Minimum descriptors for Pepino, Groundcherry and Tree Tomato

ECPGR Working Group on Solanaceae

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CONTENTS

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Foreword

Minimum descriptors for Pepino (*Solanum muricatum*) and wild relatives (*Solanum* section *Basarthrum)*, Groundcherry (*Physalis* spp.) and Tree Tomato (*Solanum betaceum = Cyphomandra betacea*) and wild relatives

To describe accessions of minor Solanaceae crops (pepino and wild relatives; groundcherry; tree tomato and wild relatives), ECPGR Solanaceae Working Group members are requested, when possible, to use the minimum set of descriptors proposed here, in addition to their own local descriptors. These descriptors, common to all ECPGR Solanaceae Working Group members, should be provided to the database managers, in order for them to compile and add the data to the Pepino, Groundcherry and Tree Tomato central databases. This information will provide considerable added value to databases which contain purely passport data sets.

General advice on description is given below, together with three tables providing details on the set of minimum descriptor lists (for pepino and wild relatives, groundcherry and tree tomato and wild relatives respectively).

These lists were revised by a group of experts of the Working Group on Solanaceae (Marie-Christine Daunay, Wolfgang Palme, Jaime Prohens and Willem van Dooijeweert) after the first meeting of the Working Group in Menemen, Turkey (February 2012), and finally approved by the Solanaceae WG in June 2012. The tree tomato list was finalized as planned after publication of the Bioversity Descriptors in 2013.

Description of a homogeneous accession

Pepino and its wild relatives, groundcherry, and tree tomato and its wild relatives are self-pollinating species. Therefore, most of the time, the accessions are homogeneous, all plants are similar and are easy to describe by using the minimum set of descriptors. The description can be made either by looking at one healthy plant representative of the others, but preferably by looking at all the plants in a batch and choosing descriptor states matching the general phenotype of the accession.

Description of a heterogeneous accession

In case of heterogeneity of an accession, the description is much more difficult, and various institutions use different methods to deal with this problem. The ECPGR Solanaceae Working Group is providing here (A) a provisional survey of the different ways heterogeneous Solanaceae accessions are described in Europe, and (B) the current Bioversity International's recommendations in case of heterogeneity.

A. Provisional survey of the different ways heterogeneous Solanaceae accessions are described in Europe

1. If there are only one or two off-type plants (most probably originating from some pollen or seed contamination) they should be discarded. The description should then be made on the plants which have a common or almost common phenotype.
2. If the accession is completely heterogeneous, it is probably a population. This is often the case for accessions like landraces. Hence, the original seed sample is a mixture of different types which were collected as one accession. From a genebank point of view this heterogeneity should be conserved. With regard to the description of such heterogeneous accessions, two methods are in common use, namely (a) accessions are described and conserved in their heterogeneous state, or (b) accessions are subdivided into new accessions that are stabilized by selfing, as described below.

a. Heterogeneity conserved

* If the accession is heterogeneous only in relation to one or a few descriptors, then comment on the heterogeneity in descriptor 12 ('Notes'), and describe this accession by using only the other descriptors for which it is homogeneous.
* If the population displays some variation around an "average phenotype", then the descriptors can be recorded as though they are for this average phenotype, while the heterogeneity of the accession should be described with some details in descriptor 12 ('Notes').
* If the accession is highly heterogeneous, then it is very difficult to describe it, because various values of each descriptor will match with the various phenotypes of the different plants. In this case, we advise describing briefly the variation within descriptor 12 ('Notes'). Any detailed description should be abandoned, except for those traits that are relatively constant from one plant to another.

b. Heterogeneity stabilized into different types

If two or more types can easily be distinguished, the accession can be divided into two or more types, as appropriate, and each type should be given a new identification number in the genebank. Each new accession should preferably be selfed in order to become genetically stabilized before being characterized separately. For each new derived type, it is recommended to specify in descriptor 12 ('Notes') from which subdivision of the well-specified initial heterogeneous accession it derives.

As a rule, if an accession is heterogeneous, make a good common sense decision concerning its description. Remember that a description is supposed to characterize an accession morphologically: if you state that you cannot characterize an accession properly, just explain the problem in descriptor 12 ('Notes').

B. Current Bioversity International's recommendations in case of heterogeneity[1]

Recording heterogeneous data

Landraces and wild populations are not as uniform as commercial varieties. Many genebanks will therefore mainly handle accessions that are heterogeneous for many traits (each accession is not genetically uniform and contains a certain amount of variation). Recording the average or most frequently occurring state does not express the extent of variation nor its range within each accession. To a certain extent, this can complicate documentation, since special provision must be made to record the diversity. If statistical studies are foreseen, the best approach is to record actual measurements.

Nevertheless, several other approaches have been proposed to address this issue. In crop descriptor lists, references are made to different methodologies, as discussed below.

- For accessions that are not generally uniform for a descriptor (e.g. a mixed collection, or genetic segregation), the mean and standard deviation can be reported where the descriptor is continuous. Where the descriptor is discontinuous, several codes in order of frequency could be recorded.
- Another approach is the method developed by van Hintum (1993), which has the following rules:
  - record the scores in decreasing order of size; and
  - add an equals sign (=) after the score if there is only one fraction.

  In this system, homogeneous populations are followed by the '=' sign. For heterogeneous populations, the ratio between two adjacent fractions is taken. If between 1.5 and 5.0, one 'x' sign is placed between the two fractions; if the ratio is higher than 5.0, two 'x' signs are placed.
- The method developed by Sapra and Singh (Rana et al. 1991), proposes the use of numbering codes from 0 to 9 based on frequency encountered (1=very low, 9=very high, with the same scale used for quantitative characters):
  - Three codes are placed in decreasing order of frequency
  - The frequency codes are placed after each descriptor code
  - For homogeneous populations, '9' is placed after the first descriptor code and '0' (indicating absence) after the other two codes.

Example #49	
Flower colour	
1	White
2	Purple
3	Red

For a population with only white flowers, the scores would be 192030. For a population with few (very low) white flowers and many (very high) red flowers, the scores would be 381120.

For descriptors with single digit states (e.g. 1–9 scale), the systems for recording heterogeneity differ and are not completely compatible. At this time, it is unclear to what extent these systems are applied by genebanks.

[1] *in* Bioversity International. 2007. Guidelines for the development of crop descriptor lists. Bioversity Technical Bulletin Series. Bioversity International, Rome, Italy. (pp. 38-41) (http://www.bioversityinternational.org/publications/pdf/1226.pdf).

- Another method, proposing how heterogeneity could be documented for specific traits of the crop, has recently been under development by A. Alercia and co-workers, and is outlined below.

  If an accession shows high variation between plots and within plants, such as the flower colour of *Lathyrus*, the method suggested is to use different columns for each colour, estimate for each plot the percentage of colours present, and record the average. Assign numbering codes for each colour in order of frequency (increasing order).

Example #50

Table 1. Flower colour

Plot No.	Accession No.	Yellow	White	Pink	Red
1	10123	50	10	15	25
2	10123	20	40	30	30
3	10123	30	20	25	25
4	10123	40	30	10	30
5	10123	70	10	10	10
Total		240	110	90	150
%		48%	22%	18%	30%

Assign numbering codes in increasing order using a 1–9 scale (low to high scale), as follows:

Example #51

1	(18%)
2	(22%)
3	(30%)
4	(48%)

- The descriptor will now will appear as:

Example #52

Flower colour

1	Pink	(18%)
2	White	(22%)
3	Red	(30%)
4	Yellow	(48%)

- If, in addition, flower characteristics also show variation between them, it is recommended that they be recorded separately. For example, in Lathyrus species there is a huge variation between accessions, replications and even flowers in the same plot. When this occurs, it is recommended that flower element data be recorded separately:

Example #53

(i)	Standard colour on upper side
(ii)	Standard colour on lower side
(iii)	Keel colour
(iv)	Wing colour
(v)	Vein colour

- Sometimes, variation may be found on the distribution of colour on standards. In this case, it is suggested to record the variation as follows:

Example #54	
Distribution of colour in the standards	
1	Colour present on margins
2	Colour present in the centre
3	Colour present along the veins

It is recommended that the Royal Horticultural Society Colour Chart be used for colour descriptors. However, in case RHS charts are not available or unaffordable (for example, small collections), using any other standard colour charts or generating one using computer tools is acceptable. When standards different from RHS charts are used, the standards used should be clearly mentioned along with information on colour and in some instances when the charts are uncommon, chart itself may have to be provided along with the information.

I. Minimum descriptor list for Pepino (*Solanum muricatum*) and wild relatives (*Solanum* section *Basarthrum)*

(Final version approved by the Solanaceae WG, June 2012)

Note: The"IPGRI/COMAV numbers" refer to the numbers used in the following publication:
IPGRI and COMAV. 2004. Descriptors for Pepino (*Solanum muricatum*). International Plant Genetic Resources Institute, Rome, Italy, and Centro de Conservación y Mejora de la Agrodiversidad Valenciana, Valencia, Spain.

Number	IPGRI/COMAV number	Descriptor name	Descriptor state	Notes
Plant				*Records should be taken on 5 plants at least, when the fruits of the 1st truss are ripened.*
1	7.1.20	**Type of leaves**	1 Simple 2 Compound	*Predominant type of leaves observed in adult plants*
Inflorescence				*Observations on the inflorescence and flowers should be taken, when possible, on the 1st truss at flowering.*
2	7.2.2	**Inflorescence type**	1 Generally uniparous 2 Both (partly uniparous, partly multiparous) 3 Generally multiparous	
3	7.2.4	**Corolla shape**	1 Stellate 2 Intermediate 3 Rotate	*See Fig. 1*

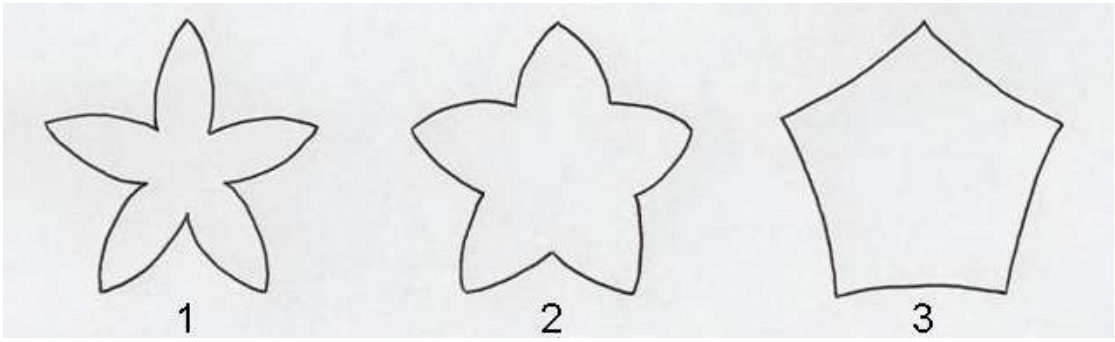

Fig. 1. Corolla shape.

Number	IPGRI/COMAV number	Descriptor name	Descriptor state	Notes
Fruit				*Records should be taken of fruits of at least 5 different plants. Unless otherwise indicated, all observations of the fruit should be taken, when possible, on the 1st truss at full maturity stage. Record the average of 10 fruits from different plants.*
4	7.3.4	**Mean fruit weight** [g]		
5	7.3.12	**Predominant fruit shape**	1 Flattened 2 Rounded 3 Ellipsoid 4 Ovate 5 Obovate 6 Cordiform 7 Conical 8 Elongate 99 Other (specify in "Notes")	*See Fig. 2*

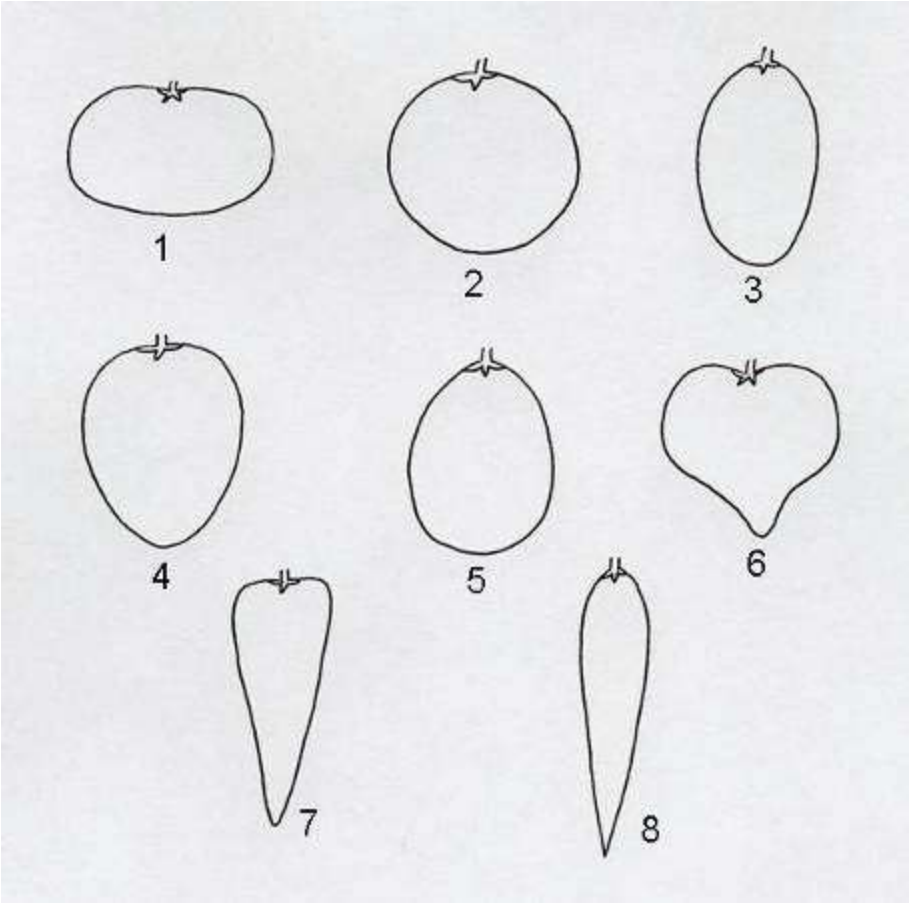

Fig. 2. Predominant fruit shape.

Number	IPGRI/COMAV number	Descriptor name	Descriptor state	Notes
6	7.3.18	**Fruit predominant colour at commercial ripeness**	1 Dark green 2 Light green 3 Milk white 4 Pale yellow 5 Golden yellow 6 Orange yellow 7 Lilac 8 Purple 9 Purple black	*Consider as commercial ripeness the state at which the fruits are used for consumption as a fresh fruit, which generally coincides with the physiological ripeness*
7	7.3.19	**Fruit secondary colour at commercial ripeness**	0 Absent 1 Dark green 2 Light green 3 Milk white 4 Pale yellow 5 Golden yellow 6 Orange yellow 7 Lilac 8 Purple 9 Purple black	
8	7.3.20	**Fruit secondary colour distribution at commercial ripeness**	1 Mottled 2 Network 3 Striped	
9	7.3.29	**Fruit flesh colour**	1 Dark green 2 Light green 3 White 4 Pale yellow 5 Golden yellow 6 Orange yellow 7 Orange 8 Salmon	
10	7.3.35	**Soluble solids content** [%]		
Additional information				
11		**Photograph**		*A photograph of several representative fruits, together with a reference scale such as a ruler or a pencil should be provided*
12		**Notes**		*Specify here any additional information.*

II. Minimum descriptor list for Groundcherry (*Physalis* spp.)

(Final version approved by the Solanaceae WG, June 2012)

Number	Descriptor name	Descriptor state	Notes
Plant			
1	**Plant habit**	1 Prostrate 2 Intermediate 3 Erect	*This trait should be recorded at complete developmental stage of the plant.*
2	**Characteristic of the stem**	0 Naked 1 Hirsute	
Flower			
3	**Diameter of the flower**	1 < 2cm 2 2-3 cm 3 > 3 cm	*Average of 10 flowers.*
Fruit			
4	**Diameter of the calyx** [in cm]		*Average of 10 ripe fruits.*
5	**Diameter of the fruit** [in cm]		*Average of 10 ripe fruits.*
6	**Fruit weight** [in g]		*Average of 10 ripe fruits.*
7	**Fruit shape**	1 Round 2 Elliptic 3 Flat 4 Ribbed	*Recorded at physiological maturity.*
8	**Colour of the mature fruit**	1 Greenish 2 Yellow 3 Orange 4 Purple (when exposed to the light)	*Recorded at physiological maturity.*
Additional information			
9	**Photograph**		*It is recommended to take a photograph of some fruits within their calyx.*
10	**Notes**		*Any original trait not taken into account by the above descriptors should be pointed out here.*

III. Minimum descriptor list for Tree Tomato (*Solanum betaceum* = *Cyphomandra betacea*) and wild relatives

(Final version approved by the Solanaceae WG, January 2013)

Note: the "Bioversity numbers" refer to the *Descriptors for tree tomato (*Solanum betaceum *Cav.) and wild relatives* published by Bioversity.[2]

Number	Bioversity number	Descriptor name	Descriptor state	Notes
Plant				
1	**7.1.1**	**Plant height** [m]	1 Short (≤3.0) 2 Intermediate (3.1–4.5) 3 Tall (4.6-6.0) 4 Very tall (>6.0)	*Measured from ground level to tree top, on at least 5 mature individuals.*
Inflorescence				
2	**7.3.5**	**Number of flowers per inflorescence**		*Mean of at least 5 inflorescences in each of at least 5 mature individuals.*
3	**7.3.10**	**Corolla shape**	1 Urceolate 2 Campanulate 3 Stellate	*See Fig. 4.*

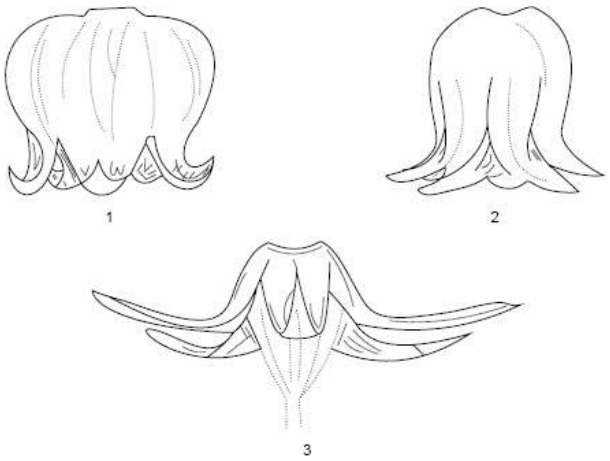

Fig. 4. Corolla shape.

[2] Bioversity International, Departamento de Ciencias Agropecuarias y de Alimentos, and COMAV. 2013. Descriptors for tree tomato (*Solanum betaceum* Cav.) and wild relatives. Bioversity International, Rome, Italy; Departamento de Ciencias Agropecuarias y de Alimentos (UTPL), Loja, Ecuador; Instituto de Conservación y Mejora de la Agrodiversidad Valenciana, Valencia, Spain. (http://www.bioversityinternational.org/nc/publications/publication.html?user_bioversitypublications_pi1[showUid]=7095&cHash=c6458c82ab2c5d9e1a84e10400334ec2&utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+BioversityInternational-LatestPublications+%28Bioversity+International+-+Latest+publications%29

Number	Bioversity number	Descriptor name	Descriptor state	Notes
4	**7.3.11**	**Corolla colour**	1 Whitish 2 Yellowish 3 Yellowish-green 4 Greenish 5 Pinkish 6 Lavender 7 Reddish 8 Purplish 9 Violet	
Fruit				
5	**7.4.2**	**Number of fruits per infructescence**		*Mean of at least 5 infructescences in each of at least 5 mature individuals.*
6	**7.4.9**	**Fruit length** [cm]		*Measured from the proximal to the distal part of the berry. Mean of at least 5 fruits in each of at least 5 mature individuals.*
7	**7.4.10**	**Fruit width** [cm]		*Measured as the maximum width of the berry. Mean of at least 5 fruits in each of at least 5 mature individuals.*
8	**7.4.14**	**Fruit weight** [g]		*Mean of at least 5 fruits in each of at least 5 mature individuals.*
9	**7.4.6**	**Fruit shape**	1 Rounded 2 Ovate elongate 3 Ovoid 4 Elliptic 5 Fusiform 99 Other (specify in descriptor 7.6 Notes)	*See Fig. 5.*

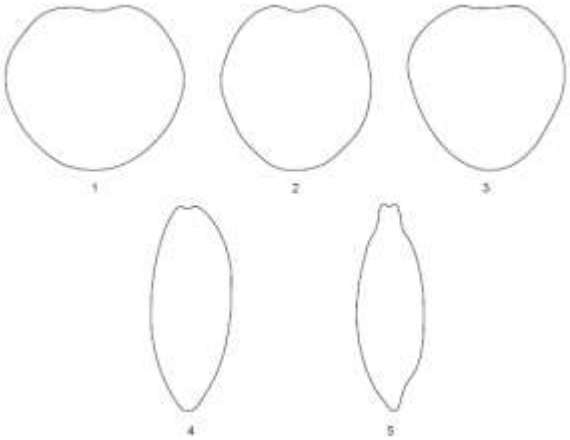

Fig. 5. Fruit shape.

Number	Bioversity number	Descriptor name	Descriptor state	Notes
10	**7.4.4**	**Mature fruit colour**	1 White 2 Green 3 Yellow 4 Orange 5 Red 6 Dark red 7 Purple 8 Blackish	*Recorded at physiological maturity.*
11	**7.4.5**	**Stripes in the mature fruit**	0 Absent 3 Green 5 Purple 7 Deep purple	*Recorded at physiological maturity.*
Additional information				
12		**Photograph**		*A photograph of several representative fruits, together with a reference scale such as a ruler or a pencil should be provided.*
13	**7.6**	**Notes**		*Specify here any additional information.*