauetet

Fig. 12. Curvature of nut basal scar.

6.6.22 Blank production [%]
Sample size 100 nuts (n blank nuts/n sample × 100).

6.6.23 Double (twin) kernels [%]
Sample size 100 nuts (n double nuts/n sample × 100).

6.6.24 Brown spots in kernel cavity [%]
Sample size 100 nuts.

6.6.25 Number of nuts in 100 g
Counted using healthy, ready-for storage nuts.

6.6.26 100-Nut weight [g]

6.6.27 100-Kernel weight [g]
Average of healthy dry kernels.

6.6.28 Kernel dry weight/nut dry weight × 100 [%]

6.6.29 Kernel length [mm]
Average of at least 25 kernels, measured from most distant points along main seed axis (see Fig. 13).

6.6.30 Kernel width [mm]
Average of at least 25 kernels, measured on the widest point perpendicular to main seed axis (see Fig. 13).

6.6.31 Kernel thickness [mm]
Average of at least 25 kernels, measured at the widest part perpendicular to cotyledon suture (see Fig. 13).

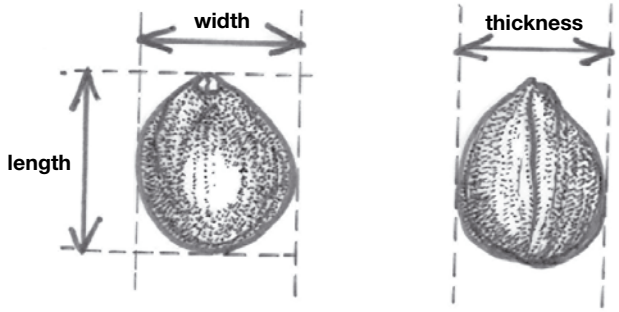

Fig. 13. Kernel length, width and thickness (Padulosi, S.).

6.6.32 Kernel shape

(See Fig. 9.)

		Reference cultivars
1	Oblate	Impériale de Trébizonde
2	Globular	Segorbe, Tonda Gentile delle Langhe, Tonda Gentile Romana
3	Conical	
4	Ovoid	Istarski duguljasti, Merveille de Bollwiller, Negret
5	Short cylindrical	Butler, Daviana
6	Long cylindrical	Cosford, Du Chilly

6.6.33 Kernel plumpness

		Reference cultivars
3	Low	Ennis
5	Moderate	Fertile de Coutard
7	High	Negret, Pauetet

6.6.34 Kernel fibre texture

		Reference cultivars
1	Smooth	Istarski duguljasti, Tombul
3	Lightly corky	Negret, Segorbe, Tonda Gentile Romana
5	Medium corky	Corabel, Fertile de Coutard, Tonda Gentile delle Langhe
7	Strongly corky	Cosford

6.6.35 Kernel blanching (Ease of pellicle removal)

Based on Thompson et al. (1978), using 115ºC for 20 minutes.

		Reference cultivars
0	None	Du Chilly, Ennis
3	Poor	Butler, Tonda Gentile Romana
5	Medium	Fertile de Coutard
7	Good	Corabel, Pauetet, Segorbe, Tonda Gentile delle Langhe
9	Very good	Istarski duguljasti, Negret, Tombul

6.6.36 Size of internal cavity of kernel

		Reference cultivars
0	Absent	
3	Small	
5	Medium	Tonda Gentile delle Langhe, Tombul
7	Large	Ennis, Fertile de Coutard, Tonda di Giffoni

6.6.37 Kernel flavour

1 Unsatisfactory
2 Satisfactory
3 Very good

6.7 Phenology descriptors

6.7.1 Reference standard

Indicate which cultivar has been used for the following descriptors, where applicable. If possible, use one of the following cultivars:

1 Butler
2 Corabel
3 Ennis
4 Fertile de Coutard
5 Merveille de Bollwiller
6 Negret
7 Pauetet
8 Segorbe
9 Tombul
10 Tonda Gentile delle Langhe
11 Tonda di Giffoni
12 Tonda Gentile Romana
99 Other (specify in **6.10 Notes**)

6.7.2 Date of vegetative budbreak [YYYYMMDD]

When over 50% of terminal buds have enlarged and the bud scales have split exposing the green of the leaves inside.

6.7.3 Blooming reference standard

Indicate which cultivar has been used for the following descriptors where applicable. If possible, use one of the listed below. If not available, use the main local cultivar

		Reference cultivars
3	Early season	Tonda Gentile delle Langhe, Pauetet, Tonda di Giffoni
5	Mid season	Negret, Fertile de Coutard, Segorbe, Tombul
7	Late season	Ennis, Merveille de Bollwiller, Corabel
99	Other	(specify in **6.10 Notes**)

6.7.3.1 Days before (-) or after (+) reference standard

6.7.4 First male bloom date [YYYYMMDD]

When 5% of flowers are open.

6.7.5 Male peak bloom date [YYYYMMDD]

When 50% of flowers are open.

6.7.5.1 Days before (-) or after (+) reference standard

6.7.6 Last male bloom date [YYYYMMDD]

When last flowers open.

6.7.7 First female bloom date [YYYYMMDD]

When 5% of flowers are open.

6.7.8 Female peak bloom date [YYYYMMDD]

When 50% of flowers are open.

6.7.8.1 Days before (-) or after (+) reference standard

6.7.9 Last female bloom date [YYYYMMDD]

When last flowers open.

6.7.10 Dichogamy

This trait depends on the climatic conditions of the site.

		Reference cultivars
3	Protandrous	Butler, Corabel, Ennis, Fertile de Coutard, Negret, Pauetet, Segorbe, Tonda Gentile delle Langhe
5	Homogamous	Merveille de Bollwiller, Morell, Tombul
7	Protogynous	Istarski duguljasti, Tonda Gentile Romana

6.8 Yield descriptors

6.8.1 Years from sucker planting, graft or seed to first yield

Yield of at least 300 nuts/tree. Specify number of years (i.e. 4G indicates first yield produced 4 years after graft establishment).

6.8.1.1 Years before (-) or after (+) reference standard

6.8.2 Nut maturity date [YYYYMMDD]

Recorded when nuts start to drop from the tree.

6.8.2.1 Days before (-) or after (+) reference standard

6.8.3 Homogeneity of nut ripening

0 Not homogeneous
1 Scarcely homogeneous
2 Mid-homogeneous
3 Homogeneous
4 Very homogeneous

6.8.4 Nut falling

Observed at maturity.

		Reference cultivars
1	Free of the husk	Negret, San Giovanni, Tonda Gentile delle Langue
2	Not free of the husk	Impériale de Trébizonda, Istarski duguljasti, Tombul

6.8.5 Tendency to alternate bearing

Provide an indicative value of the tendency to alternate bearing of the cultivar (e.g. percentage of the production in an off-year compared with an on-year).

6.9 Defoliation descriptors

6.9.1 Beginning of defoliation [YYYYMMDD]

Record when trees begin to defoliate.

6.9.1.1 Days before (-) or after (+) reference standard

6.9.2 Defoliation date [YYYYMMDD]

When trees are completely defoliated.

6.9.2.1 Days before (-) or after (+) reference standard

6.10 Notes

Specify here any additional information.

EVALUATION

7. Plant descriptors

7.1 Chilling requirements of vegetative buds

Based on Mehlenbacher, 1991. Number of hours of temperatures below 7°C.

		Reference cultivars
1	Low (<800 h)	San Giovanni, Tombul, Tonda di Giffoni
2	Medium (800–1100 h)	Negret, Fertile de Coutard, Tonda Gentile delle Langhe
3	High (>1100 h)	Butler, Corabel, Ennis, Segorbe, Tonda Gentile Romana

7.2 Yield

7.2.1 Cropping efficiency [g/cm^2]

Nut yield per unit trunk cross-sectional area. Trunk measurement at 40 cm above soil level in a self-rooted tree or 20 cm above graft union in a grafted tree.

7.2.2 Estimated yield

Rate in relation to age and volume of tree.

0 None
3 Low
5 Intermediate
7 High

7.2.3 Alternate bearing

Estimated as percentage of inflorescence bud drop in 'on-years'.

1	Slight	<35%
2	Moderate	35%–65%
3	Significant	>65%

7.3 Kernel

7.3.1 Chemical composition

Moisture content not more than 7%.

7.3.1.1 Kernel protein content [%]

7.3.1.2 Kernel oil content [%]

7.3.1.3 Kernel ash content [%]

7.3.1.4 Soluble sugars [%]

7.3.1.5 Ratio between unsaturated and saturated fatty acids (or % unsaturated)

7.3.2 Storage quality

Evaluated three months after harvest.

7.3.2.1 Kernel rancidity potential [%]

Polyunsaturated fatty acids content. Oil stability (hours at 120ºC; Rancimat[3] method).

3 Low
5 Intermediate
7 High

7.3.2.2 Kernel bitterness

3 Weak
7 Strong

7.3.2.3 Kernel crispness

0 No
1 Yes

7.3.2.4 Kernel sweetness

0 No
1 Yes

7.3.2.5 Kernel firmness

0 No
1 Yes

7.4 Pollen

7.4.1 Normal pollen [%]

Incidence of normal grains (normal pollen grains are those round in shape with four pores, three visible at one time (see Fig. 14).

[3] Rancimat Method: AOCS Cd 12b-92. Oil Stability Index (OSI).

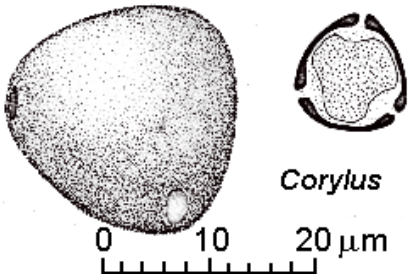

Fig. 14. Normal pollen.

7.4.2 Ratio of normal:aborted pollen grains [%]

Ratio of the percentages of normal pollen grains over those deformed or aborted.

7.4.3 Pollen vitality

Intensity of pollen grain colour after being stained with acetocarmine.

1 Scarcely coloured
2 Intensively coloured

7.4.4 Pollen fertility

Intensity of pollen grain colour after being stained with fluorescein.

1 Scarcely coloured
2 Intensively coloured

7.4.5 Pollen incompatibility alleles formula

Based on Mehlenbacher and Thompson, 1988.

7.5 Notes

Specify here any additional information

8. Abiotic stress susceptibility

Scored under artificial and/or natural conditions, which should be clearly specified. These are coded on a susceptibility scale from 1 to 9:

1 Very low or no visible sign of susceptibility
3 Low
5 Intermediate
7 High
9 Very high

8.1 Low temperature

8.1.1 Winter hardiness (Hummer et al., 1986)

8.1.2 Susceptibility to frost damage in spring

8.2 High temperature

8.2.1 Sunburn susceptibility of husk

8.2.2 Sunburn susceptibility of leaves

8.2.3 Sunburn susceptibility of trunk

8.3 Salinity

8.4 Mineral deficiency

1 Nitrogen
2 Phosphorus
3 Potassium
4 Boron
5 Zinc
6 Copper
99 Other (specify in **8.8 Notes**)

8.5 Mineral toxicity

1 Boron
2 Zinc
3 Chloride
4 Copper
5 Calcium
99 Other (specify in **8.8 Notes**)

8.6 Waterlogging

8.7 Drought

8.8 Notes

Specify here any additional information.

9. Biotic stress susceptibility

In each case, it is important to state the origin of the infestation or infection, i.e. natural, field inoculation, laboratory. Record such information in **9.10 Notes**. These are coded on a susceptibility scale from 1 to 9:

1 Very low or no visible sign of susceptibility
3 Low
5 Intermediate
7 High
9 Very high

Organisms marked with an asterisk (*) and in boldface are those found to be of major importance in recent literature, including AliNiazee (1996) and Toros and Hancıoglu (1997).

9.1 Stem- and trunk-feeding insects

	Causal organism	Common name
*9.1.1	***Oberea linearis***	**Long-horned beetle or twig borer**
*9.1.2	***Anisandrus [Xyleborus] dispar***	**Ambrosia beetle**
9.1.3	*Gypsonoma dealbana*	Twig borer
*9.1.4	***Parthenolecanium corni***	**Lecanium scale**
9.1.5	*Lepidosaphes ulmi*	Apple scale
9.1.6	*Eulecanium coryli*	Plum scale
9.1.7	*Archips rosana*	Rose tortricid moth
9.1.8	*Archips xylosteana*	Bud tortricid moth
9.1.9	*Zeuzera pyrina*	Hazel wood borer

9.2 Foliage-feeding insects and mites

*9.2.1	***Hyphantria cunea***	**Fall web-worm**
*9.2.2	***Parthenolecanium corni***	**Lecanium scale**
*9.2.3	***Myzocallis coryli***	**Filbert aphid**
*9.2.4	***Melolontha melolontha***	**Cockchafer beetle**
9.2.5	*Anoplus roboris*	Hazelnut weevil
*9.2.6	***Mikomyia coryli***	**Hazelnut gall midge**
9.2.7	*Leucoptera scitella*	Apple leaf miner
*9.2.8	***Lithocolletis corylifoliella***	**Leaf mining moth**
*9.2.9	***Stigmella [Nepticula] floslactella***	**Leaf miner**
*9.2.10	***Nepticula malella***	**Leaf miner**
9.2.11	*Corylobium avellanae*	Hazelnut aphid
9.2.12	*Tetranychus urticae*	Two-spotted spider mite
9.2.13	*Eotetranychus carpini carpini*	Tetranychid mite
9.2.14	*Tetranycopsis horridus*	Bryobiid mite
9.2.15	*Panonychus ulmi*	European red mite

9.3 Flower-feeding insects and mites

*9.3.1	***Phytoptus avellanae***	**Big bud mite**
9.3.2	*Pantilius tunicatus*	Catkin mirid

9.4 Fruit-feeding insects

*9.4.1	***Curculio nucum*** *[Balaninus nucum]*	**Hazelnut weevil**
9.4.2	*Palomena prasina*	Green shield bug
*9.4.3	***Mikomyia coryli***	**Hazelnut gall midge**
9.4.4	*Paralipsa gularis*	Pyralid storage pest
9.4.5	*Plodia interpunctella*	Indian meal moth
9.4.6	*Nezara viridula*	Pentatomid bug
9.4.7	*Gonocerus acuteangulatus*	Bug

9.5 Bud-feeding insects and mites

*9.5.1	***Cecidophyopsis vermiformis***	**Filbert bud mite**
*9.5.2	***Phytoptus avellanae***	**Big bud mite**
*9.5.3	***Gypsonoma dealbana***	**Borer**
9.5.4	*Anoplus roboris*	Hazelnut weevil
*9.5.5	***Aculus comatus***	**Eriophyid mite**

9.6 Nematodes

*9.6.1	***Cacopaurus pestis***	**Persian sessile nematode**
*9.6.2	***Criconemella xenoplax***	**Ring nematode**
9.6.3	*Longidorus* spp.	
9.6.4	*Meloidogyne* spp.	
9.6.5	*Pratylenchus vulnus*	Root-lesion nematode
9.6.6	*Xiphinema italiae*	
9.6.7	*Xiphinema mediterraneum*	

9.7 Fungi

9.7.1	*Sphaceloma coryli*	Anthracnose
*9.7.2	***Gloeosporium coryli***	**Anthracnose**
*9.7.3	***Anisogramma anomala***	**Eastern filbert blight**
9.7.4	*Phyllactinia suffulta*	Mildew
9.7.5	*Nectria galligena*	Apple canker
*9.7.6	***Phytophthora* spp.**	
9.7.7	*Armillaria mellea*	Root rot
*9.7.8	***Aspergillus flavus***	**(Aflatoxin)**
*9.7.9	***Cytospora corylicola***	**Canker**
9.7.10	*Phyllactinia guttata*	Powdery mildew
9.7.11	*Rosellina necatrix*	Root rot

9.8 Bacteria

*9.8.1	***Xanthomonas campestris* pv. *Corylina***	**Bacterial blight**
*9.8.2	***Pseudomonas avellanae***	**Decline**
9.8.3	*Agrobacterium tumefaciens*	Crown gall

9.9 Viruses, viroids and phytoplasmas

***9.9.1**	***Apple mosaic virus* (ApMV)**	***Ilarvirus***
9.9.2	*Prunus necrotic ringspot virus* (PNRSV)	*Ilarvirus*
9.9.3	*Tulare apple mosaic virus* (TAMV)	*Ilarvirus*
9.9.4	Hazelnut stunt phytoplasma	
9.9.5	Clover yellow edge phytoplasma	
9.9.6	Oregon hazelnut stunt syndrome	

9.10 Notes

Specify here any additional information

10. Biochemical markers

Refer to *Descriptors for Genetic Marker Technologies*, available in PDF (portable format document) from the Bioversity Web site (www.bioversityinternational.cgiar.org) or by e-mail request to: Bioversity-publications@cgiar.org

11. Molecular markers

Refer to *Descriptors for Genetic Marker Technologies*, available in PDF (portable format document) from the Bioversity Web site (www.bioversityinternational.org) or by E-mail request to: Bioversity-publications@cgiar.org

Primer sequences for amplification of SSR (simple sequence repeat) loci are available in Bassil et al. (2005) and Boccacci et al. (2005). The suggested set of SSR is: CaC-B020, CaC-B028, CaT-B107, CaT-B501, CaT-B502, CaT-B503, CaT-B504, CaT-B505, CaT-B507, CaT-B508

12. Cytological characters

12.1 Chromosome number

12.2 Ploidy level

(2x, 3x, 4x, etc.)

12.3 Meiosis chromosome associations

Average of 50 microspore mother cells, observed during metaphase 1.

12.4 Other cytological characters

13. Identified genes

Describe any known specific mutant present in the accession.

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ANNEX I. Collecting form for hazelnut (*Corylus avellana* L.)

SAMPLE IDENTIFICATION

COLLECTING INSTITUTE CODE (2.1):

COLLECTING No. (2.2): PHOTOGRAPH (2.19):

COLLECTING DATE OF SAMPLE [YYYYMMDD] (2.3):

GENUS (1.7.1): SPECIES (1.7.2):

COLLECTING SITE LOCATION

COUNTRY OF ORIGIN (2.4): PROVINCE/STATE (2.5):

DEPARTMENT/COUNTY (2.6): LOCATION (2.7): km: direction: from:

LATITUDE (2.8): LONGITUDE (2.9): ELEVATION (2.10): m asl

COLLECTING SITE ENVIRONMENT

COLLECTING/ACQUISITION SOURCE (2.11):
10. Wild habitat 20. Farm or cultivated habitat 30. Market or shop
40. Institute/research organization, experimental station, genebank 50. Seed company
60. Weedy, disturbed or ruderal habitat 99. Other (specify):

HIGHER-LEVEL LANDFORM (5.1.2):
1. Plain 2. Basin 3. Valley 4. Plateau
5. Upland 6. Hill 7. Mountain

SLOPE [°] (5.1.4): SLOPE ASPECT (5.1.4.1): (code N,S,E,W)

SOIL FERTILITY (5.1.20): (code: 3 - Low; 5 - Moderate; 7 - High)

SOIL TEXTURE CLASSES (5.1.17): State class (e.g. Clay, Loam, Silt)

SOIL TAXONOMIC CLASSIFICATION (5.1.18):

WATER AVAILABILITY (5.1.19):
1. Rainfed 2. Irrigated 3. Flooded 4. River bank 5. Sea coast
99. Other (specify):

RAINFALL (5.1.21.2): Annual mean: |___| mm

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Monthly mean (mm):	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|

TEMPERATURE (5.1.21.1): Annual mean: |___| °C

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Monthly mean (°C):	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|	|___|

SAMPLE

NUMBER OF TREES SAMPLED (2.17.1):

TYPE OF SAMPLE (2.14):
1. Vegetative (Budsticks, suckers) 2. Tissue culture 3. Seeds 4. Pollen

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BIOLOGICAL STATUS OF ACCESSION (2.15):

100. Wild 200. Weedy 300. Traditional cultivar/Landrace
400. Breeding/research material 500. Advanced/improved cultivar 999. Other (specify):

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ETHNOBOTANICAL DATA

LOCAL/VERNACULAR NAME (2.16.2):

LOCAL LANGUAGE (2.16.2.1):

ETHNIC GROUP (2.16.1):

USE OF SAMPLES COLLECTED (2.16.3)

1. Nut production 2. Clonal rootstock 3. Seedling rootstock 4. Pollinator
5. Ornamental 6. Medicinal 7. Wood/timber 99. Other (specify):

PREVAILING STRESSES (2.16.4):

Mention the types of major stresses, i.e. abiotic (drought, flood, etc.), biotic (pests, diseases, etc.)

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ORCHARD MANAGEMENT

ACCESSION No. (3.1)

TYPE OF GERMPLASM STORAGE (3.10)

10. Seed collection 20. Field collection 30. *In vitro* collection 40. Cryopreserved collection
99. Other (specify)

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CHARACTERIZATION

LEAF DESCRIPTORS (6.3)

Leaf length [cm] (6.3.1): Leaf width [cm] (6.3.2):

INFLORESCENCE (6.5)

Flowering precocity (6.5.1):

NUT AND KERNEL (6.6)

Nut length [mm] (6.6.9): Nut width [mm] (6.6.10):
Nut thickness [mm] (6.6.11): Nut shape (6.6.12):
Nut apex shape (6.6.16): Blank production (6.6.22):
Estimated yield (7.2.2):

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COLLECTOR'S NOTES

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