

Descriptors for

Cardamom

(*Elettaria cardamomum* Maton)



International Plant Genetic Resources Institute
IPGRI

Descriptors for

Cardamom

(*Elettaria cardamomum* Maton)

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.

The international status of IPGRI is conferred under an Establishment Agreement which, by December 1993, had been signed by the Governments of Belgium, Bolivia, Cameroon, Chile, China, Cyprus, Denmark, Egypt, Greece, Hungary, India, Iran, Italy, Jordan, Kenya, Pakistan, Poland, Portugal, Romania, Russia, Senegal, Switzerland, Syria, Turkey and Uganda. IPGRI, the legal successor to the International Board for Plant Genetic Resources (IBPGR), became operational when its Headquarters Agreement with the Italian Republic was ratified by Italian Parliament in December 1993.

Financial support for the core programme 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, the USA and the World Bank

Citation

IPGRI. 1994. Descriptors for cardamom (*Elettaria cardamomum* Maton). International Plant Genetic Resources Institute, Rome.

ISBN 92-9043-234-9

IPGRI
Via delle Sette Chiese 142
00145 Rome
Italy

© International Plant Genetic Resources Institute 1994

CONTENTS

PREFACE	v
DEFINITIONS AND USE OF THE DESCRIPTORS	1
PASSPORT	3
1. Accession descriptors	3
2. Collecting descriptors	5
MANAGEMENT	10
3. Seed management descriptors	10
4. Multiplication/regeneration descriptors	11
ENVIRONMENT AND SITE	13
5. Characterization and/or evaluation site descriptors	13
6. Collecting and/or characterization/evaluation site environment descriptors	15
CHARACTERIZATION	27
7. Plant descriptors	27
EVALUATION	41
8. Plant descriptors	41
9. Abiotic stress susceptibility	42
10. Biotic stress susceptibility	43
11. Biochemical markers	47
12. Molecular markers	47
13. Cytological characters	47
14. Identified genes	48
REFERENCES	49
CONTRIBUTORS	50
ACKNOWLEDGEMENTS	52

PREFACE

Descriptors for cardamom (*Elettaria cardamomum* Maton) was developed by a group of scientists under the auspices of the AICRP on Spices and in close collaboration with the National Research Centre for Spices (Calicut) and the Indian Cardamom Research Institute (Myladumpara), under the coordination of Dr. S. Edison. A draft version of the revision prepared in the internationally accepted IPGRI format for descriptor lists was subsequently sent to a number of experts for their comments and amendments. A full list of the names and addresses of those involved is given in 'Contributors'.

IPGRI encourages the collection of data for descriptors on 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 each curator 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.

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.

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 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);

2 DESCRIPTORS FOR CARDAMOM

- (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 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 2.2). 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

4 DESCRIPTORS FOR CARDAMOM

1.6 PEDIGREE

Parentage or nomenclature, and designations assigned to breeders' material

1.7 CULTIVAR NAME

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

Date on which the accession entered the collection (in the format DDMMYYYY)

1.9 ACCESSION SIZE

Approximate number or weight of seeds of an accession in the genebank

1.10 TYPE OF MAINTENANCE

- 1 Sucker
- 2 Seedling
- 3 Sucker and seedling
- 4 Tissue culture plantlet
- 5 Cryo-preserved (v. bud, seed)
- 6 Other (specify in the NOTES, descriptor 1.11)

1.11 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 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 and should be unique and always accompany subsamples wherever they are sent

2.3 SITE NUMBER

Number assigned to the physical site by the collector

2.4 COLLECTING DATE OF ORIGINAL SAMPLE

(in the format 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: Deutsches 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)

6 DESCRIPTORS FOR CARDAMOM

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]

Altitude above sea level

2.12 COLLECTING SOURCE

- 1 Wild habitat
- 2 Farm land
- 3 Backyard
- 4 Market
- 5 Research organization
- 6 Others (specify in the descriptor COLLECTOR'S NOTES, 2.33)

2.13 COLLECTING SOURCE ENVIRONMENT

Use descriptors listed in Section 6 as 6.1.1 - 6.1.26

2.14 STATUS OF SAMPLE

- 1 Wild
- 2 Weedy
- 3 Landrace
- 4 Advanced cultivar
- 5 Breeding/research material
- 6 Released variety
- 7 Other (specify in the descriptor COLLECTOR'S NOTES, 2.33)

2.15 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 Seed
- 3 Pollen
- 4 Tissue culture

2.16 NUMBER OF PLANTS SAMPLED

2.17 NUMBER OF SUCKERS COLLECTED

2.18 NUMBER OF CAPSULES COLLECTED

2.19 WEIGHT OF SEED COLLECTED [g]

2.20 LOCAL/VERNACULAR NAME

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

2.21 ETHNIC GROUP

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

2.22 USES OF THE ACCESSION

- 1 Spices
- 2 Medicinal
- 3 Essential oil
- 4 Other (specify in the descriptor COLLECTOR'S NOTES, 2.33)

2.23 CROPPING SYSTEM

- 1 Monoculture
- 2 Mixed with arecanut, coconut, coffee, rubber etc. (specify crop(s) in the descriptor COLLECTOR'S NOTES, 2.33)

8 DESCRIPTORS FOR CARDAMOM

2.24 CULTURAL PRACTICES

2.24.1 Sowing/planting date

(in the format DDMMYYYY)

2.24.2 First harvest date

(in the format DDMMYYYY)

2.24.3 Irrigation

Specify amount, frequency, and method of application

2.25 PLANT POPULATION DENSITY

- 3 Low
- 5 Medium
- 7 High

2.26 POPULATION ISOLATION [km]

Straight-line distance between two adjacent collecting sites

2.27 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

2.28 PHOTOGRAPH

Was a photograph(s) taken of the accession or habitat at the time of collecting? If so, provide an identification number(s) in the descriptor COLLECTOR'S NOTES, 2.33

- 0 No
- 1 Yes

2.29 HERBARIUM SPECIMEN

Was a herbarium specimen collected? If so, provide an identification number in the descriptor COLLECTOR'S NOTES, 2.33

- 0 No
- 1 Yes

2.30 ASSOCIATED FLORA

Other dominant crop species, found at and around the collecting site

2.31 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

2.32 FREQUENCY OF ACCESSION AT COLLECTING SITE

- 1 Rare
- 3 Occasional
- 5 Frequent
- 7 Abundant
- 9 Very abundant

2.33 COLLECTOR'S NOTES

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

MANAGEMENT

3. SEED MANAGEMENT DESCRIPTORS

- | | | |
|------|--|----------------|
| 3.1 | ACCESSION NUMBER | (Passport 1.1) |
| 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 numbers/location in medium- and/or long-term storage) | |
| 3.4 | STORAGE DATE | |
| | (in the format DDMMYYYY) | |
| 3.5 | SEED STORAGE TREATMENT | |
| | Specify the organic/inorganic acids used and appropriate duration of the treatment | |
| 3.6 | GERMINATION AT STORAGE (INITIAL) [%] | |
| 3.7 | DATE OF LAST GERMINATION TEST | |
| | (in the format DDMMYYYY) | |
| 3.8 | GERMINATION AT THE LAST TEST [%] | |
| 3.9 | DATE OF NEXT TEST | |
| | Date when the accession should next be tested (estimate) (in the format DDMMYYYY) | |
| 3.10 | MOISTURE CONTENT AT HARVEST [%] | |
| 3.11 | MOISTURE CONTENT AT STORAGE (INITIAL) [%] | |
| 3.12 | AMOUNT OF SEED IN STORAGE(S) [g or number] | (Passport 1.9) |
| 3.13 | DUPLICATION AT OTHER LOCATION(S) | (Passport 1.4) |

4. MULTIPLICATION/REGENERATION DESCRIPTORS

- 4.1 ACCESSION NUMBER (Passport 1.1)
- 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 MULTIPLICATION/REGENERATION SITE LOCATION
- 4.5 COLLABORATOR
- 4.6 SOWING/PLANTING DATE
 (in the format DDMMYYYY)
- 4.7 TRANSPLANTING DATE
 (in the format DDMMYYYY)
- 4.8 SOWING/PLANTING DENSITY [%]
- 4.9 CULTURAL PRACTICES (Passport 2.24)
- 4.10 FERTILIZER APPLICATION
- 4.11 GERMINATION ESTABLISHMENT IN THE FIELD [%]
- 4.12 SEEDLING VIGOUR
 Assessed at 90 days after emergence
- 4.13 NUMBER OF PLANTS ESTABLISHED
- 4.14 FIRST HARVEST DATE
 (in the format DDMMYYYY)
- 4.15 NUMBER OF PLANTS POLLINATED

12 DESCRIPTORS FOR CARDAMOM

4.16 POLLINATION METHOD

100 or more flowers are preferred

- 1 Selfing
- 2 Pair crossing
- 3 Isolation
- 4 Diallel cross

4.17 NUMBER OF TIMES ACCESSION REGENERATED

4.18 PREVIOUS MULTIPLICATION AND/OR REGENERATION

4.18.1 Location

4.18.2 Planting date

(in the format DDMMYYYY)

4.18.3 Plot number

4.19 NUMBER OF PLANTS USED IN EACH REGENERATION/MULTIPLICATION

4.20 SPECIAL MULTIPLICATION REQUIREMENTS

4.20.1 Cytological

4.20.2 Environmental

4.20.3 Isolation

4.20.4 Gene identification

4.20.5 Others (specify)

ENVIRONMENT AND SITE

5. CHARACTERIZATION AND/OR EVALUATION SITE DESCRIPTORS

5.1 COUNTRY OF CHARACTERIZATION AND/OR EVALUATION

(See instructions in COUNTRY OF COLLECTING, 2.5)

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. 07625W)

5.2.3 Elevation [m]

Altitude above sea level

5.2.4 Name of farm or institute

5.3 EVALUATOR'S NAME AND ADDRESS

5.4 SOWING OR PLANTING DATE

(in the format DDMMYYYY)

5.5 TRANSPLANTING DATE

(in the format DDMMYYYY)

5.6 HARVEST DATE

(in the format DDMMYYYY)

14 DESCRIPTORS FOR CARDAMOM

5.7 EVALUATION ENVIRONMENT

Environment in which characterization/evaluation was carried out

- 1 Field
- 2 Screenhouse
- 3 Glasshouse
- 4 Laboratory
- 5 Other (specify in the descriptor NOTES, 5.16)

5.8 SEED GERMINATION [%]

5.9 FIELD ESTABLISHMENT [%]

5.10 NUMBER OF DAYS TO 50% GERMINATION

Emergence for each accession

5.11 SOWING/PLANTING SITE IN FIELD

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

5.12 FIELD SPACING

5.12.1 Distance between plants in a row [cm]

5.12.2 Distance between rows [cm]

5.13 ENVIRONMENTAL CHARACTERISTICS OF SITE

Use descriptors listed in Section 6 as 6.1.1 - 6.1.26

5.14 FERTILIZER

(Specify names, doses, frequency of each, and method of application)

5.15 PLANT PROTECTION

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

5.16 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. In: *Guidelines For Soil Profile Description*, 3rd Edition (Revised), Rome, p.70

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 range of elevation		
8	Mountainous	>30%, great range of elevation (>300 m)		
9	Other	(Specify in the 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 processes which are mainly erosional; 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 the appropriate Section's NOTES)

6.1.4 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 | 12 Caldera | 23 Beach |
| 2 Escarpment | 13 Open depression | 24 Beachridge |
| 3 Interfluv | 14 Closed depression | 25 Rounded summit |
| 4 Valley | 15 Dune | 26 Summit |
| 5 Valley floor | 16 Longitudinal dune | 27 Coral atoll |
| 6 Channel | 17 Interdunal depression | 28 Drainage line (bottom position in flat or almost flat terrain) |
| 7 Levee | 18 Mangrove | 29 Coral reef |
| 8 Terrace | 19 Upper slope | 30 Other (specify in the appropriate Section's NOTES) |
| 9 Floodplain | 20 Mid slope | |
| 10 Lagoon | 21 Lower slope | |
| 11 Pan | 22 Ridge | |

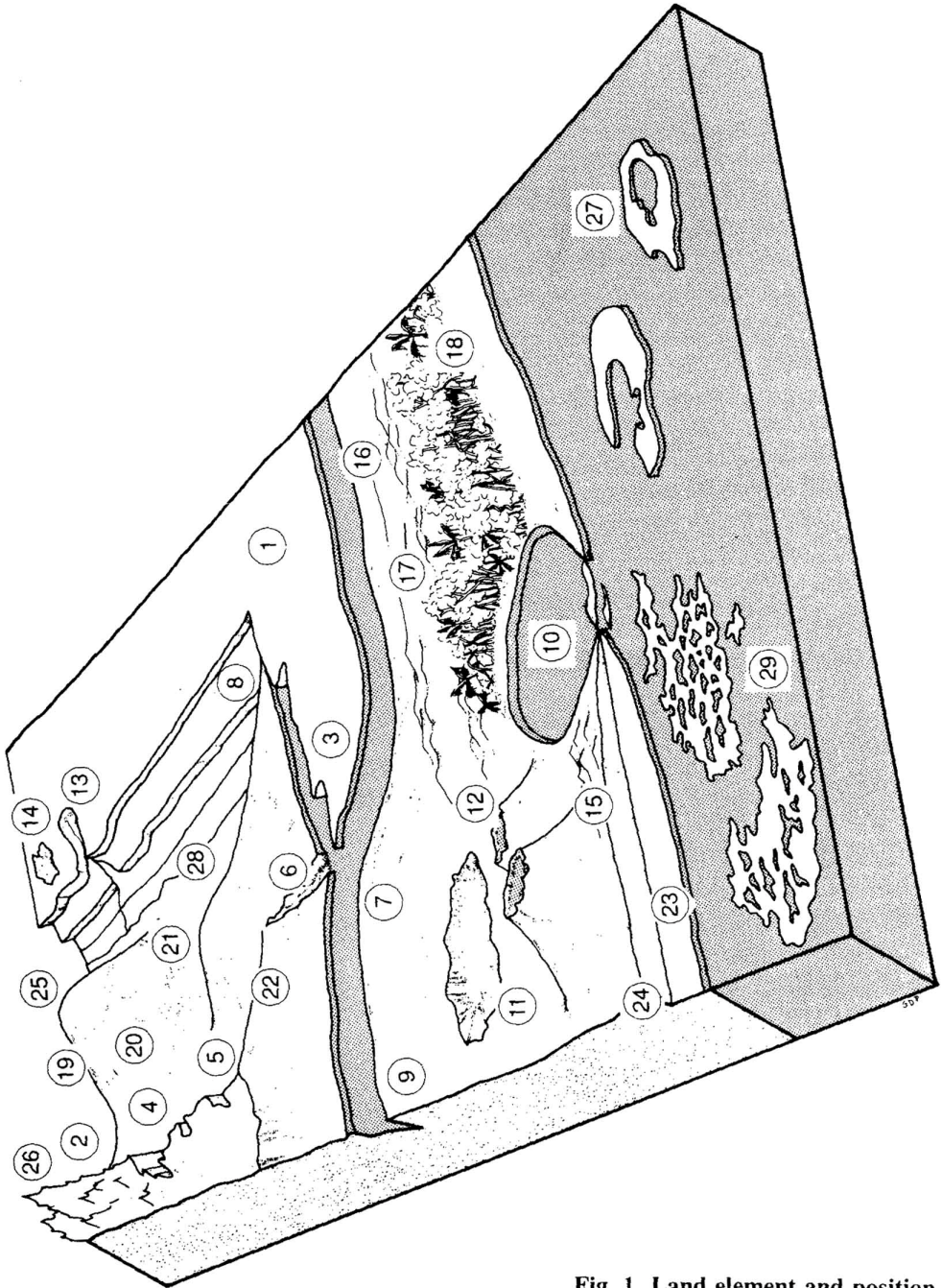


Fig. 1 Land element and position

18 DESCRIPTORS FOR CARDAMOM

6.1.5 Slope [°]

Estimated slope of the site

6.1.6 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)

6.1.7 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)

6.1.8 Crop agriculture (*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

6.1.8.3 Tree and shrub cropping

- 1 Non-irrigated tree crop cultivation
- 2 Irrigated tree crop cultivation
- 3 Non-irrigated shrub crop cultivation
- 4 Irrigated shrub crop cultivation

6.1.9 Overall vegetation surrounding and at the site (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 the 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)
- 2 Aeolian sand
- 3 Littoral deposits
- 4 Lagoonal deposits
- 5 Marine deposits
- 6 Lacustrine deposits
- 7 Fluvial deposits
- 8 Alluvial deposits
- 9 Unconsolidated (unspecified)
- 10 Volcanic ash
- 11 Loess
- 12 Pyroclastic deposits
- 13 Glacial deposits
- 14 Organic deposits
- 15 Colluvial deposits
- 16 *In situ* weathered
- 17 Saprolite

20 DESCRIPTORS FOR CARDAMOM

6.1.10.2 Rock type

- | | |
|--------------------------------------|-------------------------|
| 1 Acid igneous/
metamorphic rock | 15 Sedimentary rock |
| 2 Granite | 16 Limestone |
| 3 Gneiss | 17 Dolomite |
| 4 Granite/Gneiss | 18 Sandstone |
| 5 Quartzite | 19 Quartzitic sandstone |
| 6 Schist | 20 Shale |
| 7 Andesite | 21 Marl |
| 8 Diorite | 22 Travertine |
| 9 Basic igneous/
metamorphic rock | 23 Conglomerate |
| 10 Ultra basic rock | 24 Siltstone |
| 11 Gabbro | 25 Tuff |
| 12 Basalt | 26 Pyroclastic rock |
| 13 Dolerite | 27 Evaporite |
| 14 Volcanic rock | 28 Gypsum rock |
| | 29 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 (*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 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)

6.1.15 Quality of the groundwater (*FAO, 1990*)

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

6.1.16 Soil salinity

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

6.1.17 Soil moisture (*FAO, 1990*)

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

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

22 DESCRIPTORS FOR CARDAMOM

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 | 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 |

6.1.19 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 on 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 from 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 texture classes (Adapted from *FAO, 1990*)

For convenience in determining the texture classes of the following list, the particle size classes are given for each of the fine earth fraction 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

Soil particle size classes (Adapted from *FAO, 1990*)

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

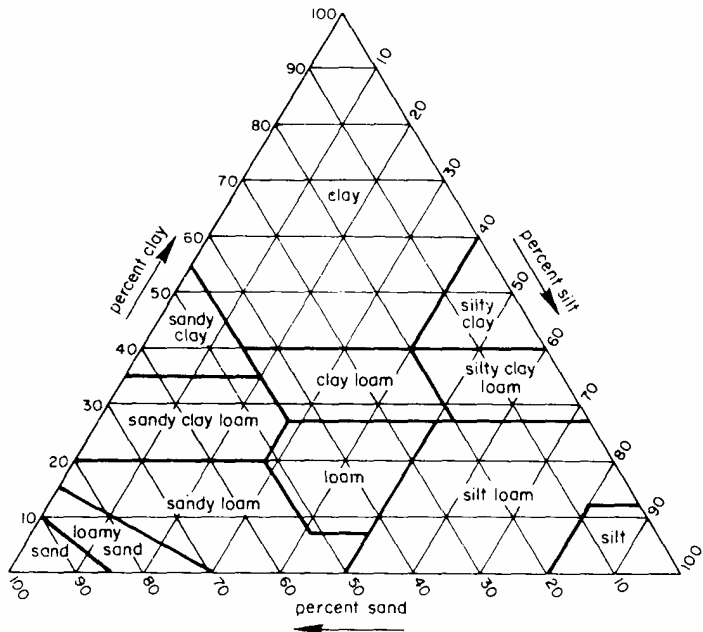


Fig. 2 Soil texture classes

6.1.23 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.)

6.1.24 Water availability

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

6.1.25 Soil fertility

- 3 Low
- 5 Moderate
- 7 High

6.1.26 Climate of the site

Should be assessed as close to the site as possible

6.1.26.1 Temperature [°C]

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

6.1.26.2 Rainfall [mm]

Annual average (state number of recorded years)

6.1.26.3 Wind [km s⁻¹]

Annual average (state number of years recorded)

6.1.26.3.1 Frequency of typhoons or hurricane force winds6.1.26.3.2 Date of most recent typhoons or hurricane force winds

(in the format DDMMYYYY)

6.1.26.3.3 Annual maximum wind velocity [km s⁻¹]6.1.26.4 Frost6.1.26.4.1 Date of most recent frost

(in the format DDMMYYYY)

6.1.26.4.2 Lowest temperature [°C]

Specify seasonal average and minimum survived

6.1.26.4.3 Duration of temperature below freezing [d]

26 DESCRIPTORS FOR CARDAMOM

6.1.26.5 Relative humidity

6.1.26.5.1 Relative humidity diurnal range [%]

6.1.26.5.2 Relative humidity seasonal range [%]

6.1.26.6 Light

3 Shady

7 Sunny

6.1.27 Other (specify in the appropriate Section's NOTES)

CHARACTERIZATION

7. PLANT DESCRIPTORS

7.1 VEGETATIVE

7.1.1 Number of days to emergence

From sowing to 50% seedling emergence

7.1.2 Seedling vigour

At 75 days after sowing

- 3 Poor
- 5 Intermediate
- 7 Vigorous

7.1.3 Plant type

- 1 Malabar (Plants are of medium size, prostrate panicle, capsules are roundish to oblong)
- 2 Mysore (Plants are robust, erect panicle, capsules are greenish and elongated)
- 3 Vazhukka (Plants are robust, semierect panicle, intermediary characters of Malabar and Mysore)

7.1.4 Plant height

Measured on the tallest tiller (up to the distal, fully opened leaf axil). Average of five plants, 3-5 years old

7.1.4.1 Malabar

- 1 (≤ 2 m)
- 2 (2.1 - 3 m)
- 3 (> 3.1 m)

7.1.4.2 Mysore/Vazhukka

- 1 (≤ 3 m)
- 2 (3.1 - 4 m)
- 3 (> 4.1 m)

28 DESCRIPTORS FOR CARDAMOM

7.1.5 Number of tillers per plant

Average of five plants, 3-5 years old

7.1.5.1 Malabar

- 1 (≤ 15)
- 2 (16 - 30)
- 3 (> 30)

7.1.5.2 Mysore/Vazhukka

- 1 (≤ 30)
- 2 (31 - 45)
- 3 (> 45)

7.1.6 Tiller colour

Observed at the base

- 1 Light green
- 2 Green
- 3 Reddish purple
- 4 Purple
- 5 Other (specify in the NOTES descriptor, 7.4)

7.1.7 Pseudostem diameter [cm]

Average of five tallest pseudostems recorded at 15 cm from base

7.1.8 Rhizome colour

- 1 Dull white
- 2 Pale green
- 3 Light purplish red
- 4 Other (specify in the NOTES descriptor, 7.4)

7.1.9 Number of leaves per plant

Average of five yielding plants, 3-5 years old

7.1.10 Leaf shape

See Fig. 3

- 1 Lanceolate
- 2 Oblong-lanceolate
- 3 Ovate
- 4 Other (specify in the NOTES descriptor, 7.4)



1 Lanceolate



2 Oblong-lanceolate



3 Ovate

Fig. 3 Leaf shape

30 DESCRIPTORS FOR CARDAMOM

7.1.11 Primary leaf shape

- 1 Reniform
- 2 Reniform-roundish
- 3 Roundish

7.1.12 Leaf pubescence

- 1 Glabrous
- 2 Puberulent (sparsely pubescent)
- 3 Pubescent

7.1.13 Primary leaf length [cm]

7.1.14 Median leaf length [cm]

Measured on the 7th leaf from the top

7.1.14.1 Malabar

- 3 Short
- 5 Intermediate
- 7 Long

7.1.14.2 Mysore/Vazhukka

- 3 Short
- 5 Intermediate
- 7 Long

7.1.15 Primary leaf width [cm]

Maximum width of first leaf from the base

7.1.16 Median leaf width [cm]

Measured on the 7th leaf from the top

7.1.16.1 Malabar

- 3 Narrow
- 5 Intermediate
- 7 Wide

7.1.16.2 Mysore/Vazhukka

- 3 Narrow
- 5 Intermediate
- 7 Wide

7.1.17 Primary leaf colour

- 1 Light green
- 2 Green
- 3 Dark Green
- 4 Reddish purple
- 5 Other (specify in the NOTES descriptor, 7.4)

7.1.18 Ligule colour

- 1 Green
- 2 Red tinted (purple)
- 3 Other (specify in the NOTES descriptor, 7.4)

7.1.19 Ligule length

- 1 ≤ 1 cm
- 2 > 1 cm

7.1.20 Pigmentation of midrib

Basal half

- 0 Not pigmented
- 1 Pigmented

7.1.21 Petiole length

- 1 (≤ 1 cm)
- 2 (> 1 cm)

7.2 INFLORESCENCE AND FRUIT

7.2.1 Number of days to first flowering

From planting to stage when 50% of bearing suckers have begun to flower

7.2.2 Regularity of fruiting

- 1 Regular
- 2 Irregular

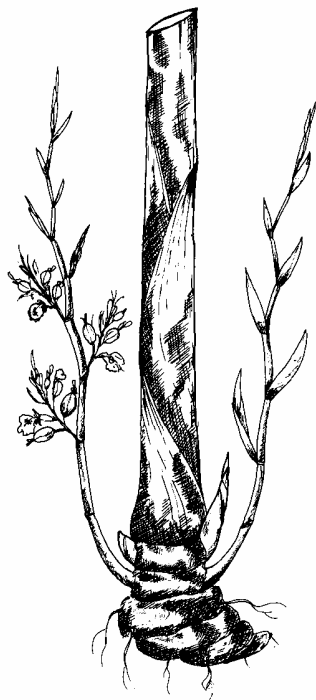
7.2.3 Presence/absence of panicle

- 0 Absent
- 1 Present

7.2.4 Nature of inflorescence origin

See Fig. 4

- 1 Basal
- 2 Terminal



1 Basal



2 Terminal

Fig. 4 Nature of inflorescence origin

7.2.5 Number of panicles per plant

Average of five plants, 3-5 years old

- 1 ≤ 10
- 2 11 - 20
- 3 21 - 30
- 4 > 31

7.2.6 Number of panicles per tiller

Average number of panicles per tiller of five 5-year-old plants

- 1 One
- 2 Two
- 3 Three and above

7.2.7 Panicle length

Average length of five plants. Recorded at the 3rd harvest

- 1 (≤ 50 cm)
- 2 (51 cm - 75 cm)
- 3 (> 75 cm)

7.2.8 Number of nodes per panicle

Average of five plants

- 1 (≤ 10)
- 2 (11 - 15)
- 3 (> 15)

7.2.9 Panicle habit

See Fig. 5

- 3 Prostrate
- 5 Intermediate (semi-erect)
- 7 Erect

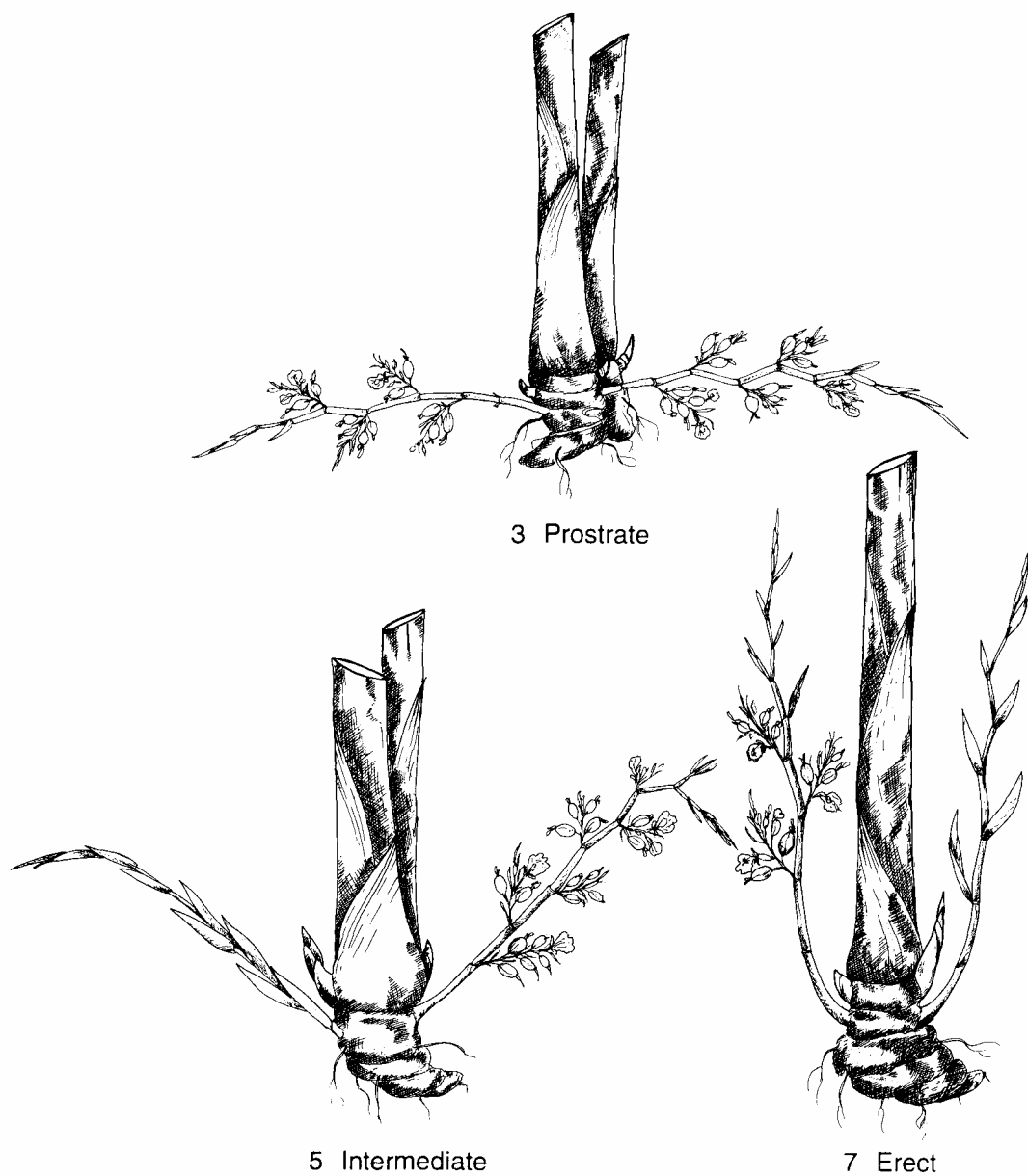


Fig. 5 Panicle habit

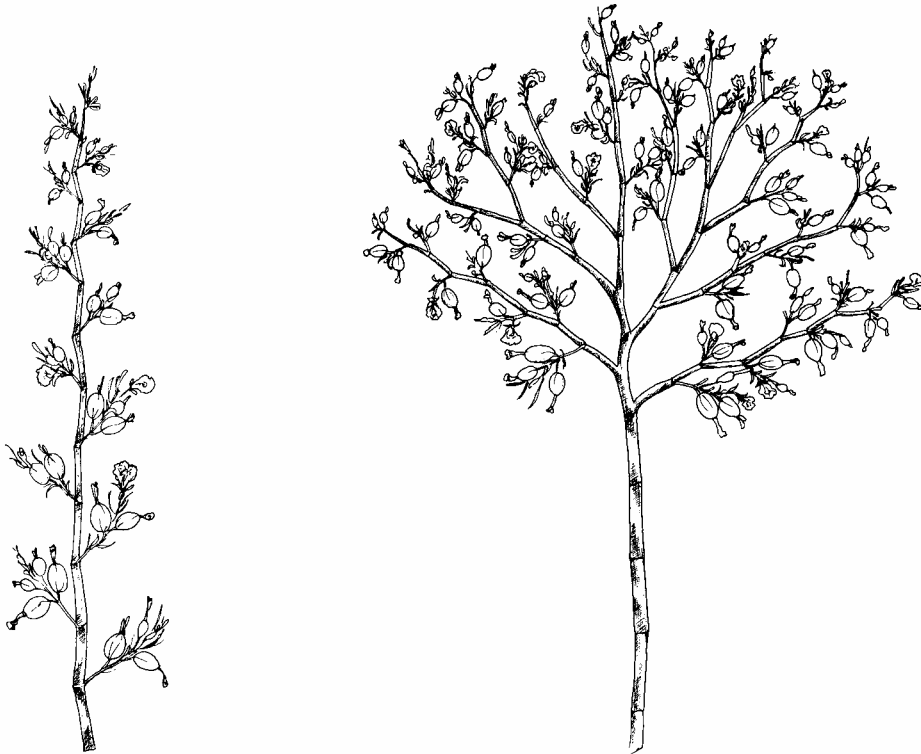
7.2.10 Internodal length [cm]

Average of five panicles taken from five plants

7.2.11 Panicle branching

See Fig. 6

- 0 Unbranched
- 1 Branched



0 Unbranched

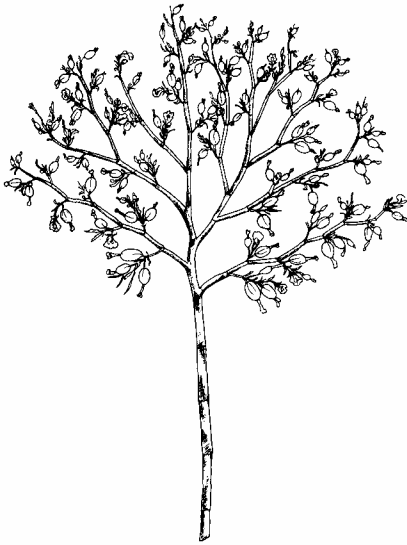
1 Branched

Fig. 6 Panicle branching

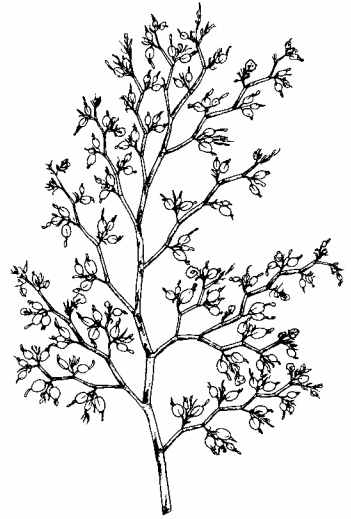
7.2.11.1 Panicle branching pattern

See Fig. 7

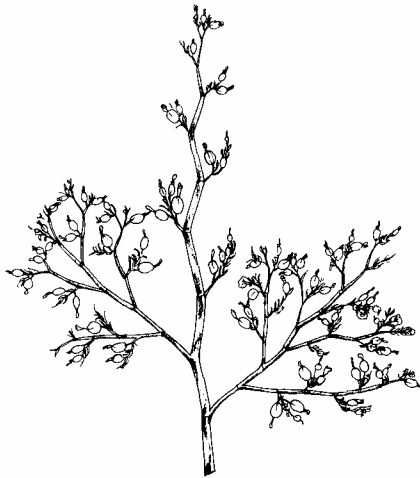
- 1 Distal
- 2 Entire
- 3 Proximal



1 Distal



2 Entire



3 Proximal

Fig. 7 Panicle branching pattern

7.2.12 Raceme branching

- 0 Unbranched
- 1 Branched

7.2.13 Number of racemes per panicle

Average of five panicles taken from five plants

7.2.14 Number of flowers per raceme

Average of five randomly selected panicles

7.2.15 Fruit-setting capacity [%]

Percentage of flowers that set capsules at the second year of flowering

7.2.16 Flower type

- 1 Open
- 2 Unopened
- 3 Cleistogamous

7.2.17 Pedicel length

- 1 <1cm
- 2 >1cm

7.2.18 Presence/absence of capsules

- 0 Absent
- 1 Present

7.2.19 Number of capsules per plant

Average of five plants, 3-5 years old

7.2.20 Number of capsules per raceme

Average of five panicles taken from five plants

7.2.21 Capsule shape

See Fig. 8

- 1 Globose
- 2 Ovoid
- 3 Narrowly ellipsoid to elongate

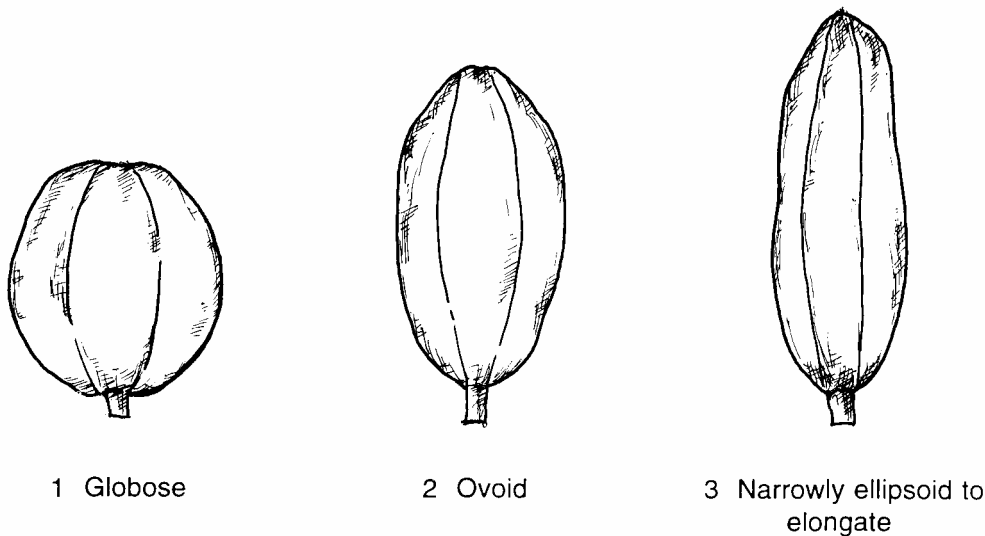


Fig. 8 Capsule shape

7.2.22 Cross section of capsule

See Fig. 9

- 1 Round
- 2 Angular
- 3 Ovate

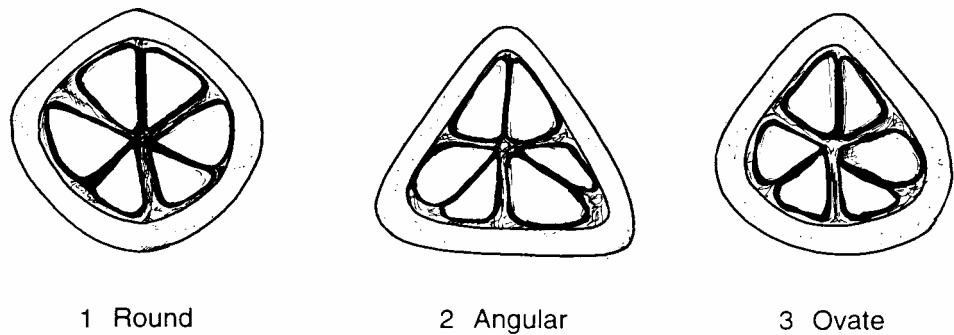


Fig. 9 Cross section of capsule

7.2.23 Immature capsule colour

- 1 Pale green
- 2 Light green
- 3 Green
- 4 Dark green
- 5 Other (specify in the NOTES descriptor, 7.4)

7.2.24 Mature capsule colour

Observed on fully matured (processed/cured) capsules

- 1 Yellow
- 2 Pale green
- 3 Parrot green
- 4 Dark green
- 5 Other (specify in the NOTES descriptor, 7.4)

7.2.25 Cured capsule colour

- 1 Yellow
- 2 Pale green
- 3 Parrot green
- 4 Dark green
- 5 Other (specify in the NOTES descriptor, 7.4)

7.2.26 100-capsule weight (dry) [g]

From the 3rd harvest. Average of 100 randomly selected capsules

7.2.27 Capsule length [mm]

Average of 20 randomly selected capsules measured at the 3rd round of harvesting

7.2.28 Capsule width [mm]

Average of 20 randomly selected capsules measured at the widest point at the 3rd harvest

40 DESCRIPTORS FOR CARDAMOM

7.2.29 Capsule shedding in the field [%]

- 1 ($\leq 1\%$)
- 2 (2 - 5%)
- 3 ($\geq 5\%$)

7.2.30 Number of seeds per capsule

Average of 50 randomly selected capsules counted at the 3rd harvest

- 1 (≤ 15)
- 2 (16 - 24)
- 3 (≥ 25)

7.3 SEED CHARACTERISTICS

7.3.1 Presence/absence of seed mucilage

- 0 Absent
- 1 Present

7.3.2 100-seed weight [g]

Weight of 100 randomly selected mature seeds from dried capsules

7.3.3 Seed size

Specify seed weight

- 3 Small
- 5 Medium
- 7 Large

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 YIELD PER PLANT

Mean weight of wet and dry capsules of five randomly selected 3-5 years old plants

8.2 SEED CHARACTERISTICS

8.2.1 Method of curing/processing

- 1 Flue pipe
- 2 Electric drier
- 3 Solar drier
- 4 Sun drying
- 5 Others (specify in the NOTES descriptor, 8.3)

8.2.2 Seed/husk ratio

Dry seed weight divided by dry capsule weight based on 100 dry capsules

8.2.3 Recovery ratio [% dry wt.)

Of one kg of wet capsules

8.2.4 Essential oil [%]

On dry whole capsule weight basis

8.2.5 Oleoresin

8.2.5.1 1,8-cineole

8.2.5.2 α Terpenyl acetate

8.2.5.3 G.L.C. profile of oils

8.3 NOTES

Any additional information may be specified 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 LOW TEMPERATURE

Measured as reduction in general vigour and productivity after being continuously exposed to an average temperature of 10°C for at least 15 days. Evaluated at full maturity

9.2 HIGH TEMPERATURE

Measured as yield reduction when continuously exposed to average of 40°C during the flowering period

9.3 DROUGHT

During first year of flowering. Number of dried leaves per tiller, number of tillers/plant

- 1 20%
- 2 21 - 50%
- 3 >51%

9.4 HIGH SOIL MOISTURE

During first year of flowering

9.5 SOIL ACIDITY

Specify pH range

- 1 ≤ 4
- 2 5 - 6
- 3 > 6

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 the NOTES descriptor, 10.5. Indicate the age of plant when damage is observed.

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

10.1 PESTS

	Causal organism	Pest or common name
10.1.1	<u><i>Acanthopsyche bipars</i> Wlk.</u>	Bag worm
10.1.2	<u><i>Alphaea biguttata</i> Wlk.</u> <u><i>Euproctis lutifacia</i> Hampson</u> <u><i>Eupterote cardamomi</i> Renga.</u> <u><i>Eupterote canaraica</i> Moore</u> <u><i>Eupterote fabia</i> Cram.</u> <u><i>Eupterote testacea</i> Wlk.</u> <u><i>Lenodora vittata</i> Wlk.</u> <u><i>Pericallia ricini</i> Fb.</u>	Hairy caterpillar
10.1.3	<u><i>Anisodes denticulatus</i> Hampson</u> <u><i>Eumelia rosalia</i> Cram.</u>	Cardamom looper
10.1.4	<u><i>Arcilasisa plagiata</i> M.</u> <u><i>Thalassodes</i> sp.</u>	Cut worm
10.1.5	<u><i>Attacus atlas</i> Linn.</u>	Leaf caterpillar
10.1.6	<u><i>Aularches miliaris</i> L.</u>	Spotted locust
10.1.7	<u><i>Basilepta fulvicorne</i> Jacoby</u>	Root grub

44 DESCRIPTORS FOR CARDAMOM

Causal organism	Pest or common name
10.1.8 <u>Brevipalpus deleoni</u> Pritchard & Baker	Mite
10.1.9 <u>Conogethes (Dichocrocis) punctiferalis</u> Guen.	Shoot/panicle/capsule borer
10.1.10 <u>Cosmoscarta thoracica</u> Dist.	Banded spittle bug
10.1.11 <u>Dialeurodes cardamomi</u> David & Subr.	Whitefly
10.1.12 <u>Discocriconemella eletariae</u> <u>Criconemella cardamomi</u>	Nematode
10.1.13 <u>Dolichotetranychus elatariae</u> Mohanasundaram <u>Eriophyes elatariae</u> Mohanasundaram <u>Tetranychus neocaledonicus</u> Andre	Mite
10.1.14 <u>Dolichotetranychus floridanus</u> (Banks)	False spider mite
10.1 15 <u>Eosocarta nilagiriensis</u> Dist.	Brown spittle bug
10.1.16 <u>Formosina flavipes</u> Malloch	Shoot fly
10.1.17 <u>Hallomyia cardamomi</u> Nayar	Root gall maggot
10.1.18 <u>Hilarographa caminodes</u> Meyr.	Root borer
10.1.19 <u>Homona</u> sp.	Leaf folding caterpillar
10.1.20 <u>Ischnodemys vachus</u> Tol.	Tingid
10.1.21 <u>Jamides</u> sp.	Early capsule borer
10.1.22 <u>Lampides elpis</u> Godt.	Flower and pod borer
10.1.23 <u>Lema</u> sp.	Leaf grub
10.1.24 <u>Meloidogyne incognita</u> <u>Meloidogyne</u> sp.	Root knot nematode
10.1.25 <u>Mytilaspis</u> sp.	Scale

Causal organism	Pest or common name
10.1.26 <u>Notocrypta feisthamelli</u> Boisduval	Cardamom skipper
10.1.27 <u>Onthophagus coorgensis</u>	Beetle borer
10.1.28 <u>Orthacris</u> sp.	Wingless grasshopper, Pink leaf hopper
10.1.29 <u>Panchaetothrips indicus</u> Bagnall <u>Sciothrips cardamomi</u> (Ramk.)	Thrips
10.1.30 <u>Pentalonia nigronervosa</u> f. <u>caladii</u> van der Goot	Aphid
10.1.31 <u>Plesioneura alysos</u> M.	Skipper
10.1.32 <u>Polythlipta maoralis</u> Led.	Leaf webbing caterpillar
10.1.33 <u>Pratylenchus</u> sp.	Lesion nematode
10.1.34 <u>Prodiotes haematicus</u> Chevr Dames	Rhizome weevil
10.1.35 <u>Radopholus</u> sp.	Burrowing nematode
10.1.36 <u>Riptortus pedestris</u> F.	Coreid bug
10.1.37 <u>Stephanitis typicus</u> Dist.	Lace wing bug
10.1.38 <u>Thammurgides cardamomi</u>	Beetle borer
10.2 FUNGI	Disease or common name
10.2.1 <u>Alternaria</u> sp. <u>Cephalosporium</u> sp. <u>Cercospora zingiberi</u> <u>Chlamydomyces palmarum</u> <u>Cladosporium</u> sp. <u>Coniothyrium</u> sp. <u>Sphaceloma</u> sp.	Leaf spot
10.2.2 <u>Colletotrichum gloeosporioides</u>	Anthrachnose
10.2.3 <u>Cylindrocarpon</u> sp.	Seedling blight

46 DESCRIPTORS FOR CARDAMOM

Causal organism	Disease or common name
10.2.4 <u><i>Fusarium</i> spp.</u>	Seedling rot
10.2.5 <u><i>Gigaspora margarita</i></u>	VAM affecting cardamom
10.2.6 <u><i>Mycosphaerella</i> sp.</u>	
10.2.7 <u><i>Microspora sphaerica</i></u>	
10.2.8 <u><i>Microxyphium</i> sp.</u>	
10.2.9 <u><i>Phaeodactylum alpiniae</i></u>	Leaf blotch
10.2.10 <u><i>Phaeotrichoconis crotalariae</i></u>	
10.2.11 <u><i>Phyllosticta eletariae</i></u>	Nursery leaf spot
10.2.12 <u><i>Phytophthora nicotianae</i> var. <i>nicotianae</i></u>	Capsule rot
10.2.13 <u><i>Pythium</i> sp.</u> <u><i>Pythium vexans</i></u> <u><i>Rhizoctonia solani</i></u>	Damping off, rhizome rot clump rot
10.2.14 <u><i>Sclerotium rolfsii</i></u>	Stem, sheath and leaf rot
10.2.15 <u><i>Septoria</i> sp.</u>	Leaf spot
10.2.16 <u><i>Uredo eletariae</i></u>	Cardamom rust
10.3 BACTERIA	
10.3.1 <u><i>Corynebacterium</i> sp.</u>	Leaf blight or Chental
10.3.2 <u><i>Xanthomonas</i> sp.</u>	Capsule canker
10.4 VIRUS	
10.4.1 <u>Cardamom mosaic virus (CarMV)</u>	Katte or mosaic
10.4.2 <u>Cardamom vein clearing virus</u>	Kokke kandu
10.4.3 <u>Nilgiri necrosis virus</u>	Nilgiri necrosis

10.5 NOTES

Specify here any additional information or response to other biotic stresses

11. BIOCHEMICAL MARKERS

11.1 ISOZYME

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

11.2 SEED PROTEINS

Record the identity of the protein where known, together with the profile with the appropriate reference to international nomenclature

11.3 OTHER BIOCHEMICAL MARKERS

(e.g. Polyphenol profile)

12. MOLECULAR MARKERS

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

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). In: *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. Rome, p.70
- Munsell Color Charts for Plant Tissues*, Second Edition, Revised 1977. Munsell Color, Macbeth Division of Kollmorgen Corporation, 2441 North Calvert Street, Baltimore, Maryland 21218, U.S.A.
- Royal Horticultural Society, 1966, c. 1986. *R.H.S. colour chart*, [ed. 1, 2]. Royal Horticultural Society, London.
- van Hintum, Th. J.L. (1993). In: *A computer compatible system for scoring heterogeneous populations*. Genetic Resources and Crop Evolution **40**: 133-136.

CONTRIBUTORS

Dr. H.M. Chandrappa

Breeder, AICRP on Spices
Regional Research Station
University of Agricultural Sciences,
Bangalore
Mudigere - 577 132
Karnataka
INDIA

Dr. S. Edison*

Project Coordinator (Spices)
National Research Centre for Spices
Marikunnu PO
Calicut - 673 012
Kerala
INDIA

Dr. A.K. Johnny

Technical Information Officer
National Research Centre for Spices
Marikunnu PO
Calicut 673 - 012
Kerala
INDIA

Mr. V.S. Korikanthimath

Scientist-in charge
National Research Centre for Spices
Cardamom Research Centre
Appangala, Heravanad PO 571 201
Kodagu Dist.
Karnataka
INDIA

Dr. K.M. Kuruvilla

Scientist (Bot.)
Indian Cardamom Research Institute
Myladumpara
Kailasanadu - 685 553
Idukki Dist.
Kerala
INDIA

Dr. Jorge León

Apartado 480
San Pedro
Montes de Oca
COSTA RICA

Mr. Regy Lukose

Scientist (Genetics & Cytogenetics)
National Research Centre for Spices
Cardamom Research Centre
Heravanad PO
Madikeri - 571 201
Karnataka
INDIA

Dr. K.J. Madhusoodhanan

Deputy Director (Research)
Indian Cardamom Research Institute
Myladumpara
Kailasanadu - 685 553
Idukki Dist.
Kerala
INDIA

* Presently on assignment with FAO as Spice Research Expert in Bangladesh

Dr. R. Naidu

Director (Research)
Coffee Board
Bangalore
Karnataka
INDIA

Dr. K.V. Peter

Director
National Research Centre for Spices
Post Bag No. 1701, Marikunnu PO
Calicut - 673 012
Kerala
INDIA

Dr. A. Ramadasan

Principal Scientist
National Research Centre for Spices
Marikunnu PO
Calicut - 673 012
Kerala
INDIA

Prof. U.R. Sangakkara

Department of Crop Science
Faculty of Agriculture
University of Peradeniya
Peradeniya
SRI LANKA

Dr. M.R. Sudharshan

Senior Scientist
I.C.R.I. (Indian Cardamom Research
Institute)
Regional Station, Donigal Post
Saklespur
Karnataka 573 134
INDIA

ACKNOWLEDGEMENTS

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

Ms. Adriana Alercia prepared the final text for publication. Illustrations were drawn by Mr. Mohankumar. The cover was drawn by Ms. Patrizia Tazza. Ms. Layla Daoud contributed to typing the text. Mr. Paul Stapleton managed the production of the publication. Dr. Marlene Diekmann verified the section on diseases. Scientific coordination was provided by Dr. Mark Perry.