Bioversity International

Descriptors for

Tree tomato

and wild relatives

COMAV

Departamento de Ciencias Agropecuarias y de Alimentos

List of Descriptors

Allium (E/S)	2000
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
Capsicum * (E/S)	1995
Cardamom (E)	1994
Carrot (E/S/F)	1999
Cashew * (E)	1986
Chenopodium pallidicaule (S)	2005
Cherimoya (E/S)	2008
Cherry * (E)	1985
Chickpea (E)	1993
Citrus (E/F/S)	1999
Coconut (E)	1992
Coffee (E/S/F)	1996
Cotton * (Revised) (E)	1985
Cowpea * (E)	1983
Cultivated potato * (E)	1977
Date palm (F)	2005
Echinochloa Millet * (E)	1983
Eggplant (E/F)	1990
Faba bean * (E)	1985
Fig (E)	2003
Finger millet * (E)	1985
Forage grass * (E)	1985
Forage legumes * (E)	1984
Grapevine (E/S/F)	1997
Groundnut (E/S/F)	1992
Hazelnut (E)	2008
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
Palmier dattier (F)	2005
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
Pistacia (excluding *P. vera*) (E)	1998
Pistachio (E/F/A/R)	1997
Plum * (E)	1985
Potato varieties * (E)	1985
Quinua * (S)	1981
Rambutan (E)	2003
Rice * (E/P)	2007
Rocket (E/I)	1999
Rye and *Triticale* * (E)	1985
Safflower * (E)	1983
Sesame * (E)	2004
Setaria italica and *S. pumila* (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 * (E)	1980
Ulluco (S)	2003
Vigna aconitifolia and *V. trilobata* (E)	1985
Vigna mungo and *V. radiata* (Revised) * (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

Tree tomato
and wild relatives

Bioversity International is a world leading research-for-development non-profit organization, working towards a world in which smallholder farming communities in developing countries are thriving and sustainable. Bioversity International's purpose is to investigate the use and conservation of agricultural biodiversity in order to achieve better nutrition, improve smallholders' livelihoods and enhance agricultural sustainability. Bioversity International works with a global range of partners to maximize impact, to develop capacity and to ensure that all stakeholders have an effective voice.

Bioversity International is a member of the CGIAR Consortium. CGIAR is a global research partnership that unites organizations engaged in research for sustainable development. CGIAR research is dedicated to reducing rural poverty, increasing food security, improving human health and nutrition, and ensuring more sustainable management of natural resources. It is carried out by the 15 centres who are members of the CGIAR Consortium in close collaboration with hundreds of partner organizations, including national and regional research institutes, civil society organizations, academia, and the private sector.

The Departamento de Ciencias Agropecuarias y de Alimentos is an educational and research centre of the Universidad Técnica Particular de Loja, Ecuador (UTPL). Its main research objective is to contribute to the improvement of agricultural and food production and natural resource conservation through applied research including management and conservation of phytogenetic resources.

The Instituto de Conservación y Mejora de la Agrodiversidad Valenciana (COMAV) was established in 1999 as a multidisciplinary research centre of the Universidad Politécnica de Valencia (UPV). Its objectives are the recovery, conservation and utilization of plant genetic resources in order to broaden the genetic base of vegetable crops production, to contribute to a more sustainable agriculture and to preserve the associated cultural heritage. Its research focuses on *Solanaceae* and *Cucurbitaceae* vegetable crops.

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CONTENTS

PREFACE

The '**Descriptors for tree tomato (*Solanum betaceum* Cav.) and wild relatives**' were developed by Dr. Pablo Geovanny Acosta-Quezada, Eng. Tania Elizabeth Riofrío-Cuenca, Prof. Dr. Juan Bautista Martínez-Laborde, and Prof. Dr. Jaime Prohens. They have been produced as an output of the PhD research work of Dr. Acosta-Quezada[1] (2011) and subsequent investigations on the diversity of tree tomato by the authors. Information on wild species characteristics for the elaboration of the descriptors has been mostly based on the personal experience of the authors and the research findings of L. Bohs (1994). The draft document was enriched with valuable research inputs from Drs. Clara Ines Medina Cano and Mario Lobo Arias (Medina and Lobo, 2006) from CORPOICA, Colombia. The scientific overview of this document was provided by Dr. Stefano Padulosi, and the technical advice by Adriana Alercia from Bioversity.

A draft version prepared in the Bioversity internationally accepted format for descriptor lists was circulated among a number of international experts for their comments. A full list of the names and addresses of those involved in the production of this publication 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 the Descriptors), whereby data from the first four categories—*Passport*, *Management*, *Environment and Site*, and *Characterization*—should be made 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 repeated trials over a period of time.

Although the suggested coding should not be regarded as the definitive scheme, this format represents an important tool for a standardized characterization system and 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 use 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 it contains. This approach assists with the standardization of descriptor definitions. Bioversity does not, however, assume that curators will characterize accessions of their collection using all descriptors given. Descriptors should be used when they are useful to curators for the management and maintenance of the collection or to the users of plant genetic resources, or both. To this end, highly discriminating descriptors are listed at the beginning of the *Characterization* section and are highlighted in the text to facilitate selection of descriptors.

[1] Morphological and molecular characterization of tree tomato, *Solanum betaceum* Cav. (Solanaceae)

The 'List of Multi-crop Passport Descriptors' (FAO/Bioversity, 2012) 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 multicrop passport descriptors, not all descriptor states for a particular descriptor will be relevant to a specific crop.

A 'List of synonymies between *Solanum* and *Cyphomandra* names' is given in Annex I. In Annex II, the reader will find a 'Collecting form for tree tomato' that will facilitate data collection.

Any suggestions for improvement of the 'Descriptors for tree tomato and wild relatives' will be highly appreciated by Bioversity[2], Departamento de Ciencias Agropecuarias y de Alimentos, and COMAV.

2 Contact: Adriana Alercia at a.alercia@cgiar.org

INTRODUCTION

The tree tomato or tamarillo (*Solanum betaceum* Cav.) is a neglected Andean crop (Sánchez-Vega, 1992), which nonetheless is quite popular in local markets of South America especially for being consumed in juices and as a fresh fruit. This crop represents an important alternative for diversification of fruit production both in its region of origin and also in other areas of the world. In this respect, important efforts have been made for the development of the crop in Colombia, Ecuador and New Zealand, where production and exports have increased markedly in the last decades (Bohs, 1994; Espinal *et al*., 2005; Acosta-Quezada, 2011; Scotsmans *et al*., 2011). In addition, it is considered as a promising crop for some regions characterized by a Mediterranean climate (Prohens & Nuez, 2000).

The tree tomato is native to the subtropical Andes and is only known in a cultivated state; it is believed that its domestication and cultivation predate the discovery of the Americas (Bohs, 1989; Sánchez-Vega, 1992). Regarding its area of origin, Bohs (1991) and Bohs & Nelson (1997) suggest that *S. betaceum* could be native to Bolivia, as *S. betaceum* is closely related to *S. unilobum*, *S. roseum*, and in particular to *S. maternum*, all of which are found in Bolivia in wild status (Bohs, 1994, 1995; Lester & Hawkes, 2001; Bohs & Nelson, 1997). Little information is available on the domestication of the tree tomato, and at present it is unknown when and where this process took place. In any case, representations of the tree tomato plant on pottery discovered in Peru (Towle, 1961) correspond only to modern pre-Columbian cultures, which may suggest a relatively recent domestication of this crop.

The tree tomato is related to a group of species that were included in the former genus *Cyphomandra* (see Annex I for synonymies). However, on the basis of morphological and molecular evidence, the species in genus *Cyphomandra* were transferred to the genus *Solanum*, subgenus *Bassovia* (D'Arcy, 1991; Bohs, 1994; Bohs, 1995). Nowadays, the *Solanum* names are used by the scientific community to refer to the tree tomato and wild relatives.

Apart from the cultigen, some of the wild species of the *Cyphomandra* group, such as *S. circinatum*, *S. sibundoyense* and *S. cajanumanse*, produce edible fruits, which are harvested on occasion from the wild. Other wild species of this group are used for medicines and dyes. This indicates that this group of plants has a great potential for several purposes, which should be explored (Bohs, 1989).

The study of the tree tomato and wild relatives is very important for the conservation of plant genetic resources, for their use and, in the case of the tree tomato, for its genetic improvement (Acosta-Quezada *et al*., 2011). In this regard, the descriptors for tree tomato and related species of the *Cyphomandra* group reported in this work follow the international standardized documentation system for the characterization and study of the genetic resources as promoted by Bioversity (Bioversity International, 2007; Gotor *et al*., 2008).

This work is expected to contribute to studies focusing on the analysis of genetic diversity, germplasm management, the definition of new varieties, and the search for markers of agronomic traits for crop management and improvement, besides being aimed at the common goal of enhancing the use and conservation of plant genetic resources (González-Andrés 2001; Engels & Visser, 2003, Colin *et al*., 2010)

Different common names can be found in literature, depending on the language. The most common are the following:

Dutch	boomtomaat
English	tamarillo, tree tomato
French	tomate d'arbre
German	Baumtomate
Indonesian	Térong blanda
Italian	pomodoro arboreo
Portuguese	tomate de érvore, tomate francês
Spanish	tomate de árbol, tomate de ají, lima tomate, pepino de árbol, tomate de palo, tomate extranjero, tamarillo, sachatomate, chilto, tomate andino.

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 when characterization and evaluation trials are held. 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 the 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 and are listed at the beginning of the *Characterization* section.

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

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

(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, Methuen Handbook of Colour, or Munsell Color Chart for Plant Tissues, are strongly recommended for all ungraded 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		

is the expression of a character. 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 10 (*Biotic stress susceptibility*), 1 = very low susceptibility and 9 = very high susceptibility;

(f) when a descriptor is scored using a scale, such as in (e), '0' would be scored when (i) the character is not expressed; (ii) a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have leaf hairs:

Leaf hairiness
Observed on abaxial side

0	Absent (glabrous)
1	Puberulent
2	Pubescent
3	Pilose
4	Tomentose

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

Presence of stone cell aggregates in mesocarp

0	Absent
1	Present

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

(i) for accessions which 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;

(j) Dates should be recorded numerically as YYYYMMDD, where

YYYY	4 digits to represent the year
MM	2 digits to represent the month
DD	2 digits to represent the day

If the month or days are missing, this should be indicated with hyphens or '00' [double zero]. (e.g. 1975----, 19750000; 197506--, 19750600).

PASSPORT

All descriptors listed under Passport, belonging to the multicrop passport descriptors category, are indicated in the text as [MCPD]

1. Accession descriptors

1.1 Institute code [MCPD]

FAO WIEWS code of the institute where the accession is maintained. The codes consist of the 3-letter ISO 3166 country code of the country where the institute is located, plus a number. The current set of institute codes is available from http://apps3.fao.org/wiews/wiews.jsp

1.2 Accession number [MCPD]

This number serves as a unique identifier for accessions within a genebank, 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 in Wageningen, the Netherlands; PI indicates an accession within the USA system)

1.3 Donor institute code [MCPD]

FAO WIEWS code of the donor institute. (See instructions under *Institute code*, **1.1**)

1.3.1 Donor institute name

Name of the donor institute (or person). This descriptor should be used only if DONORCODE cannot be filled because the FAO WIEWS code for this institute is not available.

1.4 Donor accession number [MCPD]

Identifier assigned to an accession by the donor. (See instructions under *Accession number*, **1.2**)

1.5 Other identifiers associated with the accession [MCPD]

Any other identifiers known to exist in other collections for this accession. Use the following format: INSTCODE:ACCENUMB;INSTCODE:identifier;… INSTCODE and identifier are separated by a colon without space. Pairs of INSTCODE and identifier are separated by a semicolon without space. When the institute is not known, the identifier should be preceded by a colon.

1.6 Genus [MCPD]

Genus name for taxon. Initial uppercase letter required

1.7 Species [MCPD]

Specific epithet portion of the scientific name in lowercase letters. Only the following abbreviation is allowed: 'sp.'

1.7.1 Species authority [MCPD]

Provide the authority for the species name

1.8 Subtaxon [MCPD]

Subtaxon can be used to store any additional taxonomic identifier. The following abbreviations are allowed: 'subsp.' (for subspecies); 'convar.' (for convariety); 'var.' (for variety); 'f.' (for form); 'Group' (for 'cultivar group')

1.8.1 Subtaxon authority [MCPD]

Provide the subtaxon authority at the most detailed taxonomic level

1.9 Ancestral data [MCPD]

Information about either pedigree or other description of ancestral information (i.e. parent variety in the case of mutant or selection)

1.10 Accession

1.10.1 Accession name [MCPD]

Either a registered or other designation given to the material received other than the *Donor accession number*, **1.4** or *Collecting number*, **2.2**. First letter uppercase. Multiple names are separated by a semicolon without space. Example: Accession name: Bogatyr;Symphony;Emma.

1.10.2 Synonyms

Include here any names other than the current one. Newly assigned station names are frequently used as synonyms

1.10.3 Common crop name [MCPD]

Common name of the crop. Example: 'malting barley', 'macadamia', 'maïs'.

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 or double zero.

1.12 Remarks

The *Remarks* 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]

FAO WIEWS code of the institute(s) collecting the sample. If the holding institute has collected the material, the collecting institute code should be the same as the holding institute code. Multiple values are separated by a semicolon without space. (See instructions under *Institute code*, **1.1**)

2.1.1 Collecting institute name [MCPD]

Name of the institute collecting the sample. This descriptor should be used only if *Collecting institute code* cannot be filled because the FAO WIEWS code for this institute is not available. Multiple values are separated by a semicolon without space

2.1.1.1 Collecting institute address [MCPD]

Address of the institute collecting the sample. This descriptor should be used only if *Collecting institute code* cannot be filled since the FAO WIEWS code for this institute is not available. Multiple values are separated by a semicolon without space.

2.2 Collecting number [MCPD]

Original identifier assigned by the collector(s) of the sample, normally composed of the name or initials of the collector(s) followed by a number (e.g. 'FM9909'). This identifier 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 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 or double zero [00]

2.4 Collecting mission identifier [MCPD]

Identifier of the collecting mission used by the *Collecting institute* **2.1** or **2.1.1** (e.g. 'CIATFOR-052', 'CN426').

2.5 Country of origin [MCPD]

Three-letter ISO 3166-1 code of the country in which the sample was originally collected (e.g. landrace, crop wild relative, farmers' variety), bred or selected (breeding lines, GMOs, segregating populations, hybrids, modern cultivars, etc.).

2.6 Breeding institute code [MCPD]

FAO WIEWS 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. Follow the *Institute code* **1.1** standard. Multiple values are separated by a semicolon without space.

2.6.1 Breeding institute name [MCPD]

Name of the institute (or person) that bred the material. This descriptor should be used only if BREDCODE cannot be filled because the FAO WIEWS code for this institute is not available. Multiple names are separated by a semicolon without space.

2.7 Location of collecting site [MCPD]

Location information below the country level that describes where the accession was collected, preferably in English. 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)

Geographical coordinates

- For latitude and longitude descriptors, two alternative formats are proposed, but the one reported by the collecting mission should be used

- Latitude and longitude in decimal degree format with a precision of four decimal places corresponds to approximately 10 m at the Equator and describes the point-radius representation of the location, along with geodetic datum and coordinate uncertainty in metres.

The following two mutually exclusive formats can be used for latitude and longitude:

2.8 Latitude of collecting site [DDMMSSH] [MCPD]

Degrees (2 digits), minutes (2 digits) and seconds (2 digits) followed by N (North) or S (South) (e.g. 103020S). Every missing digit (minutes or seconds) should be indicated with a hyphen. Leading zeros are required (e.g. 10----S; 011530N; 4531--S)

2.8a Latitude of collecting site [-/+DD.DDDD] [MCPD]

Latitude expressed in decimal degrees. Positive values are North of the Equator; negative values are South of the Equator (e.g. -44.6975)

2.9 Longitude of collecting site [DDDMMSSH] [MCPD]

Degrees (3 digits), minutes (2 digits) and seconds (2 digits) followed by E (East) or W (West) (e.g. 0762510W). Every missing digit (minutes or seconds) should be indicated with a hyphen. Leading zeros are required (e.g. 076 ----W)

2.9a Longitude of collecting site [-/+DDD.DDDD] [MCPD]
Longitude expressed in decimal degrees. Positive values are East of the Greenwich Meridian; negative values are West of the Greenwich Meridian (e.g. +120.9123).

2.10 Coordinate uncertainty [m] [MCPD]
Uncertainty associated with the coordinates in metres. Leave the value empty if the uncertainty is unknown.

2.11 Coordinate datum [MCPD]
The geodetic datum or spatial reference system upon which the coordinates given in decimal latitude and decimal longitude are based (e.g. WGS84, ETRS89, NAD83). The GPS uses the WGS84 datum.

2.12 Georeferencing method [MCPD]
The georeferencing method used (GPS, determined from map, gazetteer, or estimated using software). Leave the value empty if georeferencing method is not known.

2.13 Elevation of collecting site [m asl] [MCPD]
Elevation of collecting site expressed in metres above sea level. Negative values are allowed.

2.14 Collecting /acquisition source [MCPD]
The coding scheme proposed can be used at 2 different levels of detail: either by using the general codes (in **boldface**) such as 10, 20, 30, 40, etc., or by using the more specific codes, such as 11, 12, etc.

10 Wild habitat
- 11 Forest or woodland
- 12 Shrubland
- 13 Grassland
- 14 Desert or tundra
- 15 Acquatic habitat

20 Farm or cultivated area
- 21 Field
- 22 Orchard
- 23 Backyard, kitchen or home garden (urban, periurban or rural)
- 24 Fallow land
- 25 Pasture
- 26 Farm store
- 27 Threshing floor
- 28 Park

30 Market or shop

40 Institute, Experimental station, Research organization, Genebank

50 Seed company

60 Weedy, disturbed or ruderal habitat
- 61 Roadside
- 62 Field margin

99 Other (elaborate in descriptor **2.25 Remarks**)

2.15 Biological status of accession [MCPD]

The coding scheme proposed can be used at 3 different levels of detail: either by using the general codes (in **boldface**) such as 100, 200, 300, 400, or by using the more specific codes such as 110, 120, etc.

100 Wild
- 110 Natural
- 120 Semi-natural/wild
- 130 Semi-natural/sown

200 Weedy

300 Traditional cultivar/landrace

400 Breeding/research material
- 410 Breeder's line
  - 411 Synthetic population
  - 412 Hybrid
  - 413 Founder stock/base population
  - 414 Inbred line (parent of hybrid cultivar)
  - 415 Segregating population
  - 416 Clonal selection
- 420 Genetic stock
  - 421 Mutant (e.g. induced/insertion mutants, tilling populations)
  - 422 Cytogenetic stocks (e.g. chromosome addition/substitution, aneuploids, amphiploids)
  - 423 Other genetic stocks (e.g. mapping populations)

500 Advanced/improved cultivar (conventional breeding methods)

600 GMO (by genetic engineering)

999 Other (elaborate in descriptor **2.25 Remarks**)

2.16 Collecting source environment

Use descriptors **6.1** to **6.2** in section **6**

2.17 Type of sample

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

- 1 Vegetative
- 2 Seed
- 99 Other (specify which part of the plant in descriptor **2.25 Remarks**)

2.18 Number of plants sampled
Appropriate number of plants collected in the field to produce this accession

2.19 Number of seeds collected

2.20 General appearance of population
Provide a subjective assessment of the general appearance of the population

3 Poor
5 Medium
7 Good

2.21 Population isolation [km]
Straight line distance between two adjacent collecting sites

2.22 Ethnobotanical data
Information on traditional attributes of the sample in place for collecting runs (community): uses, methods of preparation, native names, healing properties, cultural beliefs and other characteristics.

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

2.22.2 Local vernacular name
Name given by farmer to crop and cultivar/landrace/clone/wild form. State local language or dialect if the ethnic group is not provided

2.22.2.1 Translation
Provide translation of the local name into English, if possible

2.22.3 History of plant use
1 Ancestral/indigenous (always associated with the place and community)
2 Introduced (but in unknown distant past)
3 Introduced (time of introduction known)

2.22.4 Parts of the plant used
1 Fruit
2 Seed
3 Leaf
99 Other (specify in descriptor **2.25 Remarks**)

2.22.5 Plant use

1 Fresh fruit
2 Juice
3 Dessert fruit
4 Salad
5 Cooked
6 Medicinal
7 Industrial
99 Other (specify in descriptor **2.25 Remarks**)

2.22.6 Cultural characteristics

Is there any folklore associated with the collected *Solanum* species (e.g. taboos, stories and/or superstitions)? If so, describe it briefly in descriptor **2.25 Remarks**

0 No
1 Yes

2.22.7 Prevailing stresses

Information on main associated biotic (pests and diseases) and abiotic (drought, salinity, temperature) stresses

2.22.8 Cultural practices

2.22.8.1 Sowing date [YYYYMMDD]

2.22.8.2 First harvest date [YYYYMMDD]

2.22.8.3 Last harvest date [YYYYMMDD]

2.22.9 Cropping system

1 Monoculture
2 Intercropped (specify other crops in descriptor **2.25 Remarks**)

2.22.10 Mode of reproduction

1 Vegetative
2 Seed
3 Both

2.22.11 Associated flora

Other dominant crop/or wild plant species, including other *Solanum* species, found in and around the collecting site

2.22.12 Seasonality

1 Available only in season/at particular period
2 Available throughout the year

2.23 Photograph

Was a photograph(s) taken of the sample or habitat at the time of collecting? If so, provide an identification number(s) in the descriptor **2.25 Remarks**

0 No
1 Yes

2.24 Herbarium specimen

Was a herbarium specimen collected? If so, provide an identification number in descriptor **2.25 Remarks** and indicate in which place (herbarium) the tree tomato specimen was deposited

0 No
1 Yes

2.25 Remarks

Specify here any additional information recorded by the collector or any specific information on descriptors with value "99" or "999" (=Other)

MANAGEMENT

3. Management descriptors

3.1 Accession number [Passport 1.2]

3.2 Population identification [Passport 2.2]

Collecting number pedigree, cultivar name etc., depending on the population type

3.3 Storage address

Building, room, shelf number/location in medium-term and/or long-term storage

3.4 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/IPGRI Genebank Standards 1994 for details on storage type)

10 Seed collection
- 11 Short term
- 12 Medium term
- 13 Long term

20 Field collection

30 *In vitro* collection

40 Cryopreserved collection

50 DNA collection

99 Other (elaborate in **3.17 Remarks**)

3.5 Accession size

Approximate number or weight of seeds, cuttings, or plants of an accession in the genebank

3.6 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 or 00 [double zero]

3.7 Location of safety duplicates [MCPD]

FAO WIEWS code of the institute(s) where a safety duplicate of the accession is maintained. Multiple values are separated by a semicolon without space. It follows **1.1** *Institute code*

3.7a Institute maintaining safety duplicates [MCPD]
Name of the institute where a safety duplicate of the accession is maintained. This descriptor should be used only if INSTCODE cannot be filled because the FAO WIEWS code for this institute is not available. Multiple values are separated by a semicolon without space.

3.8 MLS status of the accession [MCPD]
The status of an accession with regard to the Multilateral System (MLS) of the International Treaty on Plant Genetic Resources for Food and Agriculture. Leave the value empty if the status is not known

0 No (not included)
1 Yes (included)
99 Other (elaborate in Remarks field, e.g. 'under development')

3.9 Storage date [YYYYMMDD]

3.10 Seed germination at storage [%]

3.11 Date of last seed germination test [YYYYMMDD]

3.12 Seed germination at the last test [%]

3.13 Date of last regeneration [YYYYMMDD]

3.14 Date of next seed germination test [YYYYMMDD]
(Estimate)

3.15 Date of next regeneration [YYYYMMDD]
(Estimate)

3.16 Seed moisture content at harvest [%]

3.17 Seed moisture content at storage (initial) [%]

3.18 Remarks
Any additional information may be specified here

4. Multiplication/regeneration descriptors

4.1 Accession number [Passport 1.2]

4.2 Population identification [Passport 2.2]
Collecting number, pedigree, cultivar name, etc., depending on the population type

4.3 Field plot number

4.4 Collaborator(s) name
Name(s) and address(es) of the person(s) in charge of the multiplication/regeneration

4.5 Propagation
1 Seed
2 Vegetative (cuttings)
3 Vegetative (*in vitro* culture)

4.6 Substrate/medium for propagation
Indicate the substrate or *in vitro* growing medium used for propagation

4.7 Percentage of seed germination [%]

4.8 Percentage of cuttings/explants rooting and giving plantlets [%]
For vegetatively reproduced accessions

4.9 Number of plants used as seed/cuttings/explants source for each regeneration

4.10 Cultural practices

4.10.1 Sowing or vegetative propagation date [YYYYMMDD]

4.10.2 Transplanting date [YYYYMMDD]

4.10.3 Harvest date [YYYYMMDD]

4.10.4 Irrigation
Specify frequency

4.10.5 Pruning date
Specify frequency

4.10.6 Mounding
Specify frequency

4.10.7 Field spacing

4.10.7.1 Distance between plants in a row [m]

4.10.7.2 Distance between rows [m]

4.10.8 Fertilizer application [g/m2]

Indicate the type of fertilizer used and the number of applications made

4.11 Type of plant training

1 Untrained
2 Trained but not pruned
3 Trained and pruned
99 Other (specify in descriptor **4.19 Remarks**)

4.12 Breeding method

(Clonal)
1 Vegetative propagation
(Self)
2 Bulk
3 Mass selection
4 Pedigree selection
5 Single seed descent
(Outcrossing)
6 Bulk
7 Mass selection
8 Selection with progeny testing
9 Recurrent selection
(Combination)
99 Other (specify in descriptor **4.19 Remarks**)

4.13 Type of pollination

1 Artificial
2 Natural
3 Both

4.14 Pollination method

1 Self-pollinated
2 Mixed
3 Cross-pollinated

4.15 Pollen viability

Estimated using pollen viability tests (e.g. X-Gal test, MTT enzymatic test, acetocarmine stainability test, etc.)

3 Low
5 Intermediate
7 High

4.16 Previous multiplication and/or regeneration

4.16.1 Location

4.16.2 Transplanting/*in vitro* culture date [YYYYMMDD]

4.17 Date of last regeneration or multiplication [YYYYMMDD]

4.18 Number of times accession regenerated

Since the date of acquisition

4.19 Remarks

Any additional information may be specified here

ENVIRONMENT AND SITE

5. Characterization and/or evaluation site descriptors

5.1 Country of characterization and/or evaluation
(See instructions in descriptor **2.5 Country of origin**)

5.2 Site (research institute)

5.2.1 Latitude
(See format under **2.8/2.8a**)

5.2.2 Longitude
(See format under **2.9/2.9a**)

5.2.3 Elevation [m asl]

5.2.4 Name of farm or institute

5.2.5 Planting site in the field
Give block, strip and/or row/plot numbers as applicable, plants/plot, replication

5.3 Evaluator's name and address

5.4 Sowing date [YYYYMMDD]

5.5 Transplanting date [YYYYMMDD]

5.6 Harvest date [YYYYMMDD]

5.7 Evaluation environment
Environment in which characterization/evaluation was carried out

1 Field
2 Screenhouse
3 Greenhouse
4 Laboratory
99 Other (specify in descriptor **5.9 Remarks**)

5.8 Environmental characteristics of site
Use descriptors **6.1.1** to **6.2** in section **6**

5.9 Remarks
Any other site-specific information

6. Collecting and/or characterization/evaluation site environment descriptors

6.1 Site environment

6.1.1 Topography

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

1	Flat	0–0.5%
2	Almost flat	0.6–2.9%
3	Gently undulating	3–5.9%
4	Undulating	6–10.9%
5	Rolling	11–15.9%
6	Hilly	16–30%
7	Steeply dissected	>30%, moderate elevation range
8	Mountainous	>30%, great elevation range (>300 m)
99	Other (specify in descriptor **6.2 Remarks**)	

6.1.2 Higher level landform (general physiographic features)

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

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

6.1.3 Land element and position

Description of the geomorphology of the immediate surroundings of the site (adapted from FAO 1990). (See Fig. 1)

1	Plain level	17	Interdunal depression
2	Escarpment	18	Mangrove
3	Interfluve	19	Upper slope
4	Valley	20	Midslope
5	Valley floor	21	Lower slope
6	Channel	22	Ridge
7	Levee	23	Beach
8	Terrace	24	Beachridge
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	29	Coral reef
14	Closed depression	99	Other (specify in appropriate section's Notes)
15	Dune		
16	Longitudinal dune		

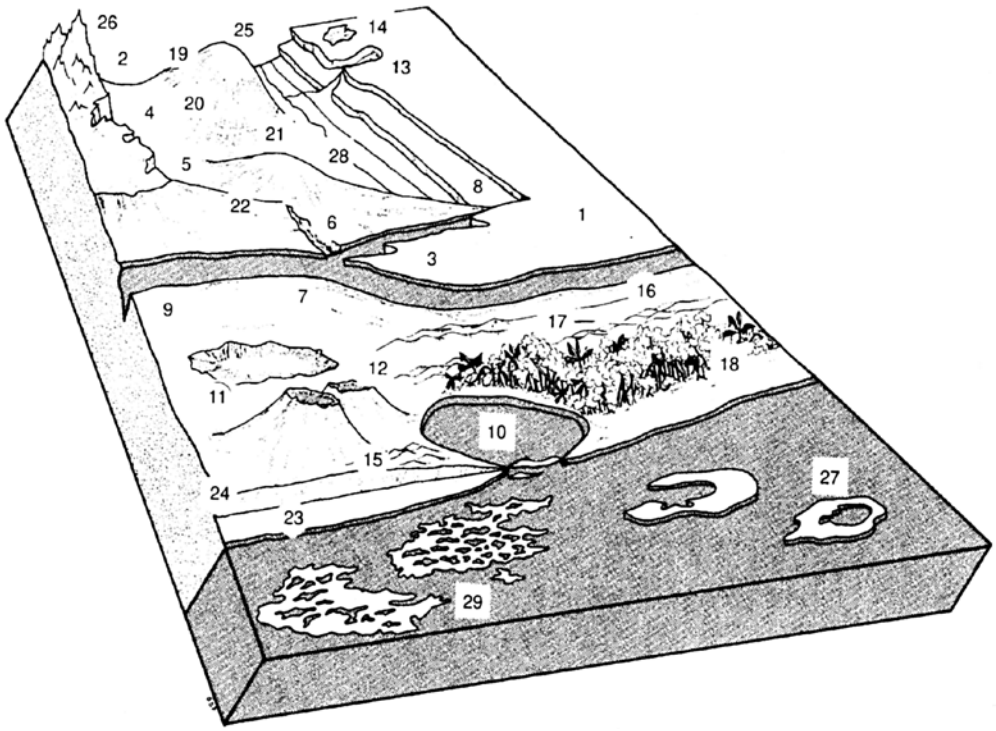

Fig. 1. Land element and position

6.1.4 Slope [°]

Estimated slope of the site

6.1.5 Slope aspect

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

6.1.6 Crop agriculture

(From FAO, 2006)

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

6.1.7 Overall vegetation surrounding and at the site

(Adapted from FAO, 2006)

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, understory may be present)
40 Scrubland
50 Dwarf shrubs
99 Other (specify in appropriate descriptor **Remarks**)

6.1.8 Soil drainage

(Adapted from FAO, 2006)

3 Poorly drained
5 Moderately drained
7 Well drained

6.1.9 Soil matrix colour

(Adapted from FAO, 2006)

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

6.1.10 Soil texture classes

(Adapted from FAO, 2006). 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
  10.1 Fine sandy loam
  10.2 Coarse sandy loam
11 Loamy sand
  11.1 Loamy very fine sand
  11.2 Loamy fine sand
  11.3 Loamy coarse sand
12 Sand (unspecified)
  12.1 Very fine sand
  12.2 Fine sand
  12.3 Medium sand
  12.4 Coarse sand

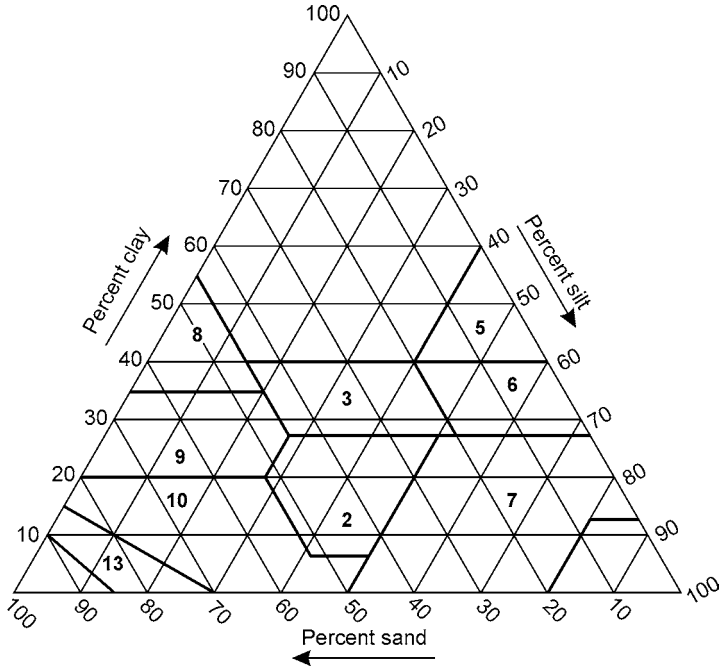

Fig. 2. Soil texture classes (adapted from FAO, 2006)

6.1.11 Soil organic matter content

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

6.1.12 Water availability

1 Rainfed
2 Irrigated
3 Flooded
4 River banks
5 Sea coast
99 Other (specify in appropriate descriptor **Remarks**)

6.1.13 Soil fertility

General assessment of the soil fertility based on existing vegetation

3 Low
5 Moderate
7 High

6.1.14 Climate of the site

Should be assessed as close to the site as possible

6.1.14.1 Temperature [°C]

Provide either the monthly or the annual mean

6.1.14.1.1 Number of recorded years

6.1.14.2 Duration of the dry season [d]

6.1.14.3 Rainfall [mm]

Provide either the monthly or the annual mean (state number of recorded years)

6.1.14.3.1 Number of recorded years

6.2 Remarks

Provide here any additional information related to the site (i.e. if data collected refers to collecting or to characterization/evaluation sites)

CHARACTERIZATION

7. Plant descriptors

Records should be taken from five plants at least, when fruit ripening is at its peak. Young individuals are considered those being one year old and mature individuals those being 4-6 years old. To ensure consistent recording of colour states, the use of a standard colour chart is recommended. The Royal Horticultural Society (RHS) Colour Chart codes are provided in parentheses besides descriptors colour states.

List of minimum discriminating descriptors for tree tomato

Number	Name
7.1.1	Plant height
7.2.2	Type of leaves in the crown
7.2.6	Leaf blade shape
7.2.8	Leaf base shape
7.2.12	Leaf central vein length
7.2.15	Leaf maximum width
7.3.2	Inflorescence length
7.3.5	Number of flowers per inflorescence
7.3.9	Corolla diameter
7.3.10	Corolla shape
7.3.11	Corolla colour
7.4.2	Number of fruits per infructescence
7.4.4	Mature fruit colour
7.4.5	Stripes in the mature fruit
7.4.6	Fruit shape
7.4.7	Fruit apex shape
7.4.9	Fruit length
7.4.10	Fruit width
7.4.14	Fruit weight
7.4.16	Fruit mesocarp colour
7.4.17	Seed-mucilage colour

7.1 Tree

7.1.1 **Plant height** [m]

Measured from ground level to tree top in mature individuals

1	Short	(≤ 3.0)
2	Intermediate	(3.1 – 4.5)
3	Tall	(4.6 – 6.0)
4	Very tall	(> 6.0)

7.1.2 **Stem length** [cm]

Measured from the stem base to first branching in mature individuals

7.1.3 **Stem diameter** [cm]

Measured at 30 cm above ground level in mature individuals

7.1.4 **Stem internode length** [cm]

Measure length between the first and second nodes in young individuals

7.1.5 **Tree crown diameter** [cm]

Measure the crown diameter of the horizontal projection on the ground in mature individuals

7.1.6 **Stem ramification**

Measured in mature individuals

3	Low
5	Intermediate
7	High

7.1.7 **Angle of branches with stem**

Measured in the basal crown branches of mature individuals

1	Acute
2	Obtuse

7.1.8 **Foliage density**

Measured in mature individuals

3	Sparse
5	Intermediate
7	Dense

7.2 Leaf descriptors

Unless otherwise indicated, evaluated in full sized crown leaves of mature individuals

7.2.1 Type of leaves in the stem

Predominant type of leaves observed in a young plant

1 Simple
2 Compound
3 Both

7.2.2 Type of leaves in the crown

Predominant type of leaves observed in an adult plant

1 Simple
2 Compound
3 Both

7.2.3 Number of leaflets

Average number of leaflets in the predominant type of compound leaf. Score one (1) for simple leaves

7.2.4 Colour of young leaf

Measured at juvenile stage

1 Light green (138A, 144A, 146A)
2 Green (139A)
3 Dark green (189A, N189A)
4 Purple (77A, N77AB, 79BCD, N79AB)
99 Other (specify in descriptor **7.6 Notes**)

7.2.5 Colour of fully developed leaf

1 Light green (RHS 138A, 144A, 146A)
2 Green (RHS 139A)
3 Dark green (189A, N189A)
99 Other (specify in descriptor **7.6 Notes**)

7.2.6 Leaf blade shape

(See Fig. 3)

1 Cordate
2 Ovate
3 Obovate
4 Elliptic
5 Lanceolate
6 Oblique
99 Other (specify in descriptor **7.6 Notes**)

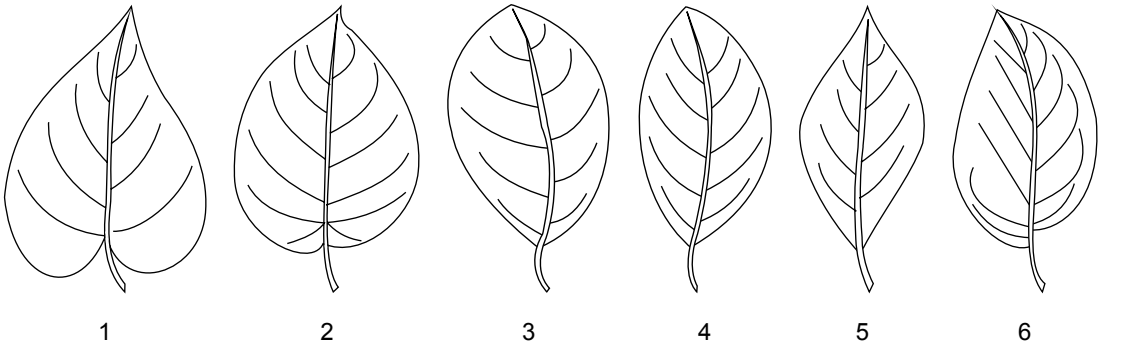

Fig. 3. Leaf blade shape

7.2.7 Leaf apex shape

(See Fig. 4)

1 Acuminate
2 Acute
3 Apiculate
4 Obtuse

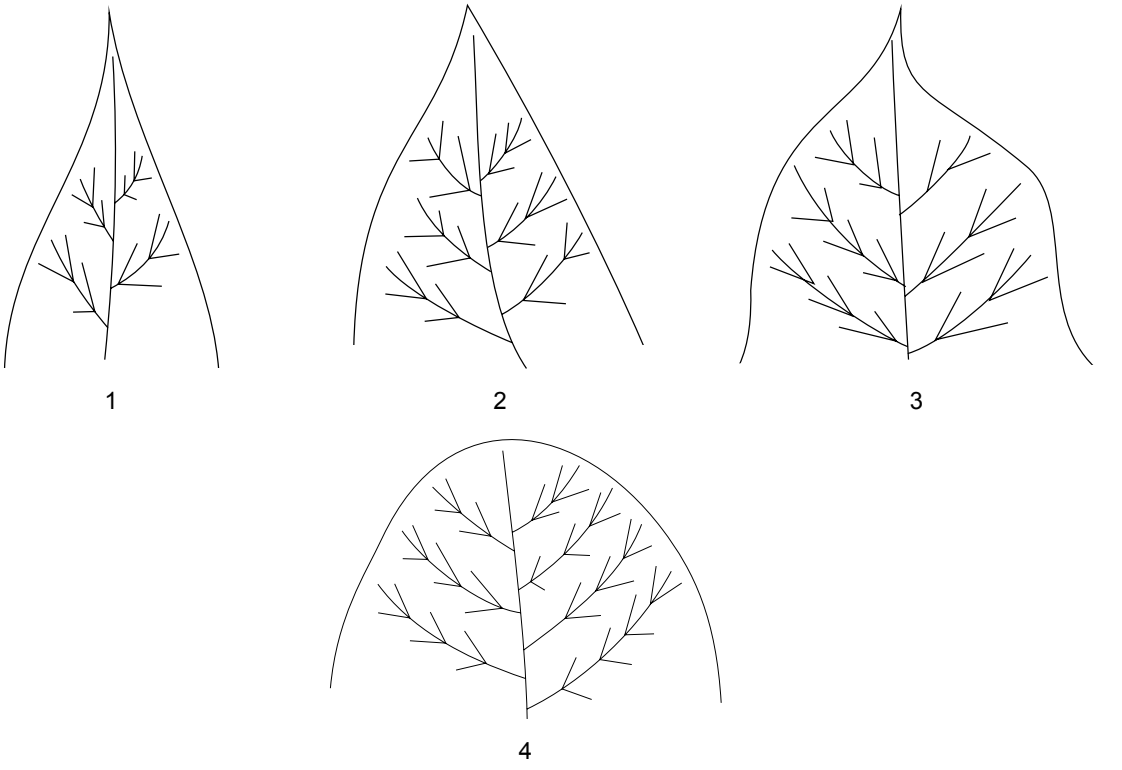

Fig. 4. Leaf apex shape

7.2.8 Leaf base shape

(See Fig. 5)

1 Cordate
2 Cuneate
3 Oblique
4 Obtuse
5 Subcordate

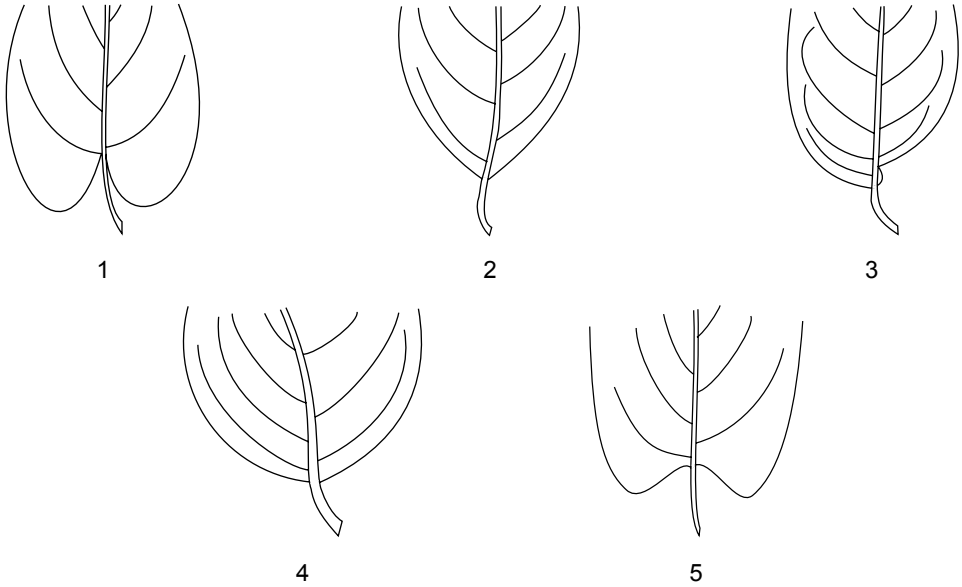

Fig. 5. Leaf base shape

7.2.9 Leaf margin

(See Fig. 6)

1 Entire
2 Crenate
3 Lobed

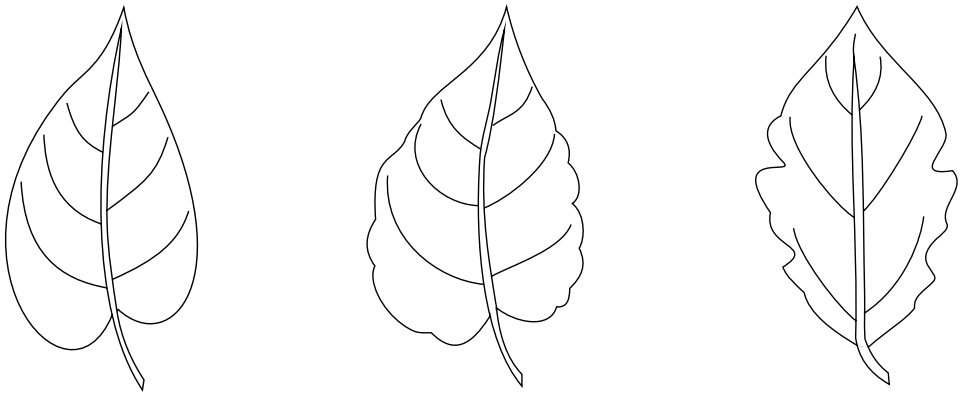

Fig. 6. Leaf margin

7.2.10 Leaf hairiness

Observed on abaxial side

0 Glabrous (i.e. without hairs)
1 Puberulent (i.e. covered with down or fine hairs)
2 Pubescent (i.e. covered with very short soft dense hairs)
3 Pilose (i.e. covered with short, thin hairs
4 Tomentose (i.e. covered with short, dense, matted hairs)

7.2.11 Anthocyanin pigmentation of the leaf veins

0 Absent
1 Present

7.2.12 Leaf central vein length [cm]

Measured from the petiole insertion to the apex. (See Fig. 7.a)

7.2.13 Leaf lobe length [cm]

Measured as the difference between the lamina length and the leaf central vein length. (See Fig. 7.b). Score as 0 if no leaf lobes are present.

7.2.14 Leaf width at the petiole insertion [cm]

Measured at the petiole insertion point. (See Fig. 7.c)

7.2.15 Leaf maximum width [cm]

(See Fig. 7.d)

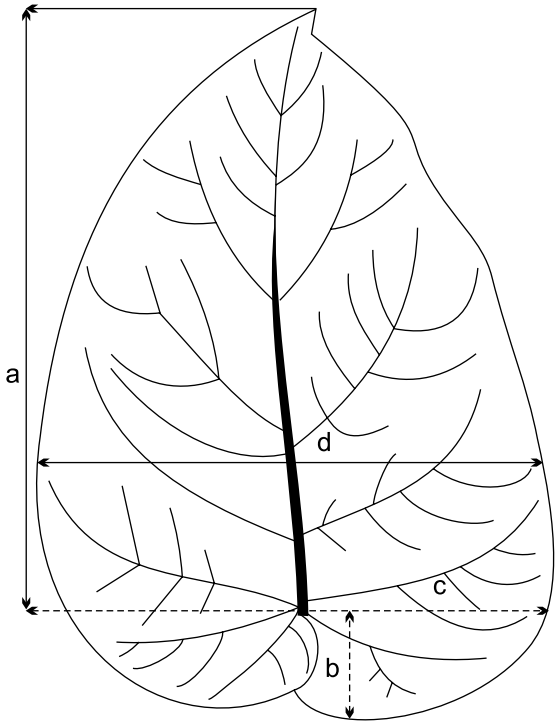

Fig. 7. Leaf measurements

7.2.16 Leaf petiole anthocyanin pigmentation

0 Absent
1 Present

7.2.17 Leaf petiole shape

1 Cylindrical
2 Flattened
99 Other (specify in the **Notes** descriptors)

7.2.18 Leaf petiole pubescence

0 Absent
1 Present

7.2.19 Leaf petiole length [cm]

Measured from petiole base to leaf lamina base

7.2.20 Leaf petiole diameter [mm]

Measured in the middle part of the petiole

7.3 Inflorescence/flower descriptors

All flower observations should be taken when flowering is at its peak if possible, unless otherwise indicated. Record the average of at least five inflorescences/flowers from each of five different plants

7.3.1 Inflorescence branching

(See Fig. 8)

1 Branched (like in *S. betaceum*)
2 Unbranched (like in *S. latiflorum*)
3 Forked (like in *S. roseum*)

Fig. 8. Inflorescence type

7.3.2 **Inflorescence length** [cm]

Measured as the distance from the inflorescence base to the apex

7.3.3 **Inflorescence peduncle length** [cm]

7.3.4 **Inflorescence rachis internode length** [cm]

Measured as the distance between the first and second nodes of the inflorescence rachis

7.3.5 **Number of flowers per inflorescence**

7.3.6 **Flower pedicel length** [cm]

7.3.7 **Petal length** [cm]

7.3.8 **Petal width** [cm]

7.3.9 **Corolla diameter** [cm]

Measured at the largest point

7.3.10 **Corolla shape**

(See Fig. 9)

1 Urceolate
2 Campanulate
3 Stellate

7.3.11 **Corolla colour**

1 Whitish
2 Yellowish
3 Yellowish-green
4 Greenish
5 Pinkish
6 Lavender
7 Reddish
8 Purplish
9 Violet

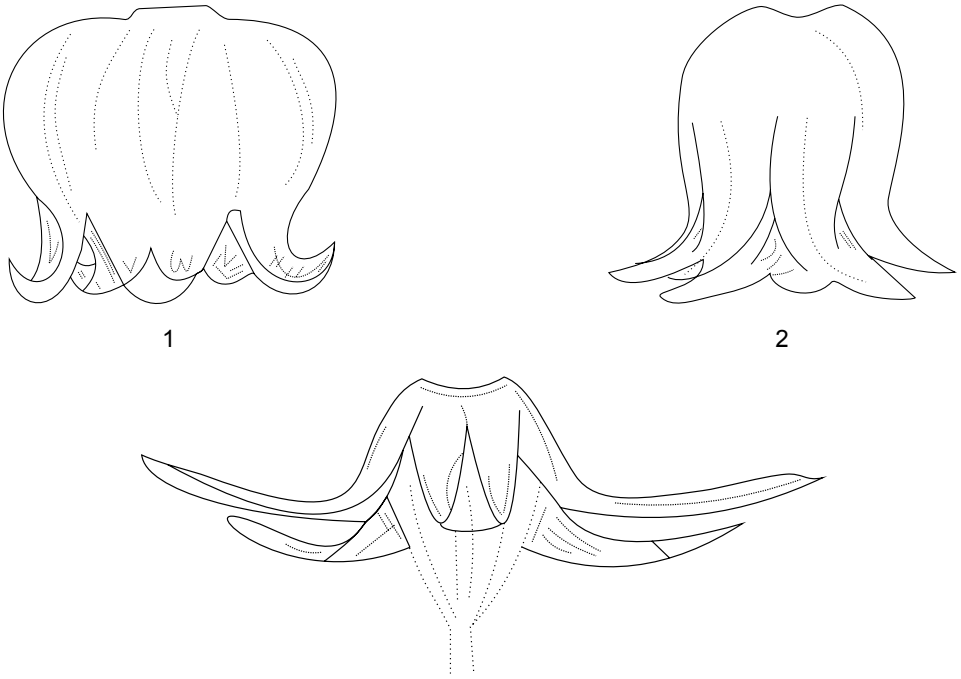

Fig. 9. Corolla shape

7.3.12 Anther length [cm]

7.3.13 Anther thecae shape

1 Oblong
2 Ovate
3 Lanceolate
4 Elliptic
5 Triangular

7.3.14 Anther thecae colour

1 White
2 Pale yellow
3 Yellow
4 Pinkish
5 Purplish
6 Violet

7.3.15 Anther connective colour

1 White
2 Pale yellow
3 Yellow
4 Pinkish
5 Purplish
6 Violet

7.3.16 Style length [cm]

7.3.17 Presence of leafy bracts

Report the presence of leafy bracts within the inflorescence

0 Absent
1 Present

7.3.18 Flower pubescence

0 Glabrous
1 Low
2 Intermediate
3 High

7.3.19 Ovary pubescence

0 Glabrous
1 Low
2 Intermediate
3 High

7.3.20 Flower odour

Recorded at anthesis

0 Absent
1 Mild
2 Strong

7.4 Fruit descriptors

Record the average of ten fruits from five different plants, at least. Unless otherwise indicated, all observations on the fruit should be taken when fruit ripening is at its peak, if possible

7.4.1 Number of fruits per plant

7.4.2 Number of fruits per infructescence

7.4.3 Immature fruit colour

1 Green
2 Green with green or greyish longitudinal stripes
3 Green mottled with dark green stripes
4 Light green with darker green stripes
5 Green spotted with white

7.4.4 Mature fruit colour

1 White
2 Green
3 Yellow
4 Orange
5 Red
6 Dark red
7 Purple
8 Blackish

7.4.5 Stripes in the mature fruit

0 Absent
1 Green
2 Purple
3 Deep purple

7.4.6 Fruit shape

(See Fig. 10)

1 Rounded
2 Ovate elongate
3 Ovoid
4 Elliptic
5 Fusiform
99 Other (specify in descriptor **7.6 Notes**)

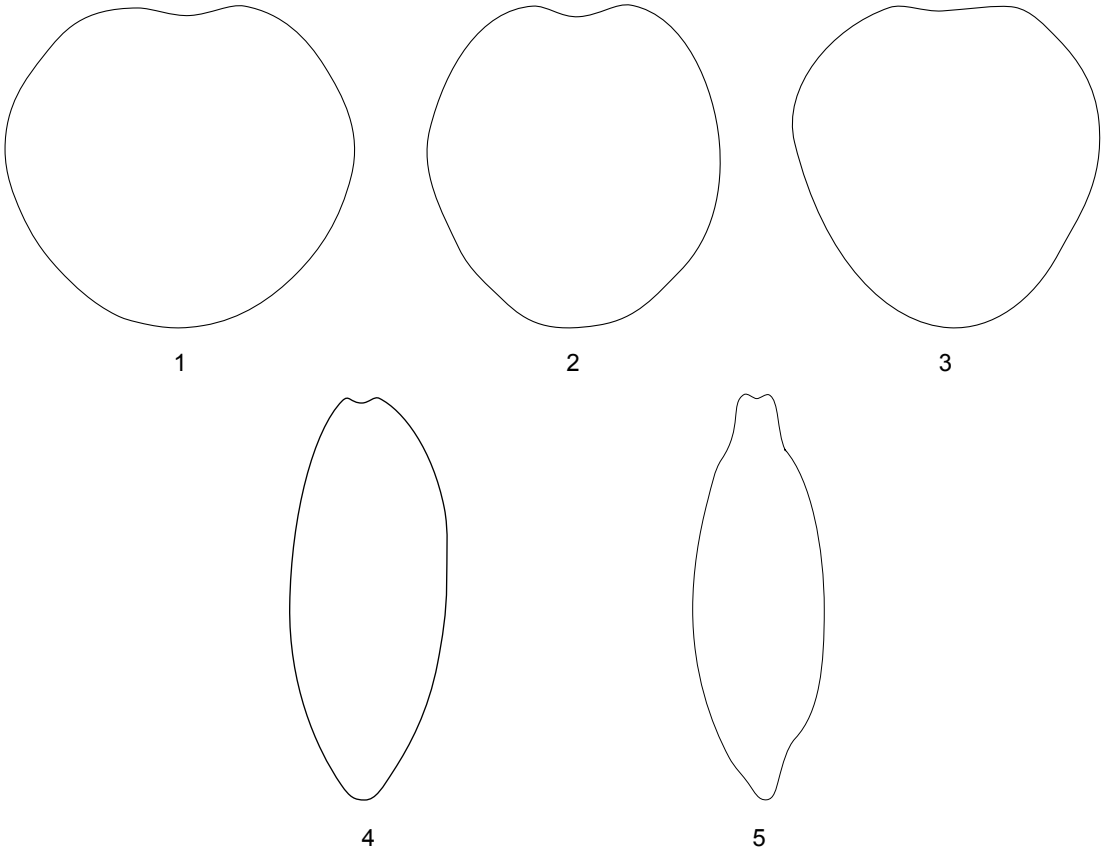

Fig. 10. Fruit shape

7.4.7 Fruit apex shape

(See Fig. 11)

1 Acuminate
2 Acute
3 Obtuse
99 Other (specify in descriptor **7.6 Notes**)

7.4.8 Fruit apex angle [degrees]

Measured as the angle formed by the berry edges at 2 cm of the apex x

7.4.9 Fruit length [cm]

Measured from the proximal to the distal part of the berry

7.4.10 Fruit width [cm]

Measured as the maximum width of the berry

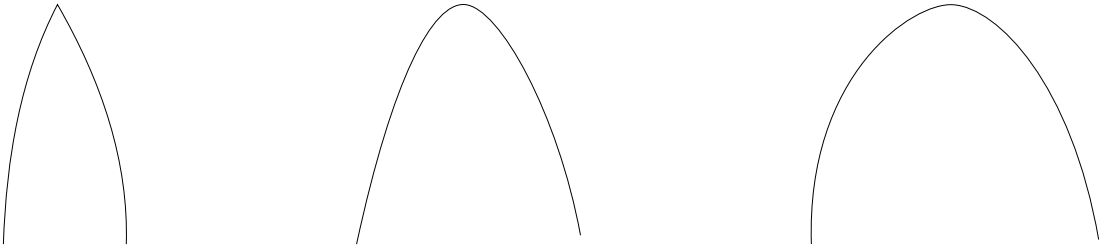

Fig. 11. Shape of fruit apex

7.4.11 Fruit size uniformity

3 Low
5 Intermediate
7 High

7.4.12 Fruit pedicel length [cm]

7.4.13 Diameter of the internal cavity of the fruit [cm]

Measured as the width of the cavity formed by the lobules

7.4.14 Fruit weight [g]

7.4.15 Fruit hairiness

0 Glabrous
1 Pubescent

7.4.16 Fruit mesocarp colour

1 Light green
2 Pale yellow
3 Orange yellow
4 Orange

7.4.17 Seed-mucilage colour

1 Orange
2 Purple

7.4.18 Fruit skin thickness [mm]

7.4.19 Fruit surface

1 Smooth
2 Slightly rough

7.4.20 Fruit attractiveness

Combined assessment of shape, size and appearance, coloration, etc.

1 Poor
2 Average
3 Good
4 Excellent

7.4.21 Fruit flavour

1 Very acidic
3 Acidic
5 Moderately sweet
7 Sweet

7.4.22 Bitter off-flavour

0 Absent
3 Weak
5 Intermediate
7 Strong

7.4.23 Pulp juiciness

1 Slightly juicy
2 Juicy
3 Very juicy

7.4.24 Pulp aroma

1 Mild
2 Intermediate
3 Strong

7.4.25 Fruit epidermis glossiness

3 Dull
5 Intermediate
7 Bright

7.4.26 Fruit peeling

3 Easy
5 Intermediate
7 Difficult

7.4.27 Stone cell aggregates in mesocarp

0 Absent
1 Present

7.5 Seed

7.5.1 **Number of seeds per fruit**

7.5.2 **100-seed weight** [g]

7.5.3 **Seed colour**

1 Brown
2 Light brown
3 Dark brown

7.5.4 **Seed length** [mm]

7.5.5 **Seed width** [mm]

7.5.6 **Seed hairiness**

0 Absent
1 Present

7.6 Notes

Specify here any additional information

EVALUATION

8. Plant descriptors

8.1 Agronomic characters

Agronomic characteristics should be observed on 10 plants at least

8.1.1 **Number of days to flowering** [d]

From transplanting until 50% of the plants have at least one open flower

8.1.2 **Flowering duration** [d]

Number of days from first flower opening until end of flowering

8.1.3 **Secondary/off-season flowering**

0 Absent
1 Rare
2 Intermediate
3 Frequent

8.1.4 **Regularity of flowering**

1 Regular
2 Irregular

8.1.5 **Number of nodes between inflorescences**

8.1.6 **Number of days to maturity** [d]

From transplanting until 50% of the plants have at least one fruit ripened

8.1.7 **Ripening uniformity**

3 Poor
5 Intermediate
7 Good

8.1.8 **Fruit storage life** [d]

Number of days of storage of ripe fruits under ambient conditions after harvest

8.1.9 **Self-compatibility**

1 Self-compatible
2 Self-incompatible
3 Unknown (sterile)

8.1.10 **Parthenocarpic (seedless) fruits** [%]

Indicate in descriptor **8.4 Notes** if the parthenocarpy may be attributed to lack of pollinators or to other factors

8.2 Fruit characteristics

All fruit characteristics should be evaluated on ten ripe fruits from five different plants, at least

8.2.1 **Sunscald**

0 Absent
3 Slight
5 Intermediate
7 Severe

8.2.2 **Fruit cracking**

0 Absent
3 Slight
5 Intermediate
7 Severe

8.2.3 **Fruit susceptibility to bruising**

3 Sensitive
5 Intermediate
7 Resistant

8.2.4 **Juice yield** (%)

Ratio of juice weight to fruit weight after extraction with a domestic juice extractor

8.3 Chemical composition

8.3.1 **Fruit sugar content** [g/100g FW]

8.3.1.1 **Fructose content** [g/100g FW]

8.3.1.2 **Glucose content** [g/100g FW]

8.3.1.3 **Sucrose content** [g/100g FW]

8.3.2 **Soluble solids content** [%]

8.3.3 **Titratable acidity** [g of citric acid/100 g FW]

8.3.4 **Ratio sugar content/titratable acidity**

8.3.5 **Ascorbic acid content** [g/100 g FW]

8.3.6 **Total acidity** [g of malic acid/100 g]

8.3.7 **Fruit juice pH**

8.3.8 **Antioxidant activity** [µmol TEAC/100g FW]

8.3.9 **Phenolics compounds content** [g GAE/100g FW]

8.3.10 **Carotenoids content** [g/100g FW]

8.3.11 **Total chlorophylls content** [g/100g FW]

8.3.12 **Alkaloid content**

8.3.12.1 **Type of alkaloid**

8.3.12.2 **Part of the plant used**

1 Fruit
2 Leaf
3 Root
99 Other (specify in descriptor **8.4 Notes**)

8.4 Notes

Specify any additional information here

9. 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, viz.:

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

9.1 Reaction to frost

9.2 Reaction to high temperature

9.3 Reaction to wind

9.4 Reaction to drought

9.5 Reaction to waterlogging

9.6 Reaction to high soil moisture

9.7 Reaction to salinity
Specify water conductivity (dS·m-1) and main salt involved (NaCl, Na_2CO_3, $CaCl_2$, etc.)

9.8 Reaction to soil acidity
Specify soil pH

9.9 Reaction to soil alkalinity
Specify soil pH

9.10 Remarks
Specify any additional information here

10. 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 descriptor **10.5 Remarks**. These are coded on a susceptibility scale from 1 to 9, viz:

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

The organisms considered most important by breeders and pathologists are indicated by asterisks (*) and **boldface**

10.1 Pests

	Causal organism	Common name
10.1.1	*Agrotis* sp.	Cutworms
10.1.2	*Anastrepha* sp.	Fruit flies
	Carpolonchaea pendula	
10.1.3	*Costelytra zealandica*	Grass grub beetle
10.1.4	*Chrysodeixis* sp.	Green looper caterpillar
***10.1.5**	***Leptoglossus zonatus***	**Leaf-footed bug**
***10.1.6**	***Myzus* sp.**	**Aphids**
10.1.7	*Neoleucinodes elegantalis*	Tomato fruit borer
10.1.8	*Nezara viridula*	Southern green stink bug
10.1.9	*Thrips* sp.	Thrips
	Frankliniella occidentalis	Western flower thrips
***10.1.10**	***Trialeurodes vaporariorum***	**Greenhouse white-fly**

10.2 Nematodes

***10.2.1**	***Meloidogyne incognita***	**Root-knot nematode**
	Meloidogyne java	
	Meloidogyne hapla	
10.2.2	*Pratylenchus crenatus*	

10.3 Fungi

10.3.1	*Alternaria alternata*	Fruit rot
10.3.2	*Alternaria* sp.	Early blight
***10.3.3**	***Colletotrichum* sp.**	**Anthracnose**
10.3.4	*Fusarium solani*	Stem black lesion
10.3.5	*Glomerella cingulata*	Anthracnose
***10.3.6**	***Oidium* sp.**	**Powdery mildew**
***10.3.7**	***Phytophthora infestans***	***Phytophthora* root rot**
10.3.8	*Phoma exigua*	Tamarillo leaf spot

10.4 Viruses

10.4.1 Alfalfa mosaic virus (AMV)
10.4.2 Arabis mosaic virus (ArMV)
10.4.3 Cucumber mosaic virus (CMV)
10.4.4 Potato aucuba mosaic virus (PAMV)
10.4.5 Potato leaf roll virus (PLRV)
10.4.6 Potato virus Y (PVY)
***10.4.7** **Tamarillo mosaic virus (TaMV)**
10.4.8 Tobacco streak virus (TSV)
10.4.9 Tomato aspermy virus (TAV)
***10.4.10** **Tomato spotted wilt virus (TSWV)**
***10.4.11** **Tomato ringspot virus (ToRSV)**

10.5 Remarks

Specify any additional information here

11. Biochemical markers

Specify methods used and cite reference(s). Refer to *Descriptors for genetic marker technologies*, available in PDF format from Bioversity International web site (http://www.bioversityinternational.org/) or by email request to bioversityinternational-publications@cgiar.org.

12. Molecular markers

Refer to *Descriptors for genetic marker technologies*, available in PDF format from Bioversity International web site (http://www.bioversityinternational.org/) or by email request to bioversityinternational-publications@cgiar.org.

13. Cytological characters

13.1 Chromosome number

The chromosome count of normal diploid individuals is 2n=24

13.2 Ploidy level

13.3 Trisomics

13.4 Monosomics

13.5 Other cytological characters

14. Identified genes

Describe any known specific mutant present in the accession

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ANNEX I. List of synonymies between *Solanum* and *Cyphomandra* names

Because *Cyphomandra* names are still used in many germplasm collections, the synonymies between *Solanum* and *Cyphomandra* names for the tree tomato and wild relatives (according to Bohs, 1995) are given below:

***Solanum* names**	***Cyphomandra* names**
Solanum betaceum Cav.	*Cyphomandra betacea* (Cav.) Sendtn.
Solanum cacosmum Bohs	*Cyphomandra foetida* Bohs
Solanum cajanumense Kunth	*Cyphomandra cajanumensis* (Kunth) Walp.
Solanum calidum Bohs	*Cyphomandra pilosa* Bohs
Solanum circinatum Bohs	*Cyphomandra hartwegii* (Miers) Walp.
Solanum corymbiflorum (Sendtn.) Bohs	*Cyphomandra corymbiflora* Sendtn.
Solanum diploconos (Mart.) Bohs	*Cyphomandra diploconos* (Mart.) Sendtn.
Solanum diversifolium Dunal	*Cyphomandra diversifolia* (Dunal) Bitter
Solanum endopogon (Bitter) Bohs	*Cyphomandra endopogon* Bitter
Solanum exiguum Bohs	*Cyphomandra benensis* Britton
Solanum fallax Bohs	*Cyphomandra hypomalaca* Bitter
Solanum fortunense Bohs	*Cyphomandra dolichocarpa* Bitter
Solanum latiflorum Bohs	*Cyphomandra calycina* Sendtn.
Solanum melissarum Bohs	*Cyphomandra divaricata* (Mart.) Sendtn.
Solanum obliquum Ruiz & Pav.	*Cyphomandra obliqua* (Ruiz & Pav.) Sendtn.
Solanum occultum Bohs	*Cyphomandra stellata* Bohs
Solanum ovum-fringillae (Dunal) Bohs	*Cyphomandra ovum-fringillae* Dunal
Solanum oxyphyllum C.V. Morton	*Cyphomandra fragilis* Bohs
Solanum paralum Bohs	*Cyphomandra heterophylla* Taub.
Solanum pendulum Ruiz & Pav.	*Cyphomandra pendula* (Ruiz & Pav.) Sendtn.
Solanum pinetorum (L.B. Sm. & Downs) Bohs	*Cyphomandra pinetorum* L.B. Sm. & Downs
Solanum premnifolium (Miers) Bohs	*Cyphomandra premnifolia* (Miers) Dunal
Solanum proteanthum Bohs	*Cyphomandra oblongifolia* Bohs
Solanum rojasianum (Standl. & Steyerm.) Bohs	*Cyphomandra rojasiana* Standl. & Steyerm.
Solanum roseum Bohs	*Cyphomandra acuminata* Rusby
Solanum sciadostylis (Sendtn.) Bohs	*Cyphomandra sciadostylis* Sendtn.
Solanum sibundoyense (Bohs) Bohs	*Cyphomandra sibundoyensis* Bohs
Solanum sycocarpum Mart. & Sendtn.	*Cyphomandra sycocarpa* (Mart. & Sendtn.) Sendtn.
Solanum tegore Aubl.	*Cyphomandra tegore* (Aubl.) Walp.
Solanum tenuisetosum (Bitter) Bohs	*Cyphomandra tenuisetosa* Bitter
Solanum tobagense (Sandwith) Bohs	*Cyphomandra tobagensis* Sandwith
Solanum unilobum (Rusby) Bohs	*Cyphomandra uniloba* Rusby

ANNEX II. COLLECTING FORM for tree tomato

SAMPLE IDENTIFICATION

COLLECTING INSTITUTE CODE (2.1):

COLLECTING NUMBER (2.2):

PHOTOGRAPH No. (2.23): HERBARIUM SPECIMEN (2.24):

COLLECTING DATE OF SAMPLE [YYYYMMDD] (2.3):

GENUS (1.6): SPECIES (1.7): SUBTAXON (1.8):

COMMON CROP NAME (1.10.3):

COLLECTING SITE LOCATION

COUNTRY OF ORIGIN (2.5):

LOCATION (2.7): km: direction: from:

LATITUDE (2.8/a): LONGITUDE (2.9/a): ELEVATION (2.13): m asl

Additional notes:

COLLECTING SITE ENVIRONMENT

COLLECTING/ACQUISITION SOURCE (2.14):

10.Wild habitat

20.Farm or cultivated habitat

30.Market or shop

40.Institute, Experimental station, Research Org., Genebank

50.Seed company

60.Weedy, disturbed or ruderal habitat

99.Other (specify):

HIGHER LEVEL LANDFORM (6.1.2):

1.Plain 2.Basin 3.Valley 4.Plateau

5.Upland 6.Hill 7.Mountain

SLOPE [°] (6.1.4): SLOPE ASPECT (6.1.5): (code N,S, E, W)

OVERALL VEGETATION SURROUNDING AND AT THE SITE (6.1.7):

11.Grassland 12.Forbland 20.Closed forest 30.Woodland

40.Scrubland 50.Dwarf shrubs 99.Other (specify):

SOIL DRAINAGE (6.1.8):

3.Poorly drained . 5.Moderately drained 7.Well drained

SAMPLE

BIOLOGICAL STATUS OF ACCESSION (2.15):

100.Wild 200.Weedy 300.Traditional cultivar/landrace

400.Breeding/research material 500.Advanced/improved cultivar (conventional breeding)

600.GMO (by genetic engineering) 999.Other (specify):

TYPE OF SAMPLE (2.17):

1.Vegetative 2.Seed 99.Other (specify):

No. PLANTS SAMPLED (2.18): No. SEEDS COLLECTED (2.19):
GENERAL APPEARANCE OF POPULATION (2.20): 3.Poor 5.Medium 7.Good
POPULATION ISOLATION (2.21) km
PREVAILING STRESSES (2.22.7): Information on main associated biotic (pests and diseases) and abiotic (drought, salinity, temperature) stresses

ETHNOBOTANICAL DATA
LOCAL/VERNACULAR NAME (2.22.2):
ETHNIC GROUP (2.22.1):
HISTORY OF PLANT USE (2.22.3): 1.Ancestral/indigenous (always associated with the place and community) 2.Introduced (but in unknown distant past) 3.Introduced (time of introduction unknown)
PARTS OF THE PLANT USED (2.22.4):
1.Fruit 2.Seed 3.Leaf 99.Other (specify):
PLANT USE (2.22.5): 1. Fresh fruit 2.Juice 3.Dessert fruit 4.Salad 5.Cooked 6.Medicinal 7. Industry 99.Other (specify):
CULTURAL CHARACTERISTICS (2.22.6): Mention if there is any folklore (i.e., taboos, stories and/or superstitions) 0.No 1.Yes: specify in REMARKS (2.25)
CULTURAL PRACTICES (2.22.8): Sowing date [YYYYMMDD] (2.22.8.1):
First harvest date [YYYYMMDD] (2.22.8.2):
Last harvest date [YYYYMMDD] (2.22.8.3):
CROPPING SYSTEM (2.22.9):
1.Monoculture 2.Intercropped (specify other crops in REMARKS (2.25))
MODE OF REPRODUCTION (2.22.10): 1.Vegetative 2.Seed 3.Both
SEASONALITY (2.22.12): 1.Available only in season/at particular period 2.Available throughout the year
ASSOCIATED FLORA (2.22.11): Other dominant crop/or wild plant species, including other *Solanum* species, found in and around the collecting site
REMARKS (2.25):

Descriptors for Tree tomato and wild relatives

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