
Descriptors for

Black pepper

(*Piper nigrum* L.)



International Plant Genetic Resources Institute
IPGRI

ISBN 92-9043-241-1

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Black pepper

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The International Plant Genetic Resources Institute (IPGRI) is an autonomous international scientific organization operating under the aegis of the Consultative Group on International Agricultural Research (CGIAR). IPGRI's mandate is to advance the conservation and use of plant genetic resources for the benefit of present and future generations. IPGRI works in partnership with other organizations, undertaking research, training and the provision of scientific and technical advice and information, and has a particularly strong programme link with the Food and Agriculture Organization of the United Nations. Financial support for the agreed research agenda of IPGRI is provided by the Governments of Australia, Austria, Belgium, Canada, China, Denmark, France, Germany, India, Italy, Japan, the Republic of Korea, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK and the USA, and by the Asian Development Bank, IDRC, UNDP and the World Bank.

Citation

IPGRI. 1995. Descriptors for Black pepper (*Piper nigrum* L.). International Plant Genetic Resources Institute, Rome, Italy.

ISBN 92-9043-241-1

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PREFACE

Descriptors for Black pepper (*Piper nigrum* L.) was developed by P.N. Ravindran, K. Nirmal Babu and V.V. Radhakrishnan with the auspices of the Indian Institute of Spices Research (Kerala, India) and prepared in the internationally accepted IPGRI format for descriptor lists. A draft version of the revision was subsequently sent to a number of experts for their comments and amendments. Their amendments were used to produce the definitive list. A full list of the names and addresses of those involved is given in 'Contributors'.

IPGRI encourages the collection of data for descriptors in the first four categories of this list: *Passport, Management, Environment and site* and *Characterization*; and endorses data in these categories as those that should be available for any accession. However, the number of each of the site and environment descriptor types used will depend on the crop and their importance to the crop's description. Descriptors listed under *Evaluation* allow for a more detailed description of the accession's characters, but generally require replicated site and time trials.

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 IPGRI throughout the world.

This descriptor list is intended to be comprehensive for the descriptors that it contains. This approach assists with the standardization of descriptor definitions. IPGRI does not, however, assume that all 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 and/or to the users of the plant genetic resources. Minimum, highly discriminating descriptors are marked with a star (★).

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 IPGRI 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.

Any suggestions on this descriptor list will be highly appreciated by IPGRI.

DEFINITIONS AND USE OF THE DESCRIPTORS

IPGRI now uses the following definitions in genetic resources documentation:

Passport descriptors: These provide the basic information used for the general management of the accession (including the 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. Germplasm collecting site descriptors 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: Many of the descriptors in this category are susceptible to environmental differences but are generally useful in crop improvement and others may involve complex biochemical or molecular characterization. They include yield, agronomic performance, stress susceptibilities and biochemical and cytological traits.

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.

Minimum highly discriminating descriptors are marked with a star (★).

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

- (a) the *Système International d'Unités* (SI system) is used. The units to be applied are given in square brackets following the descriptor name;
- (b) standard colour charts, e.g. Royal Horticultural Society Colour Chart, Methuen Handbook of Colour, or Munsell Color Charts 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);

(c) many quantitative characters which are continuously variable are recorded 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;

(d) when a descriptor is scored using a 1-9 scale, such as in (c), '0' would be scored when (i) the character is not expressed; (ii) when a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have a central leaf lobe:

Shape of central leaf lobe

- | | |
|---|----------|
| 3 | Toothed |
| 5 | Elliptic |
| 7 | Linear |

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

Absence/presence of terminal leaflet

- | | |
|----------|---------|
| 0 | Absent |
| 1 (or +) | Present |

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

(g) 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 van Hintum (1993), that clearly state a method for scoring heterogeneous accessions;

(h) dates should be expressed numerically in the format DDMMYYYY, where

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

PASSPORT

1. Accession descriptors

★ 1.1 Accession number

This number serves as a unique identifier for accessions and is assigned when an accession is entered into the collection. Once assigned this number should never be reassigned to another accession in the collection. Even if an accession is lost, its assigned number is still not available for re-use. Letters should be used before the number to identify the genebank or national system (e.g. IDG indicates an accession that comes from the genebank at Bari, Italy; CGN indicates an accession from the genebank at Wageningen, The Netherlands; PI indicates an accession within the USA system)

1.2 Donor name

Name of institution or individual responsible for donating the germplasm

1.3 Donor number

Number assigned to an accession by the donor

1.4 Other number(s) associated with the accession

Any other identification number known to exist in other collections for this accession, e.g. USDA Plant Inventory number (not Collecting number, see 2.3). Other numbers can be added as 1.4.3, etc.

1.4.1 Other number 1

1.4.2 Other number 2

★ 1.5 Scientific name

1.5.1 Genus

1.5.2 Species

1.5.3 Subspecies

1.5.4 Botanical variety

1.6 Pedigree

Parentage or nomenclature, and designations assigned to breeders' material

1.7 Cultivar

1.7.1 Cultivar name

Either a registered or other formal cultivar designation given to the accession

1.7.2 Translation/Transliteration

Provide translation of the local cultivar name into English

1.7.3 Synonyms

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

1.8 Acquisition date [DDMMYYYY]

1.9 Type of material received

- 1 Plant (including seedling)
- 2 Fruit/berry
- 3 Shoot/bud
- 4 Pollen
- 5 Other (specify in descriptor 1.12 Notes)

1.10 Accession size

Approximate number of clonal progeny of an accession in the genebank

1.11 Type of maintenance

- 1 Vegetative
- 2 Tissue culture
- 3 Other (specify in descriptor 1.12 Notes)

1.12 Notes

Any additional information may be specified here

2. Collecting descriptors

2.1 Collecting institute(s)

Institute(s) and people collecting/sponsoring the sample collection

2.2 Site number

Number assigned to the physical site by the collector

2.3 Collecting number

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

2.4 Collecting date of original sample [DDMMYYYY]**2.5 Country of collecting**

Name of the country in which the sample was collected or bred. Use the three-letter abbreviations from the *International Standard (ISO) Codes for the representation of names of countries*, No. 3166, 4th Edition. Copies of these are available from DIN: Deutsche Institut für Normung e.V., 10772 Berlin, Germany; Tel. 30-2601-2860; Fax 30-2601-1231, Tlx. 184 273-din-d

2.6 Province/State

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

2.7 Department/County

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

2.8 Location of collecting site

Distance in kilometers and direction from the nearest town, village or map grid reference point (e.g. CURITIBA 7S means 7 km south of Curitiba)

2.9 Latitude of collecting site

Degrees and minutes followed by N (North) or S (South) (e.g. 01030S)

2.10 Longitude of collecting site

Degrees and minutes followed by E (East) or W (West) (e.g. 07625W)

★ 2.11 Elevation of collecting site [m]**2.12 Collecting source**

- 1 Wild habitat
- 2 Farm land
- 3 Backyard
- 4 Market
- 5 Research organization
- 6 Other (specify in descriptor 2.32 Collector's notes)

2.13 Collecting source environment

Use descriptors 6.1.1 to 6.1.27 in section 6

2.14 Type of sample

Form 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
- 2 Pollen
- 3 Tissue culture (specify which part of the plant is used in descriptor **2.32 Collector's notes**)

2.15 Status of sample

- 1 Wild
- 2 Weedy
- 3 Breeding/research material
- 4 Landrace
- 5 Advanced cultivar
- 6 Other (specify in **2.32 Collector's notes**)

★ **2.16 Plant type**

- 1 Female
- 2 Hermaphrodite
- 3 Male

★ **2.17 Local/vernacular name**

Name given by farmer to crop and cultivar/landrace/weed. State language and dialect if the ethnic group is not provided

2.18 Ethnic group

Name of the tribe of the farmer donating the sample or of the people living in the area of collecting

2.19 Population size

Number of plants sampled. If estimated, provide method used (i) row per column count; (ii) area per plant density; for both, allow for missing stands

2.20 Plant population density

- 3 Low
- 5 Intermediate
- 7 High

2.21 Population isolation [km]

Straight line between two adjacent collecting sites

2.22 Number of clonal material (stem cuttings) collected

2.23 Type of stem cuttings collected

- 1 Terminal shoots
- 2 Lateral shoots
- 3 Runners
- 4 Hanging shoots

2.24 Cultural practices

2.24.1 Planting date [DDMMYYYY]

2.24.2 First harvest date [DDMMYYYY]

2.24.3 Irrigation

Specify amount, frequency, and method of application

2.24.4 Other

Specify in descriptor **2.32 Collector's notes**

2.25 Cropping system

- 1 Monoculture
- 2 Mixed with arecanut, coconut, etc.
- 3 Ancillary crops with tea, coffee, cardamom, rubber, etc.
- 4 Other (specify crop in descriptor **2.32 Collector's notes**)

2.26 Uses of the accession

- 1 Spice
- 2 Masticatory
- 3 Medicinal
- 4 Oleoresin
- 5 Oil
- 6 Other (specify in descriptor **2.32 Collector's notes**)

2.27 Associated flora

Other dominant crop/plant species, found in and around the collecting site

2.28 Photograph

Was a photograph(s) taken of the accession or habitat at the time of collecting? If so, provide an identification number(s) in descriptor **2.32 Collector's notes**

- 0 No
- 1 Yes

2.29 Herbarium specimen

Was a herbarium specimen collected? If so, provide an identification number in descriptor

2.32 Collector's notes

- 0 No
- 1 Yes

2.30 Prevailing stresses

Information on associated biotic and abiotic stresses and the accession's reaction. Indicate if disease indexing was done at the time of collecting

2.31 Genetic erosion

Estimate of the rate at which genetic erosion of the species is occurring in the region of collecting

- 3 Slow
- 5 Intermediate
- 7 Rapid

2.32 Collector's notes

Additional information recorded by the collector or any specific information on any state in any of the above descriptors

MANAGEMENT

3. Plant management descriptors

3.1 Accession number (Passport 1.1)

3.2 Population identification (Passport 2.3)
Collecting number, pedigree, cultivar name, etc. depending on the population type

3.3 Planting date [DDMMYYYY]

3.4 Storage address
Location of clonal, field and *in vitro* repositories and, building, room, shelf numbers/location in medium- and/or long-term storage

3.5 Storage date [DDMMYYYY]
In case of *in vitro* conservation

3.6 Plants established after storage [%]

3.7 Date of last establishment test [DDMMYYYY]
For *in vitro* repository

3.8 Establishment at the last test [%]
For *in vitro* repository

3.9 Date of next test [DDMMYYYY]
Date (estimate) when the accession should next be tested

3.10 Moisture content at storage (initial) [%]

3.11 Cultures in storage(s) [number] (Passport 1.10)

3.12 Location of duplicates of this accession
(Within the host's programme)

4. Multiplication/Regeneration descriptors

4.1 Accession number (Passport 1.1)

4.2 Population identification (Passport 2.3)
Collecting number, pedigree, cultivar name, etc. depending on the population type

4.3 Field plot number

4.4 Location

4.5 Collaborator

4.6 Cultural practices

4.6.1 Planting date [DDMMYYYY]

4.6.2 Planting density [%]

4.6.3 Harvest date [DDMMYYYY]

4.6.4 Irrigation [DDMMYYYY]
Specify amount, frequency and method of application

4.6.5 Weeding
Specify amount, frequency and method

4.6.6 Fertilizer application [g m⁻²]

4.7 Establishment in the field [%]

4.8 Plant vigour

Assessed at one year after planting

3 Low

5 Intermediate

7 High

4.9 Number of plants established by hectare

★ **4.10 Pollination method**

1 Self pollinated

2 Often cross-pollinated

3 Cross pollinated

4.11 Pollen viability

3 Low

5 Intermediate

7 High

4.12 Agronomic evaluation

Indicate vine vigour, appearance, height, width

4.13 Previous multiplication and/or regeneration

4.13.1 Location

4.13.2 Planting date [DDMMYYYY]

4.13.3 Plot number

4.14 Number of times accession regenerated

Since the date of acquisition

4.15 Number of plants used in each regeneration

4.16 Notes

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 2.5 Country of collecting)

5.2 Site (research institute)

5.2.1 Latitude

Degrees and minutes followed by N (North) or S (South) (e.g. 01030S)

5.2.2 Longitude

Degrees and minutes followed by E (East) or W (West) (e.g. 07625 W)

5.2.3 Elevation [m]

5.2.4 Name of farm or institute

5.3 Evaluator's name and address

5.4 Planting date [DDMMYYYY]

5.5 First harvest date [DDMMYYYY]

5.6 Evaluation environment

Environment in which characterization/evaluation was carried out

- 1 Field
- 2 Screenhouse
- 3 Glasshouse/plastic house
- 4 Laboratory
- 5 Other (specify in descriptor 5.13 Notes)

5.7 Field establishment [%]

5.8 Planting site in the field

Give block, strip and/or row/plot numbers as applicable, plants/plot, replication

5.9 Field spacing [%]

5.9.1 Distance between plants in a row [m]

5.9.2 Distance between rows [m]

5.10 Environmental characteristics of site

Use descriptors 6.1.1 to 6.1.27 in section 6

5.11 Fertilizer

Specify types, doses, frequency of each, and method of application

5.12 Plant protection

Specify pesticides used, doses, frequency of each, and method of application

5.13 Notes

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 profiles in elevation of the land surface on a broad scale.

The reference is 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)
9	Other	(Specify in appropriate section's Notes)

★ **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 Second level landform

(Adapted from FAO 1990)

- | | | |
|----|------------------|--|
| 1 | Alluvial plain | (A plain formed from the deposition of alluvium usually adjacent to a river that periodically overflows (aggraded valley plain, river plain, wash plain, waste plain)) |
| 2 | Coastal plain | |
| 3 | Lacustrine plain | |
| 4 | Glacial plain | |
| 5 | Peneplain | (Base-leveled plain) (Any land surface changed almost to a plain by subaerial erosion) |
| 6 | Pediment | (A piedmont slope formed from a combination of mainly erosional processes; the surface is chiefly bare rock but may have a covering veneer of alluvium or gravel (conoplain, piedmont interstream flat)) |
| 7 | Volcano | |
| 8 | Dunefield | |
| 9 | Delta | |
| 10 | Tidal flat | (A marshy, sandy, or muddy nearly horizontal coastal flatland which is alternately covered and exposed as the tide rises and falls) |
| 11 | Playa | (A small, generally sandy land area at the mouth of a stream or along the shore of a bay) |
| 12 | Cay | (A flat coral island) |
| 13 | Other | (Specify in appropriate section's Notes) |

★ **6.1.4 Slope [°]**
Estimated slope of the site

★ **6.1.5 Slope form**
It refers to the general shape of the slope in both the vertical and horizontal directions (FAO 1990)

- 1 Straight
- 2 Concave
- 3 Convex
- 4 Terraced
- 5 Complex (irregular)

★ **6.1.6 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 southwestern direction has an aspect of SW)

★ 6.1.7 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 Interfluvium | 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 | 30 Other (specify in appropriate section's Notes) |
| 15 Dune | |
| 16 Longitudinal dune | |

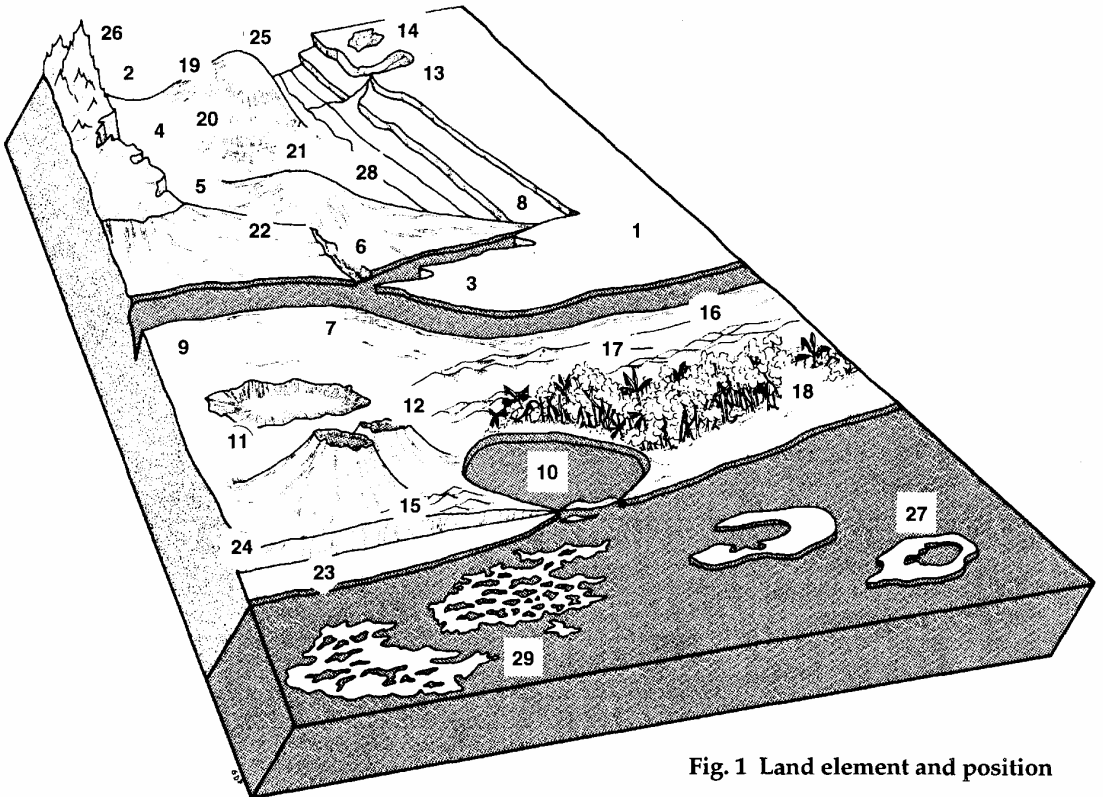


Fig. 1 Land element and position

6.1.8 Crop agriculture

(From FAO 1990)

6.1.8.1 Annual field cropping

- 1 Shifting cultivation
- 2 Fallow system cultivation
- 3 Ley system cultivation
- 4 Rainfed arable cultivation
- 5 Wet rice cultivation
- 6 Irrigated cultivation

6.1.8.2 Perennial field cropping

- 1 Non-irrigated cultivation
- 2 Irrigated cultivation

6.1.9 Overall vegetation surrounding and at the site

(From FAO 1990)

- 1 Grassland (Grasses, subordinate forbs, no woody species)
- 2 Forbland (Herbaceous plants predominant)
- 3 Forest (Continuous tree layer, crowns overlapping, large number of tree and shrub species in distinct layers)
- 4 Woodland (Continuous tree layer, crowns usually not touching, understorey may be present)
- 5 Shrubland (Continuous layer of shrubs, crowns touching)
- 6 Savanna (Grasses with a discontinuous layer of trees or shrubs)
- 7 Other (Specify in appropriate section's **Notes**)

★ **6.1.10 Soil parent material**

(Adapted from FAO 1990)

Two lists of examples of parent material and rock are given below. The reliability of the geological information and the knowledge of the local lithology will determine whether a general or a specific definition of the parent material can be given. Saprolite is used if the *in situ* weathered material is thoroughly decomposed, clay-rich but still showing rock structure. Alluvial deposits and colluvium derived from a single rock type may be further specified by that rock type

6.1.10.1 Unconsolidated material

- | | |
|----------------------------------|---|
| 1 Aeolian deposits (unspecified) | 10 Volcanic ash |
| 2 Aeolian sand | 11 Loess |
| 3 Littoral deposits | 12 Pyroclastic deposits |
| 4 Lagoonal deposits | 13 Glacial deposits |
| 5 Marine deposits | 14 Organic deposits |
| 6 Lacustrine deposits | 15 Colluvial deposits |
| 7 Fluvial deposits | 16 <i>In situ</i> weathered |
| 8 Alluvial deposits | 17 Saprolite |
| 9 Unconsolidated (unspecified) | 18 (Specify in appropriate section's Notes) |

6.1.10.2 Rock type

- | | |
|----------------------------------|---|
| 1 Acid igneous/metamorphic rock | 16 Limestone |
| 2 Granite | 17 Dolomite |
| 3 Gneiss | 18 Sandstone |
| 4 Granite/gneiss | 19 Quartzitic sandstone |
| 5 Quartzite | 20 Shale |
| 6 Schist | 21 Marl |
| 7 Andesite | 22 Travertine |
| 8 Diorite | 23 Conglomerate |
| 9 Basic igneous/metamorphic rock | 24 Siltstone |
| 10 Ultra basic rock | 25 Tuff |
| 11 Gabbro | 26 Pyroclastic rock |
| 12 Basalt | 27 Evaporite |
| 13 Dolerite | 28 Gypsum rock |
| 14 Volcanic rock | 29 Other (specify in appropriate section's Notes) |
| 15 Sedimentary rock | 30 Not known |

6.1.11 Stoniness/rockiness/hardpan/cementation

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

★ **6.1.12 Soil drainage**

(Adapted from FAO 1990)

- 3 Poorly drained
- 5 Moderately drained
- 7 Well drained

6.1.13 Flooding

(From FAO 1990)

Flooding or temporary inundation is described according to its estimated frequency, duration and sampling depth. Information may be obtained from records of past flooding or from local enquiry. The frequency and duration classes should give an indication of the average occurrence of inundation

★ 6.1.14 Soil salinity

- 1 <160 ppm dissolved salts
- 2 160 - 240 ppm
- 3 241 - 480 ppm
- 4 >480 ppm

6.1.15 Quality of the groundwater

(From FAO 1990)

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

★ 6.1.16 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

6.1.17 Soil moisture

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. (from FAO 1990)

- 3 Dry
- 5 Slightly moist
- 7 Moist
- 9 Wet

6.1.18 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 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 | 7 Reddish brown | 13 Greyish |
| 2 Red | 8 Yellowish brown | 14 Blue |
| 3 Reddish | 9 Yellow | 15 Bluish-black |
| 4 Yellowish red | 10 Reddish yellow | 16 Black |
| 5 Brown | 11 Greenish, green | |
| 6 Brownish | 12 Grey | |

★ **6.1.19 Soil pH**

Actual value of the soil within the following root depths around the accession

6.1.19.1 pH at 10-15 cm

6.1.19.2 pH at 30-60 cm

6.1.19.3 pH at 60-90 cm

6.1.20 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

★ **6.1.21 Rock fragments**

(Adapted from FAO 1990)

Large rock and mineral fragments (>2 mm) are described according to abundance

- 1 0 - 2%
- 2 2.1 - 5%
- 3 5.1 - 15%
- 4 15.1 - 40%
- 5 40.1 - 80%
- 6 >80%

- ★ 6.1.22 Soil erosion
 - 3 Low
 - 5 Intermediate
 - 7 High

6.1.23 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 below. (See Fig. 2)

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

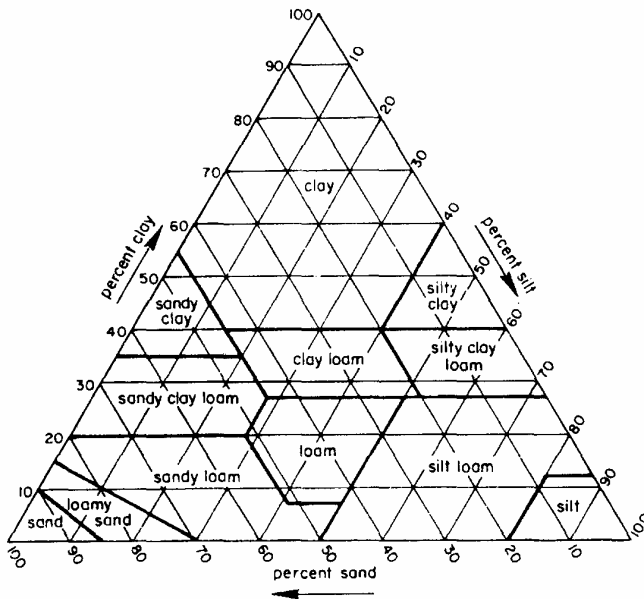


Fig. 2 Soil texture classes

★ **6.1.23.1 Soil particle size classes**

(Adapted from FAO 1990)

1	Clay	< 2 μm
2	Fine silt	2 - 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

6.1.24 Soil taxonomic classification

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

★ **6.1.25 Water availability**

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

6.1.26 Soil fertility

General assessment of the soil fertility based on existing vegetation

- 3 Low
- 5 Moderate
- 7 High

6.1.27 Climate of the site

Should be assessed as close to the site as possible

6.1.27.1 Temperature [$^{\circ}\text{C}$]

Provide either the diurnal (mean, maximum, minimum) or the seasonal (mean, maximum, minimum)

6.1.27.2 Rainfall [mm]

Annual average (state number of recorded years)

6.1.27.3 Wind [km s^{-1}]

Annual average (state number of years recorded)

6.1.27.3.1 Frequency of typhoons or hurricane force winds

6.1.27.3.2 Date of most recent typhoons or hurricane force winds
[DDMMYYYY]

6.1.27.3.3 Annual maximum wind velocity [km s⁻¹]

6.1.27.4 Frost

6.1.27.4.1 Date of most recent frost [DDMMYYYY]

6.1.27.4.2 Lowest temperature [°C]
Specify seasonal average and minimum survived

6.1.27.4.3 Duration of temperature below freezing [d]

6.1.27.5 Relative humidity

6.1.27.5.1 Relative humidity diurnal range [%]

6.1.27.5.2 Relative humidity seasonal range [%]

6.1.27.6 Light

3 Shady

7 Sunny

6.1.28 Other

(Specify in appropriate section's Notes)

Characterization

7. Plant descriptors

Unless otherwise specified, data from 5-6 year old vines should be recorded. For all colour descriptors, colour codes from Munsell Color Charts for Plant Tissues are given in parentheses beside the descriptor states

7.1 Vegetative

★ 7.1.1 Plant growth habit

- 1 Climbing (on support)
- 2 Trailing (on the ground)
- 3 Erect

7.1.2 Vine column height [m]

Measured from ground to the tip of the vine

7.1.3 Vine column diameter [m]

Measured as a means of three different locations of the column each taken from the bottom, middle and upper position of the vine

7.1.4 Support type

- 1 Living
- 2 Non-living

7.1.5 Support height [m]

Effective total height of the support available for the vine to climb

7.1.6 Support diameter [cm]

7.1.7 Branching type

- 1 Dimorphic
- 2 Polymorphic
- 3 Other (specify in descriptor 7.4 Notes)

★ 7.1.8 Young (emerging) orthotropic shoot tip colour

- 1 Greenish yellow (5GY 7-6/5GY 7-8)
- 2 Light purple (5RP 5-4/5RP 6-2)
- 3 Dark purple (5RP 4-2/5RP 4-4/5RP 5-2)
- 4 Light red (5R 4-4/5R 5-6)
- 5 Other (specify in descriptor 7.4 Notes)

7.1.9 Runner shoot production

- 3 Few
- 7 Many

7.1.10 Holding capacity

Ability to hold the support in case of climbing vines

- 3 Weak
- 7 Strong

7.1.11 Adventitious root production

- 3 Few
- 7 Many

★ **7.1.12 Absence/presence of pubescence on stem**

- 0 Absent
- 1 Present

7.1.13 Lateral branch habit

(See Fig. 3)

- 1 Erect
- 2 Horizontal
- 3 Hanging

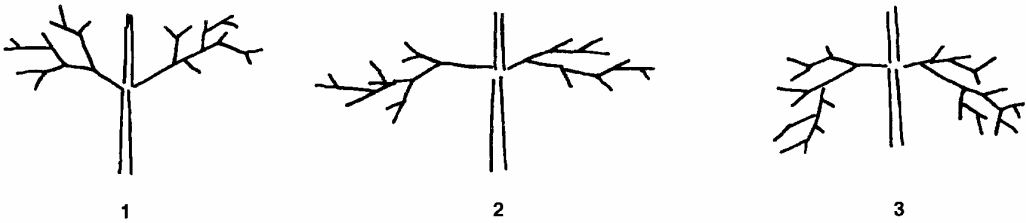


Fig. 3 Lateral branch habit

7.1.14 Lateral branch length [cm]

Average length of 50 randomly selected lateral branches

7.1.15 Number of nodes per lateral branch

Average number of 50 lateral branches

7.1.16 Juvenile leaf length

- 3 Short
- 5 Intermediate
- 7 Long

7.1.17 Leaf petiole length [cm]

Average of 50 randomly selected mature leaf petioles from the lateral branches, measured from the base to the insertion with the blade

7.1.18 Leaf length [cm]

Average of 50 randomly selected mature leaves from lateral branches, measured from the base of the midrib to the tip

7.1.19 Leaf width [cm]

Average of 50 randomly selected mature leaves from lateral branches, measured at the maximum width

7.1.20 Leaf thickness [mm]

Measured from transverse section, average of four measurements from five sections of five randomly selected mature leaves from lateral branches

7.1.21 Leaf lamina shape

Recorded from the lateral branches. See Fig. 4

- 1 Ovate
- 2 Ovate - elliptic
- 3 Ovate - lanceolate
- 4 Elliptic - lanceolate
- 5 Cordate

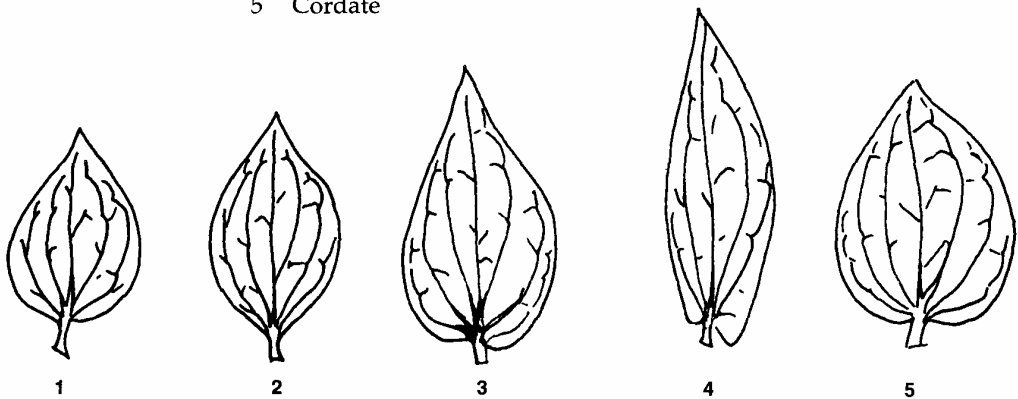


Fig. 4 Leaf lamina shape

7.1.22 Leaf base shape

(See Fig. 5)

- 1 Round
- 2 Cordate
- 3 Acute
- 4 Oblique

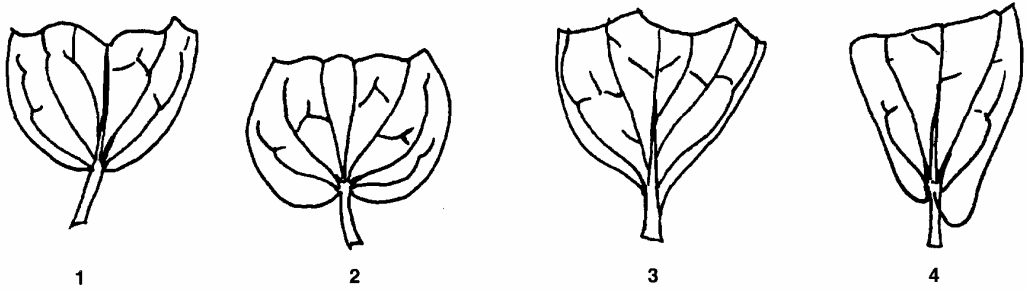


Fig. 5 Leaf base shape

7.1.23 Leaf margin

(See Fig. 6)

- 1 Even (entire)
- 2 Wavy (repand)

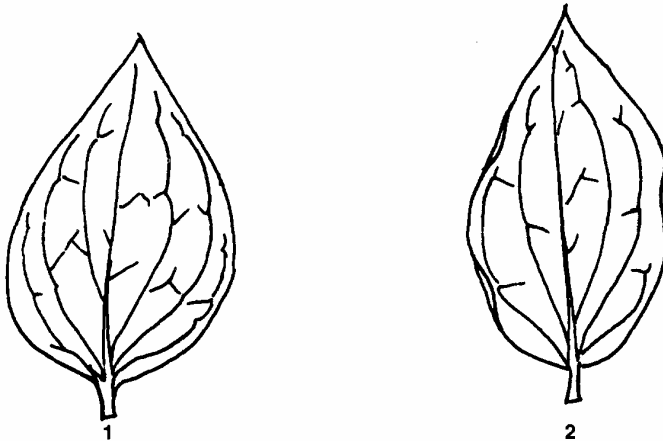


Fig. 6 Leaf margin

★ **7.1.24 Types of veining**

(See Fig. 7)

- 1 Acrodromous
- 2 Campylodromous
- 3 Eucamptodromous

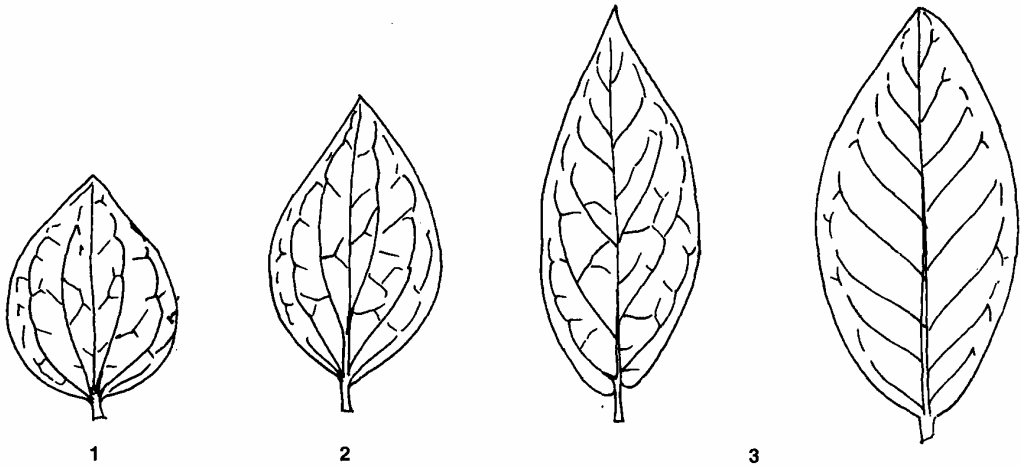


Fig. 7 Types of veining

7.1.25 Leaf texture

- 1 Glabrous coriaceous
- 2 Glabrous membranous
- 3 Glabrous sarcous
- 4 Downy membranous
- 5 Downy along the veins

★ **7.1.26 Leaf hairiness**

- 1 All over the leaf
- 2 Mainly along the veins

7.1.27 Presence/absence of leaf scales

- 0 Absent
- 1 Present

7.1.28 Presence of pearl (wax) glands

- 3 Sparse
- 5 Intermediate
- 7 Dense

7.1.29 Wax secretion

Recorded on the growing parts during the active growth period

- 3 Scarce
- 5 Intermediate
- 7 Profuse

7.2 Inflorescence and fruit

★ 7.2.1 Spike orientation

(See Fig. 8)

- 1 Erect
- 2 Prostrate

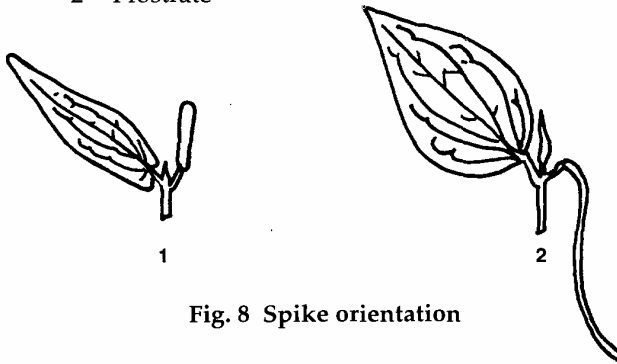


Fig. 8 Spike orientation

★ 7.2.2 Spike shape

(See Fig. 9)

- 1 Filiform
- 2 Cylindrical
- 3 Globular
- 4 Conical
- 5 Other (specify in descriptor 7.4 Notes)

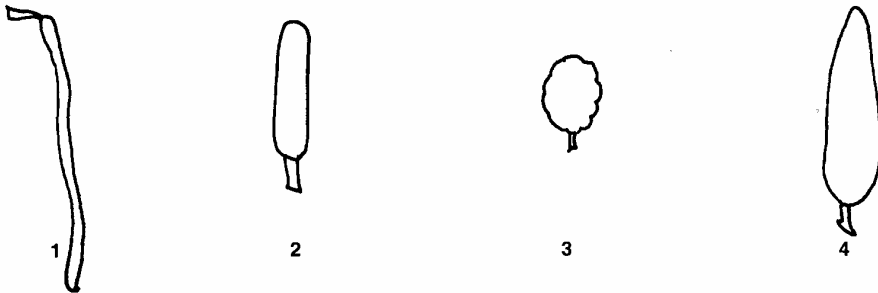


Fig. 9 Spike shape

7.2.3 Spike colour

- 1 Green (7.5GY 4-4/7.5GY 5-4)
- 2 Greenish yellow (5GY 6-8/5GY 7-6)
- 3 Light yellow (5Y 8-6)
- 4 Light purple (5RP 5-4/5RP 6-2)
- 5 Other (specify in descriptor 7.4 Notes)

- 7.2.4 Spike fragrance**
0 Not fragrant
1 Fragrant
- ★ **7.2.5 Spike length [cm]**
Average of 50 randomly selected spikes
- ★ **7.2.6 Type of hermaphroditism in spike**
1 Staminate flowers only
2 Pistillate flowers only
3 Bisexual flowers only
4 Predominantly male
5 Predominantly female
6 Predominantly bisexual
- ★ **7.2.7 Peduncle length [cm]**
Average of 50 randomly selected spikes
- 7.2.8 Number of spikes per lateral branch**
Average of 50 lateral branches
- 7.2.9 Number of spikes per vine**
Average of five vines
- 7.2.10 Number of spikes per kg**
Average of five samples
- 7.2.11 Bisexual flowers per spike [%]**
Average of 50 spikes
- 7.2.12 Pistillate flowers per spike [%]**
Average of 50 spikes
- 7.2.13 Staminate flowers per spike [%]**
Average of 50 spikes
- 7.2.14 Protogynous nature [d]**
Time gap between emergence of stigma and emergence of anthers
- 7.2.15 Flower arrangement on spike**
1 Free
2 Fused laterally

7.2.16 Number of stamens

- 1 Two
- 2 Three
- 3 Four

7.2.17 Mature anther filament length

Visual observation

- 3 Short
- 7 Long

7.2.18 Pollen fertility [%]

Estimated based on carmine, glycerol staining

7.2.19 Spike texture

- 1 Glabrous
- 2 Hirtellous

★ **7.2.20 Bract type**

(See Fig. 10)

- 1 Sessile oblong and adnate to the rachis
- 2 Peltate orbicular
- 3 Cupular with decurrent base
- 4 Fleshy, connate, transformed into a cup
- 5 Deeply cupular with decurrent base
- 6 Other (specify in descriptor 7.4 Notes)

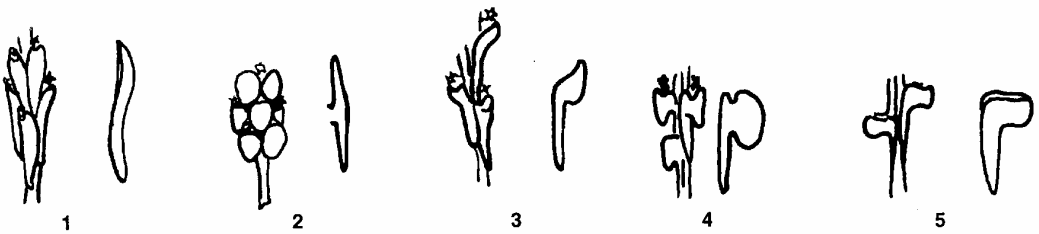


Fig. 10 Bract type

★ **7.2.21 Flower nature (insertion)**

- 1 Sessile
- 2 Shortly stipitate
- 3 Pedicillate

7.2.22 Fruit setting [%]

Average of 50 spikes

7.2.23 Number of well-developed fruits per spike

Average of 50 spikes

★ **7.2.24 Fruit shape**

(See Fig. 11)

- 1 Round
- 2 Ovate
- 3 Oblong
- 4 Other (specify in descriptor 7.4 Notes)



Fig. 11 Fruit shape

7.2.25 Fruit size

- 3 Small
- 5 Intermediate
- 7 Large

★ **7.2.26 Colour change while fruit ripening**

- 1 Green to black
- 2 Green to yellow, orange and then to red

7.2.27 Fruit taste

- 1 Bitter
- 2 Pungent
- 3 Spicy

7.2.28 1000-fruit volume [cc]**7.2.29 1000-fruit weight [g]****7.2.30 Number of days to maturity [d]**

From flowering to fruit ripening

7.3 Seed

7.3.1 1000-seed volume [cc]

Average of randomly selected seeds, recorded after removal of seed coat

7.3.2 1000-seed weight [g]

Average of randomly selected seeds recorded after removal of seed coat

7.3.3 Seed shape

- 1 Round
- 2 Ovate
- 3 Elliptical

7.3.4 Seed texture

- 1 Smooth
- 2 Sculptured

7.3.5 Seed viability

Number of days, seeds can be stored under normal conditions with 80% germination

7.3.6 Seed germination [%]

7.4 Notes

Any additional information, especially in the category of 'other' under various descriptors above, may be specified here

EVALUATION

8. Plant descriptors

8.1 Vine yield data

8.1.1 Yield of fresh fruit per vine [kg y⁻¹]

Recorded every year from first year of harvest. Average of five vines

8.1.2 Yield of dry fruit per vine [kg]

Recorded every year from first year of harvest. Average of five vines

8.1.3 Yield performance

Ability to give yields in each year

- 1 Regular
- 2 Alternate
- 3 Irregular

8.1.4 Yield per year

Average yield of five vines at 5th year

8.2 Chemical quality

To be determined after oven drying of fruits with (black pepper) or without (white pepper) fruit coat for 48 h at 45°C (ASTA method)

8.2.1 Piperine content [%]

Black pepper
White pepper

8.2.2 Oleoresin content [%]

Black pepper
White pepper

8.2.3 Essential oil content [%]

Black pepper
White pepper

8.2.4 Starch content [%]

Black pepper
White pepper

- 8.2.5 **Dry recovery**
 - Black pepper
 - White pepper

8.3 Notes

Specify here any additional information

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:

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

9.1 Low temperature

9.2 High temperature

9.3 Drought

9.4 High soil moisture

9.5 High humidity

9.6 Water salinity

9.7 Soil salinity

9.8 Reaction to mineral deficiencies

9.9 Reaction to heavy shade

9.10 Notes

Specify here any additional information

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. Indicate the age of plant when damage is observed. Record such information in descriptor **10.5 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

10.1 Arthropod pests

	Causal organism	Common name
10.1.1	<i>Longitarsus nigripennis</i>	Pollu beetle
10.1.2	<i>Cydia hemidoxa</i>	Top shoot borer
10.1.3	<i>Lophobaris piperis</i>	Stem borer
10.1.4	<i>Lepidosaphes piperis</i>	Scales
10.1.5	<i>Liothrips karnyi</i>	Marginal gall forming thrips

10.2 Nematodes

10.2.1	<i>Radopholus similis</i>	Burrowing nematode
10.2.2	<i>Meloidogyne incognita</i>	Root knot nematode
10.2.3	<i>Trophotylenchulus piperis</i>	

10.3 Fungal pathogens

10.3.1	<i>Phytophthora capsici</i>	Foot rot disease
10.3.2	<i>Phytophthora palmivora</i>	Wilt disease
10.3.3	<i>Rhizoctonia</i> , <i>Fusarium</i> and <i>Diplodia</i> spp.	Damping off, slow wilt complex
10.3.4	<i>Colletotrichum gloeosporoides</i> [<i>Glomerella cingulata</i>]	Fungal pollu, anthracnose

10.4 Phytoplasma

10.4.1	Unidentified phytoplasma	Little leaf disease
10.4.2	Unidentified phytoplasma	Phyllody disease

10.5 Notes

Specify here any additional information

11. Biochemical markers

11.1 Isozyme

For each enzyme, indicate the tissue analyzed and the zymogram type. A particular enzyme can be recorded as 11.1.1; 11.1.2, etc.

11.2 Other biochemical markers

(e.g. Flavonoid and polyphenol profiles)

12. Molecular markers

Describe any specific discriminating or useful trait for this accession. Report probe-enzyme combination analyzed

12.1 Restriction Fragment Length Polymorphism (RFLP)

12.2 Other molecular markers

(e.g. Random Amplified Polymorphic DNA (RAPD); Specific Amplicon Polymorphism (SAP))

13. Cytological characters

★ 13.1 Chromosome number

13.2 Ploidy level

(e.g. aneuploid or structural rearrangement)

13.3 Other cytological characters

14. Identified genes

Describe any known specific mutant present in the accession

REFERENCES

FAO. 1990. Guidelines for Soil Profile Description, 3rd edition (revised). Food and Agriculture Organization of the United Nations, International Soil Reference Information Centre, Land and Water Development Division. FAO, Rome.

Munsell Color. 1977. Munsell Color Charts for Plant Tissues, 2nd edition, revised. Munsell Color, Macbeth Division of Kollmorgen Corporation, 2441 North Calvert Street, Baltimore, Maryland 21218, USA.

Munsell Color. 1975. Munsell Soil Color Chart. Munsell Color, Baltimore, MD, USA.

Royal Horticultural Society, 1966, c. 1986. R.H.S. Colour Chart [ed. 1, 2]. Royal Horticultural Society, London.

van Hintum, Th. J.L. 1993. A computer compatible system for scoring heterogeneous populations. *Genetic Resources and Crop Evolution* 40:133-136.

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ACKNOWLEDGEMENTS

IPGRI wishes to place on record their sincere thanks to the numerous black pepper workers around the world who have contributed directly or indirectly to the development of the **Descriptors for Black pepper**.

Ms Adriana Alercia supervised the drafting and re-drafting of the text up to the pre-publication stage, Ms Linda Sears edited the text, Mr K. Nirmal Babu drew the illustrations, Ms Patrizia Tazza drew the cover and prepared the layout, and Mr Paul Stapleton managed the production of the publication.