

Catalogue of Sweet Potato Genetic Resources (Volume-1)



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भाकृअनुप - केंद्रीय कंद फसल अनुसंधान संसथान
(भारतीय कृषि अनुसंधान परिषद्)
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ICAR-CENTRAL TUBER CROPS RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Sreekariyam, Thiruvananthapuram – 695017, Kerala, India

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FOREWARD

Sweet potato (*Ipomoea batatas* L.) is one of the world's most important root crops, playing a vital role in food and nutritional security, particularly across tropical and subtropical regions. With its wider adaptability, short maturity period, and high beta-carotene content, it offers tremendous potential in addressing hunger, malnutrition, and climate resilience. ICAR-Central Tuber Crops Research Institute (ICAR-CTCRI), Thiruvananthapuram, Kerala, functions as the National Active Germplasm Site (NAGS) for tropical tuber crops in India. In this capacity, the Institute has taken a lead role in the systematic collection, conservation, characterization, and evaluation of sweet potato germplasm. This *Catalogue of Sweet Potato Genetic Resources – Volume 1* is a significant contribution that documents the diversity of 482 sweet potato accessions conserved at ICAR-CTCRI. It provides detailed information on morphological descriptors, duplicate accessions, core collections, and evaluation results, serving as a critical reference for researchers and breeders. As a premier institute dedicated to tropical tuber crop research, ICAR-CTCRI remains committed to preserving genetic diversity and promoting its strategic use in crop improvement programs. This catalogue reflects the institute's long-standing commitment to preserving genetic diversity and promoting its use in breeding programs to develop resilient, high-yielding, and consumer-preferred varieties. It is our hope that this catalogue will not only support ongoing research and breeding initiatives but also inspire broader utilization of sweet potato genetic resources for the benefit of farming communities and food systems worldwide.

12.12.2025

G. Byju

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INTRODUCTION

Sweet potato (*Ipomoea batatas* L.) is a versatile and climate-resilient root crop cultivated extensively in tropical, subtropical, and temperate regions. It is valued for its high productivity, adaptability to diverse agro-ecological conditions, and significant nutritional benefits particularly as a rich source of complex carbohydrates, dietary fiber, vitamins, and beta-carotene. In India, sweet potato plays an important role in food and nutritional security, particularly in rainfed, marginal, and tribal farming systems. Sweet potato with an annual global production of 93.51 million tonnes is considered as world's fifth important crop (FAOSTAT, 2023). Despite its origin in Latin America, the major share of the world's total sweet potato production is from the Asiatic belt with China being the largest producer with a production of 80.86 million tonnes followed by Malawi (6.04 million tonnes), Nigeria (3.06 million tonnes), Uganda (2.08million tonnes), Union republic of Tanzania (2.26million tonnes) and Indonesia (1.93 million tonnes) (FAOSTAT, 2023). In India, sweet potato is grown widely in the sub-tropical eastern parts of India where it is grown for consumption and is popularly referred to as "Poor man's rich food" providing adequate nutrition at a cheaper cost compared to other staples. In India, it is largely grown in north and eastern parts of India comprising of Odisha, Bihar, Chattisgarh, Jharkhand, West Bengal and Uttar Pradesh which together contributes to 90 per cent of the production in India. In South India, it is grown at several places and is traditionally popular among a large portion of India's population.

Origin and distribution

Sweet potato (*Ipomoea batatas* (L.) Lam.) originated at least 5000 years ago in tropical America and markers studies confirmed the availability of highest diversity in Central America making it the centre of origin and centre of maximum diversity (Loebenstein, 2009). Native to Central America, this plant has now established itself across the globe. Sweet potato is widely cultivated in tropical and warm temperate climates and is an important food crop in the southern United States, tropical America and the Caribbean, the warmer islands of the Pacific, Japan, and parts of Russia.

Sweet potato is grown in a wide range of environmental conditions and is associated with a number of annual and perennial crops (Nedunchezhiyan et al., 2012). Sweet potatoes can grow at altitudes ranging from sea level to 2500 meters and have a wide spectrum of variability in the skin and flesh colour starting from white to yellow, orange, and deep purple.

Taxonomy

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Solanales
Family : Convolvulaceae
Genus : *Ipomoea*
Species : *batatas*

Botany

Root System: The adventitious roots arise from the nodes of the stem that come in contact with the soil. Two distinct types of roots are observed: Fibrous roots : thin, hair-like, involved in water and nutrient absorption and storage roots : thickened, fleshy roots that store carbohydrates (mainly starch). Storage roots develop from fibrous roots through cambial activity and secondary growth. The shape and skin colour of storage roots vary with cultivar (round, long, oblong; skin and flesh colour may be white, yellow, orange, or purple).

Vines: Sweet potato vines are creeping, prostrate, or spreading in nature, though some cultivars may show semi-erect or bushy growth. Vines can grow up to 3 to 4 meters long, depending on the variety and growing conditions. They develop from the main stem and branch profusely, often covering the ground like a mat. Vines may be green or purple and may be smooth or slightly hairy.

Leaves: Leaves may be alternate, simple, highly variable in shape (cordate, lobed, or deeply palmately divided) and ranges from light green to dark green or purplish. Leaf morphology is an important taxonomic character and used for genotype differentiation.

Floral morphology: Flowers are axillary cymes, bisexual, funnel-shaped, and resemble morning glory flowers. Corolla is usually pale purple with five lobes and the flower contains 5 stamens and a single pistil with a superior ovary. Flowers are infrequent under normal cultivation, as many cultivars are sterile or require specific day lengths and temperatures to initiate flowering. Pollination is typically cross-pollination, although some varieties can self-pollinate. Flowering is influenced by photoperiod and temperature (generally short-day conditions promote flowering). Some cultivars flower profusely; others rarely flower, making

hybridization difficult. Successful pollination requires synchronization of flowering and suitable environmental conditions.

Fruits and Seeds: Fruit is a dehiscent capsule, about 1 cm in diameter, containing 1 to 4 hard black seeds. Seed formation is rare in cultivated types due to sterility or lack of pollination. Seeds are used mainly for breeding purposes, not commercial propagation.

Tubers: Sweet potato tubers, more accurately called storage roots, are modified adventitious roots that develop from fibrous roots near the stem nodes. These roots undergo secondary thickening due to cambial activity, allowing them to store large amounts of starch and other carbohydrates. They vary in shape (cylindrical, spindle-shaped, or irregular), size, skin colour (white, cream, red, or purple), and flesh colour (white, yellow, orange, or purple), depending on the variety. Orange-fleshed types are rich in β -carotene (provitamin A), while purple types are high in anthocyanins. The storage roots are the primary edible part of the plant, widely used for food, animal feed, and industrial products such as starch, flour, and alcohol.

Growth Habit: Sweet potato (*Ipomea batatas*) is grown across different agro-climatic zones such as tropical, subtropical, and frost-free temperate climatic conditions. Sweet potato grows well in temperatures between 24°C to 30°C and well drained sandy loam soils. Maturity period is 90 to 150 days, depending on variety and environmental conditions.

Propagation: Sweet potato is primarily propagated vegetatively by vine cuttings (top or middle portions with 3–5 nodes) and are planted in ridges or mounds and develop roots at the nodes. True seeds are used only in breeding programs due to genetic variability and low germination.

Genetics of sweet potato

Sweet potato is a cross pollinated, heterozygous, autohexaploid crop with $2n=6x=90$ chromosomes and *Ipomea trifida* is considered to be the diploid ancestor of cultivated sweet potato. Sweet potato exhibits self and cross-incompatibility, sterility, low flowering and low seed fertility (Vimala et al.2012). On the other hand, the hexaploidy and heterozygosity, maximum heterosis in F1 generation and vegetative propagation of sweet potato facilitates breeding for important traits.

Economic and Nutritional Importance

Sweet potato ranks second in terms of energy output among tropical tuber crops next only to cassava (Ray and Ravi, 2005). Sweet potato has been a saviour crop during the famine, disease endemic and storm-hit conditions in Japan, Africa, and China respectively. Apart from being used as a staple, the diverse utilization of sweet potato has increased over recent years and new prospects of value addition in sweet potato have gained importance. Sweet potato is a high-value nutrition-rich tuber crop often consumed for its high energy output of 150MJ/ha/day (Padmaja et al., 2012). Besides carbohydrates, they are found to be rich in dietary fiber, protein, and minerals like potassium, calcium, magnesium, sodium, phosphorus, and iron (USDA, 2009). Sweet potato (*Ipomoea batatas*) leaves and tubers are rich sources of a diverse group of antioxidative compounds with potent antioxidant activities.

**DESCRIPTORS FOR DUPLICATE IDENTIFICATION AND
CATALOUGING**

4.0 VINE CHARACTERS

4.1 Twining: Ability of vines to climb on supports.

- 0 Non- twining
- 3 Slightly twining
- 5 moderately twining
- 7 Twining
- 9 Highly twining

4.2 Plant type: Growth habit determined by length of main vines at 90 days after planting (DAP)

- 3 Erect (<7.5cm)
- 5 Semi compact (75-150 cm)
- 7 Spreading (151-250 cm)
- 9 Extremely spreading (>250cm)

4.3 Vine internode length/Diameter: Average length/diameter of three internodes located in the middle section of the vine.

4.3.1 Internode length

- 1 Very short (< 3 cm)
- 3 Short (3-5 cm)
- 5 Intermediate (6-9 cm)
- 7 Long (10-12 cm)
- 9 Very long (>12 cm)

4.3.2 Internode Diameter

- 1 Very thin (<4 mm)
- 3 Thin (4-6 mm)
- 5 Intermediate (7-9 mm)
- 7 Thick (10-12 mm)
- 9 Very thick (>12 mm)

4.4 Vine Pigmentation

Anthocyanin (purple) pigmentation present in the vines besides the green colour. The predominant colour should be evaluated considering the whole vine from base to tip. The secondary colour is more easily evaluated using younger vines.

4.4.1 Predominant vine colour

- 1 Green
- 3 Green with few purple spots
- 4 Green with many purple spots
- 5 Green with many dark purple spots
- 6 Mostly purple
- 7 Mostly dark purple
- 8 Totally purple
- 9 Totally dark purple

4.4.2 Secondary vine colour

- 0 Absent
- 1 Green base
- 2 Green tip
- 3 Green nodes
- 4 Purple base
- 5 Purple tip
- 6 Purple nodes
- 7 Other

4.5. Vine tip pubescence

Degree of hairiness of immature leaves recorded at the apex of the vines

- 0 Absent
- 3 Sparse
- 5 Moderate
- 7 Heavy

5.0 LEAF CHARACTERS

5.1 Mature leaf shape: Described by the most common expression of the outline of the leaf (Plate 1), type of the leaf lobes (Plate 2), the average total number of lobes (Plate 3) and shape of the central lobe (Plate 4) of leaves located in the middle section of the vines of 90 days old plants.

5.1.1 General outline of leaf

- 1 Rounded
- 2 Reniform (Kidney shaped)

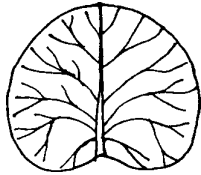
3 Cordate (Heart shaped)

4 Triangular

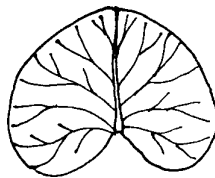
5 Hastate (Trilobular, spear shaped, with the basal lobes more or less divergent)

6 Lobed

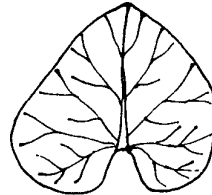
7 Almost divided



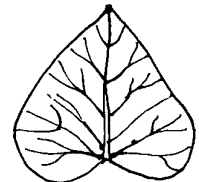
1 Rounded



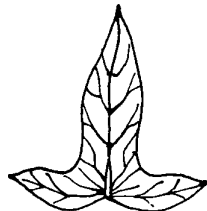
2 Reniform



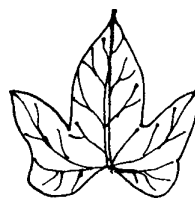
3 Cordate



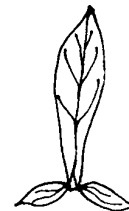
4 Triangular



5 Hastate



6 Lobed



7 Almost divided

General outline of the leaf

5.1.2 Type of lobbing

0 No lateral lobes (entire)

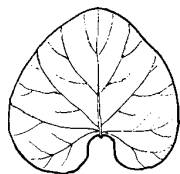
1 Very slight (teeth)

3 Slight

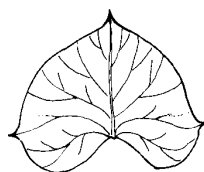
5 Moderate

7 Deep

9 Very deep



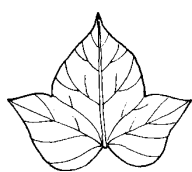
0 No lateral lobes (entire)



1 Very slight (teeth)



3 Slight



5 Moderate



7 Deep



9 Very deep

5.1.3 Number of lobes

0

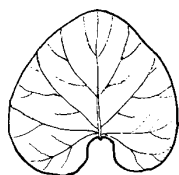
1

3

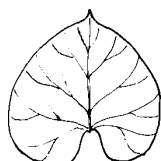
5

7

9



0



1



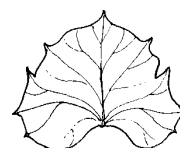
3



5



7



9

Leaf lobes number

5.1.4 Shape of central lobe

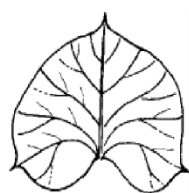
0 Absent

1 Toothed

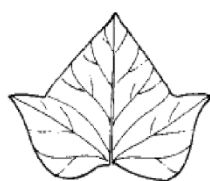
2 Triangular

3 Semi-circular

- 4 Semi-elliptic
- 5 Elliptic
- 6 Lanceolate
- 7 Oblanceolate
- 9 Linear



1 Toothed



2 Triangular



3 Semi-circular



4 Semi-elliptic



5 Elliptic



6 Lanceolate



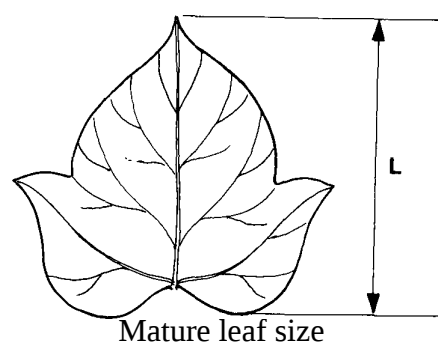
7 Oblanceolate



9 Linear(narrow)

5.2 Mature leaf size: Length from the basal lobes to the tip of the leaves. Record the average expression of at least 3 leaves located in the middle section of the vine.

- 3 Small (<8 cm)
- 5 Medium (8-15 cm)
- 7 Large (16-25 cm)
- 9 Very large (>25 cm)



5.3 Abaxial leaf vein pigmentation: Describe the most frequent expression of the distribution of anthocyanin (purple) pigmentation shown in the veins of the lower surface of leaves.

- 1 Yellow
- 2 Green

- 3 Purple spots in the base of main rib
- 4 Purple spots in several veins
- 5 Main rib partially purple
- 6 Main rib mostly or totally purple
- 7 All veins partially purple
- 8 All veins mostly or totally purple
- 9 Lower surface and veins totally purple

5.4 Foliage colour: Describe the overall foliage colour considering the colour of fully expanded mature and immature leaves of several plants. The variegation in leaf colour due to virus symptoms should not be recorded.

5.4.1 Mature leaf colour

- 1 Yellow-green
- 2 Green
- 3 Green with purple edge
- 4 Greyish-green (due to heavy pubescence)
- 5 Green with purple veins on upper surface
- 6 Slightly purple
- 7 Mostly purple
- 8 Green upper, purple lower
- 9 Purple both surfaces

5.4.2 Immature leaf colour

- 1 Yellow-green
- 2 Green
- 3 Green with purple edge
- 4 Greyish-green (due to heavy pubescence)
- 5 Green with purple veins on upper surface
- 6 Slightly purple
- 7 Mostly purple
- 8 Green upper, purple lower
- 9 Purple both surfaces

5.5 Petiole pigmentation and length: Distribution of anthocyanin pigmentation in the petiole and of leaves indicate the most predominant colour. Measure the average length from

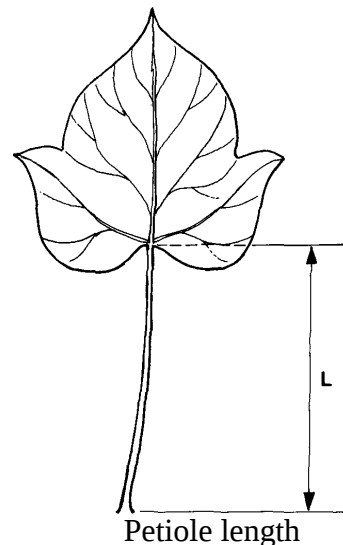
the base to the insertion with the blade of at least 3 leaves in the middle portion of a main vine.

5.5.1 Petiole pigmentation: Distribution of anthocyanin (purple) pigmentation in the petioles of leaves. Indicate the most predominant colour first

- 1 Green
- 2 Green with purple near stem
- 3 Green with purple near leaf
- 4 Green with purple at both ends
- 5 Green with purple spots throughout petiole
- 6 Green with purple stripes
- 7 Purple with green near leaf
- 8 Some petioles purple, others green
- 9 Totally or mostly purple

5.5.2 Petiole length: Average petiole length, from the base to the insertion with the blade, of at least 3 leaves in the middle portion of a main vine.

- 1 Very short (< 10 cm)
- 3 Short (10—20 cm)
- 5 Intermediate (21-30 cm)
- 7 Long (31-40 cm)
- 9 Very long (>40 cm)



6.0 STORAGE ROOT

Record all storage root descriptors considering the most representative expression of the character shown in medium- to large-sized storage roots of several plants.

6.1 Storage root shape

Storage root outline shown in longitudinal section.

- 1 Round - almost a circular outline with a length to breadth (L/β) ratio of about 1:1
- 2 Round elliptic - a slightly circular outline with acute ends. L/β ratio not more than 2:1

3 Elliptic - symmetrical outline with about the maximum breadth at equal distance from both ends which are slightly acute. L/B ratio not more than 3:1

4 Ovate - outline resembling the longitudinal section of an egg. The broadest part is at the distal end (i.e. away from the root stalk)

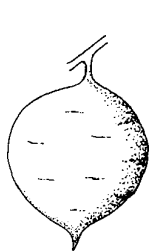
5 Obovate - inversely ovate outline. The broadest part is at the proximal end (i.e. close to the root stalk)

6 Oblong - almost rectangular outline with sides nearly parallel and corners rounded. L/B ratio about 2:1

7 Long oblong - oblong outline with a L/B ratio of more than 3:1

8 Long elliptic - elliptic outline with a L/B ratio of more than 3 to 1

9 Long irregular or curved



1 Round



2 Round elliptic



3 Elliptic



4 Ovate



5 Obovate



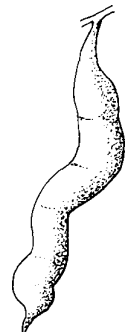
6 Oblong



7 Long oblong



8 Long Elliptic



9 Long
irregular or curved

Storage root shape

6.2 Storage root surface defects

0 Absent

1 Alligator-like skin

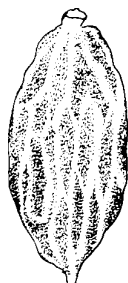
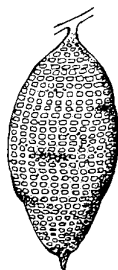
2 Veins

3 Shallow horizontal constrictions

4 Deep horizontal constrictions

5 Shallow longitudinal grooves

- 6 Deep longitudinal grooves
- 7 Deep constrictions and deep grooves
- 8 Other (specify in the NOTES descriptor, 4.4)



- 1 Alligator-like skin
- 2 Veins
- 3 Horizontal constrictions
- 5 Longitudinal grooves

Storage root surface defects

6.3 Storage root cortex thickness

- 1 Very thin (< 1 mm)
- 3 Thin (1-2 mm)
- 5 Intermediate (2-3 mm)
- 7 Thick (3-4 mm)
- 9 Very thick (>4 mm)

6.4 Storage root skin colour: Freshly harvested storage roots should be washed and dried prior to evaluation. Describe the predominant colour, it's intensity and the secondary colour. The most representative skin colour observed in the cultivar should be recorded.

6.4.1 Predominant skin colour

- 1 White
- 2 Cream
- 3 Yellow
- 4 Orange
- 5 Brownish orange
- 6 Pink
- 7 Red
- 8 Purple-red
- 9 Dark purple

6.4.2 Intensity of predominant skin colour

- 1 Pale
- 2 Intermediate
- 3 Dark

6.4.3 Secondary skin colour

- 0 Absent
- 1 White
- 2 Cream
- 3 Yellow
- 4 Orange
- 5 Brownish orange
- 6 Pink
- 7 Red
- 8 Purple-red
- 9 Dark purple

6.5 Storage root flesh colour: Describe the predominant colour, secondary colour, and the distribution of the secondary colour, from cross and longitudinal sections made about the middle of freshly harvested storage roots.

6.5.1 Predominant flesh colour

- 1 White
- 2 Cream
- 3 Dark cream
- 4 Pale yellow
- 5 Dark yellow
- 6 Pale orange
- 7 Intermediate orange
- 8 Dark orange
- 9 Strongly pigmented with anthocyanins

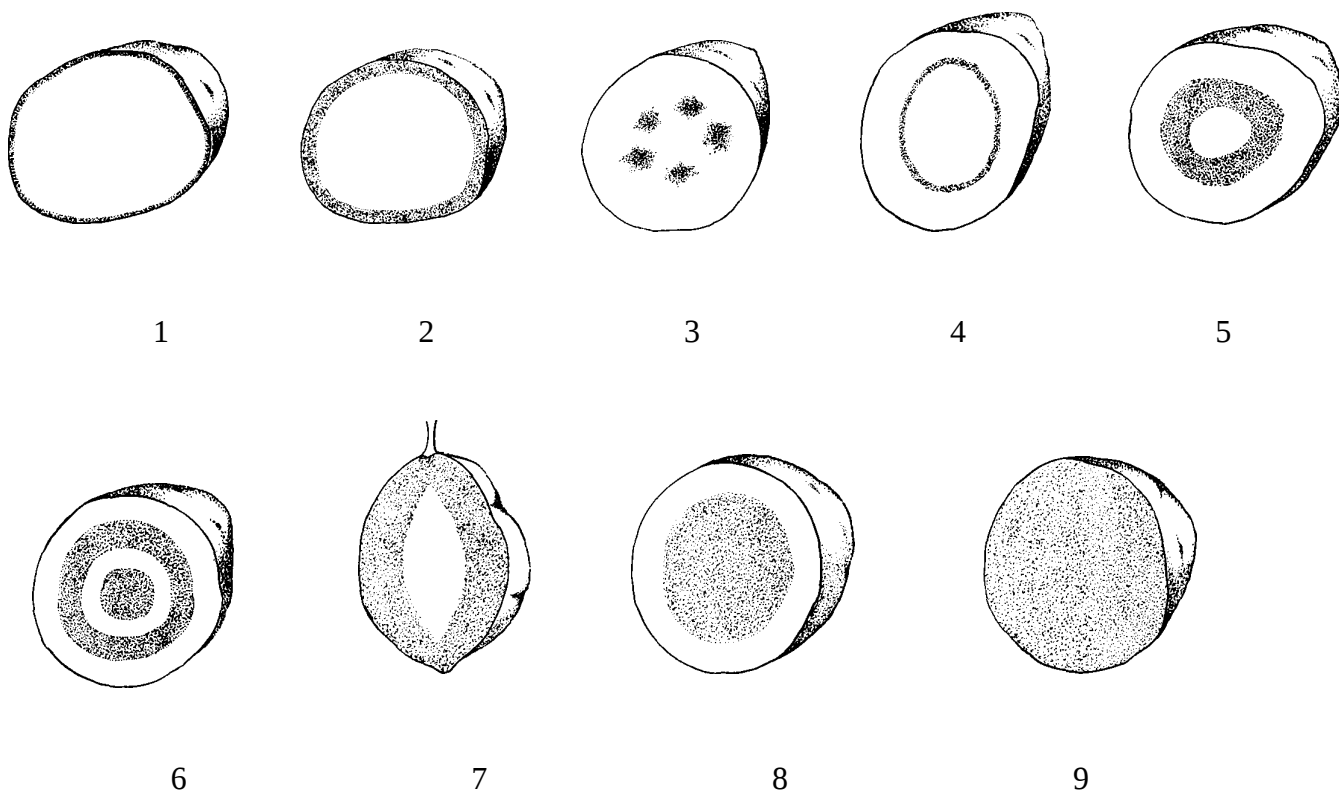
6.5.2 Secondary flesh colour

- 0 Absent
- 1 White
- 2 Cream
- 3 Yellow

- 4 Orange
- 5 Pink
- 6 Red
- 7 Purple-red
- 8 Purple
- 9 Dark purple

6.5.3 Distribution of secondary flesh colour

- 0 Absent
- 1 Narrow ring in cortex
- 2 Broad ring in cortex
- 3 Scattered spots in flesh
- 4 Narrow ring in flesh
- 5 Broad ring in flesh
- 6 Ring and other areas in flesh
- 7 In longitudinal sections
- 8 Covering most of the flesh
- 9 Covering all flesh



6.6 Root latex

- 0 No latex
- 1 low
- 2 Medium
- 3 High

6.7 Storage root arrangement: Description of the arrangement of the storage root on the underground stems.

- 1 Closed cluster
- 3 Open cluster
- 5 Disperse
- 7 very disperse

7.0 FLORAL CHARACTERS

7.1 Flowering habit

- 0 None
- 3 Sparse
- 5 Moderate
- 7 Profuse

7.2 Flower colour

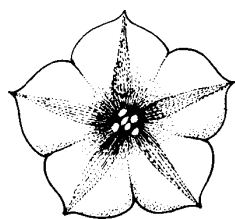
- 1 White
- 4 Pale purple limb with purple throat
- 5 Purple

7.3 Flower length

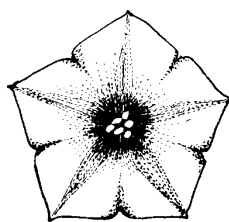
- 1 Short
- 3 Medium
- 5 Long

7.4 Shape of limb

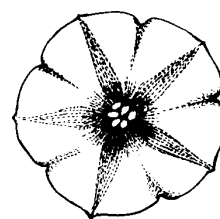
- 3 Semi-stellate
- 5 Pentagonal
- 7 Rotate



3 Semi-stellate



5 Pentagonal



7 Rotate

Shape of limb

7.5 Equality of sepal length

- 1 outer two shorter
- 2 Equal

7.6 Sepal shape

- 1 Ovate
- 3 Elliptic
- 5 Obovate
- 7 Oblong
- 9 Lanceolate



1 Ovate



3 Elliptic



5 Obovate



7 Oblong



9 Lanceolate

Sepal shape

7.7 Sepal apex

- 3 Acute
- 3 Obtuse
- 5 Acuminate
- 7 Caudate



1 Acute



3 Obtuse



5 Acuminate



7 Caudate



Sepal apex

7.8 Sepal pubescence

0 Absent

3 Sparse

5 Moderate

7 Heavy

7.9 Sepal colour

1 Green

2 Green with pigmented edge

3 Lightly pigmented

7 totally pigmented

7.10 Colour of stigma

1 White

3 Partially purple

5 Pale purple

7 Dark purple

9 Purple

7.11 Colour of style

1 White

3 White with purple at the base

5 White with purple at the top

7 Purple

7.12 Stigma exertion: The relative position of stigma as compared to the highest anther.

1 Inserted

3 Same height as highest anther

5 Slightly exerted

7 Exerted

7.13 Seed capsule set

0 None

3 Sparse

5 Moderate

7 Heavy

7.14 Length of peduncle

1 Short (<8cm)

3 Medium (9-15 cm)

5 Long (>15cm)

7.15 Length of pedicel

1 Short (<1 cm)

3 Medium (1-1.5 cm)

5 Long (>1.5cm)

7.16 Number of buds/inflorescences

1 Low (1-3)

3 Medium (4-6)

5 High (>6)

TABULATED DATA

Accession	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5.1	5.5.2	6.1	6.2	6.3	6.4	6.5	6.6
S- 1	0	5	35	10	0	7959	5	2	26	1	3	3	0	3	810	200	1
S-2	0	5	55	10	0	4155	5	2	29	1	1	2	0	3	730	700	1
S-3	0	5	13	10	0	7959	5	2	29	1	5	2	0	3	220	200	1
S-4	0	7	35	10	0	4103	5	2	23	1	1	2	0	3	820	200	1
S-6	0	5	33	10	0	4153	5	2	22	1	3	8	0	3	820	100	2
S-8	0	7	13	10	0	4133	5	3	26	1	3	3	0	3	820	100	1
S-9	0	5	35	10	0	4103	5	7	22	7	3	8	0	5	720	200	1
S-10	0	7	53	30	5	6555	5	2	26	1	3	3	0	5	810	200	1
S-11	0	7	33	30	5	6554	3	2	29	1	3	7	0	5	810	200	1
S-12	0	5	13	60	0	6554	5	3	23	5	3	8	0	1	810	700	2
S-14	0	5	33	16	0	7959	3	7	23	8	3	2	0	1	220	200	1
S-16	0	5	13	10	0	6553	5	3	22	1	3	8	0	1	210	100	1
S-17	0	7	33	10	3	6556	5	3	29	1	3	2	0	3	730	300	1
S-18	0	5	13	30	0	2163	5	2	23	1	1	2	0	3	810	200	1
S-21	0	5	13	60	0	6556	5	3	26	1	3	3	0	5	730	162	1
S-23	0	7	35	10	0	3133	5	2	22	1	3	8	0	1	210	100	1
S-24	0	7	35	10	5	3133	5	2	22	1	3	8	0	1	210	100	1
S-25	0	7	55	60	0	2103	3	3	26	4	3	8	0	9	810	292	2
S-26	0	5	55	16	0	2153	5	3	13	3	3	8	0	7	820	283	2
S-27	0	5	33	40	0	6543	3	2	22	5	3	8	0	3	910	100	2
S-28	0	5	31	10	0	6546	3	2	22	7	3	3	0	5	810	100	1
S-29	0	5	31	16	0	6546	3	3	23	1	3	2	0	3	226	100	1
S-33	0	9	55	10	0	6553	5	2	22	1	3	1	0	3	210	100	1
S-34	0	9	33	10	0	3153	3	2	22	1	1	2	0	5	220	200	0
S-35	0	9	35	10	0	3153	5	2	22	1	3	8	0	3	210	100	3
S-37	0	9	55	10	3	6761	5	2	22	1	3	3	0	5	730	200	0
S-38	0	5	35	10	0	6554	5	2	22	1	3	3	0	5	730	700	0
S-39	0	5	15	10	0	6334	5	3	23	1	1	3	0	5	730	100	0
S-41	0	7	13	60	0	6334	5	3	22	1	1	9	0	5	220	200	0
S-52	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	1
S-53	0	7	33	10	0	4133	5	2	22	1	3	3	0	5	730	100	1
S-58	0	5	13	10	0	6344	5	2	22	1	3	8	0	5	820	600	3
S-61	0	5	17	30	0	4144	5	2	23	1	3	8	0	9	830	761	1
S-62	0	5	15	30	0	3154	5	2	26	1	3	8	0	5	210	100	2
S-64	0	5	33	10	0	6343	5	2	22	1	3	8	0	5	130	100	2
S-68	0	5	33	36	0	7755	5	3	22	1	3	8	0	5	730	200	3
S-70	0	9	53	10	0	4133	5	2	23	1	3	8	0	3	810	210	1
S-71	0	9	53	10	0	4133	5	2	23	1	3	8	0	3	810	210	1
S-72	0	3	11	10	0	6755	5	2	22	1	3	3	0	5	830	200	1
S-75	5	9	53	50	3	6755	5	3	23	1	3	9	0	3	730	200	1
S-78	0	7	33	30	0	3153	5	3	26	5	3	3	0	5	810	200	1

S-80	0	5	15	10	0	6575	5	5	22	1	3	8	0	5	730	200	1
S-81	0	5	15	10	0	6555	5	2	22	1	3	3	0	7	730	200	2
S-88	0	9	13	10	0	3133	3	2	23	1	3	3	0	7	610	100	3
S-92	0	9	33	10	0	6755	5	2	22	1	5	3	0	5	830	600	2
S-95	0	5	55	16	0	3153	7	3	22	1	3	3	0	9	730	200	3
S-101	0	5	33	20	0	7959	3	7	22	4	3	3	0	3	230	200	1
S-105	0	7	33	90	0	3154	3	2	22	5	3	8	0	3	220	100	3
S-106	0	7	53	10	0	4153	5	2	22	1	5	2	0	3	620	100	1
S-109	0	5	33	10	5	3374	5	2	23	1	3	2	0	5	130	100	0
S-112	5	9	55	10	3	3133	5	2	22	1	3	3	0	5	210	200	3
S-114	0	9	53	10	0	3133	5	2	22	1	3	8	0	3	620	100	1
S-117	3	9	53	60	3	6755	5	3	23	1	1	2	0	3	820	400	3
S-118	0	9	55	30	0	2103	5	2	23	1	3	8	0	7	830	200	3
S-123	0	5	37	60	0	2103	7	2	22	1	3	8	0	5	810	200	3
S-125	0	9	53	10	0	3363	5	3	23	1	3	8	0	5	720	200	3
S-127	0	5	13	10	0	3153	5	3	22	1	3	9	0	3	730	200	3
S-129	0	5	33	10	3	2103	5	2	23	1	3	8	0	3	810	200	0
S-131	0	5	35	10	0	6554	5	2	22	1	3	8	0	3	620	400	1
S-132	0	3	13	10	5	7745	3	2	29	1	3	9	0	5	820	100	1
S-133	0	3	15	10	0	6555	5	3	22	1	1	9	0	3	420	200	1
S-134	0	7	33	10	0	3133	5	3	23	1	3	8	0	5	810	300	2
S-140	0	5	33	10	0	6554	5	2	22	1	5	3	0	5	510	300	2
S-141	0	7	51	10	0	3374	3	3	23	1	3	9	0	3	130	100	3
S-154	0	7	33	10	0	3363	3	2	23	1	3	2	0	3	620	100	2
S-167	0	5	33	10	3	7753	3	4	23	4	3	8	0	3	220	200	1
S-170	0	7	35	10	3	3153	5	3	22	1	5	2	0	3	220	100	2
S-172	0	7	53	10	0	2101	5	2	22	1	3	3	0	3	820	100	1
S-175	0	7	33	10	3	6555	5	3	22	1	3	3	0	3	620	200	3
S-182	0	7	31	10	0	2103	3	2	22	1	3	1	0	5	810	600	1
S-183	0	7	53	10	0	3133	5	2	22	1	3	2	0	3	210	100	1
S-184	0	7	31	10	0	3153	5	3	22	1	3	2	0	9	210	200	1
S-185	3	9	33	34	3	7755	5	3	23	1	3	3	0	3	210	100	2
S-187	0	5	33	17	0	6554	5	2	22	1	3	3	0	3	130	200	1
S-188	0	5	33	16	0	7959	3	7	22	4	3	3	0	3	220	200	0
S-189	0	7	33	17	0	3163	5	4	22	1	3	8	0	3	230	200	1
S-191	0	7	33	10	3	3353	3	2	22	1	1	9	0	5	730	200	3
S-197	0	5	33	10	0	6354	5	2	23	1	1	8	0	5	730	200	2
S-199	0	5	33	17	0	7959	3	3	22	1	3	8	0	3	510	200	2
S-200	0	5	33	20	0	7959	3	7	22	4	3	8	0	3	230	200	1
S-202	0	9	53	37	0	3353	5	3	26	1	1	3	0	3	510	200	1
S-203	0	7	53	37	3	6554	5	3	23	1	3	2	0	3	820	300	1
S-204	0	7	35	10	3	2104	5	3	22	1	3	2	0	7	230	400	2

S-207	0	7	33	10	3	6554	5	3	26	1	3	3	0	7	220	400	2
S-214	0	3	33	60	0	2104	5	3	22	1	3	2	0	9	130	400	2
S-215	0	3	13	10	0	3134	5	3	22	1	3	3	0	7	220	100	2
S-216	7	3	33	10	0	2104	5	3	22	1	3	2	0	5	130	100	2
S-217	0	3	33	60	3	2104	5	3	22	1	3	2	0	9	130	400	2
S-219	0	7	53	10	0	3133	5	2	23	1	3	8	0	5	230	200	1
S-220	0	3	33	10	0	7735	3	2	22	1	3	8	0	7	230	400	1
S-221	0	7	33	10	0	6554	5	2	22	1	1	9	0	5	130	100	1
S-222	0	5	33	17	0	7735	3	2	26	1	3	3	0	3	230	300	1
S-223	0	5	15	10	0	7959	5	2	26	1	3	8	0	3	810	500	2
S-224	0	7	31	10	0	3133	5	2	23	1	1	8	0	5	220	100	0
S-227	0	7	31	10	0	2104	3	4	23	1	3	9	0	5	610	200	2
S-231	0	5	31	10	0	6554	5	1	23	1	1	8	0	5	320	600	1
S-235	0	7	13	10	0	3133	5	2	23	1	3	8	0	7	220	100	1
S-236	0	7	33	10	0	3333	5	2	22	1	1	8	0	5	210	100	2
S-238	0	7	53	10	0	2104	5	2	22	1	3	8	0	5	610	200	2
S-241	0	9	53	10	0	3353	5	2	23	1	3	8	0	5	210	400	3
S-245	0	7	51	10	3	6555	3	4	23	1	3	8	0	9	220	400	2
S-254	0	7	53	10	0	3354	5	3	26	1	3	3	0	9	730	400	1
S-260	0	5	33	36	0	7959	3	2	22	5	3	3	0	5	810	400	2
S-262	0	7	53	10	0	3334	5	2	26	1	1	3	0	9	730	400	2
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S-270	0	9	55	30	5	7755	3	3	23	1	3	2	0	5	730	400	3
S-274	0	5	33	20	0	7939	3	4	22	1	1	3	0	7	730	200	1
S-275	0	5	33	26	0	7939	3	4	22	1	1	3	0	5	510	400	2
S-276	7	7	33	10	0	3134	5	2	22	1	3	3	5	3	230	100	1
S-277	0	5	35	30	0	3334	5	2	23	1	3	2	0	5	730	400	2
S-284	0	5	33	30	0	2103	5	2	22	1	3	3	0	5	130	100	1
S-285	0	7	31	10	3	3134	3	3	22	1	3	3	0	3	620	400	2
S-295	0	7	35	10	5	2103	5	3	23	1	1	8	0	3	510	400	1
S-299	3	7	51	16	3	2103	5	3	23	1	1	8	0	3	230	100	2
S-308	0	7	13	10	0	3133	5	2	23	1	3	8	0	7	220	100	1
S-310	0	7	33	10	0	2103	5	2	23	1	1	8	0	3	230	200	2
S-313	0	5	33	10	0	6554	5	2	22	1	3	3	0	5	730	400	1
S-314	0	7	51	30	0	3353	5	2	22	1	3	1	0	3	230	200	0
S-318	0	5	33	10	0	6555	5	2	23	1	3	2	0	7	730	400	1
S-324	0	5	33	30	0	2103	3	2	26	1	3	3	0	9	210	200	2
S-333	0	7	53	10	0	3133	5	2	23	1	3	3	0	5	820	200	2
S-335	0	7	33	16	0	2103	5	2	23	1	3	8	0	7	210	100	1
S-339	0	7	33	30	0	3353	5	2	22	1	1	1	0	3	216	100	1
S-341	0	5	33	35	3	3133	5	2	26	1	3	2	0	5	810	400	1
S-346	0	5	33	30	0	6534	5	4	29	5	3	3	0	3	730	100	0

S-347	0	5	33	10	5	6535	5	2	29	1	3	3	0	3	730	100	2
S-361	5	9	55	10	3	3133	5	2	22	1	3	3	0	5	210	200	3
S-363	0	7	31	10	0	3153	5	2	26	1	1	1	0	7	120	100	1
S-365	0	7	53	10	0	3133	5	2	26	1	3	1	0	5	830	200	1
S-369	0	7	33	10	0	3133	5	2	22	1	3	2	0	3	130	100	1
S-374	0	5	35	10	0	2103	5	2	26	1	3	2	0	7	230	200	1
S-382	0	7	33	10	0	3333	5	2	26	1	1	8	0	7	610	100	0
S-385	0	7	33	30	0	3333	5	2	23	1	3	2	0	5	230	100	1
S-389	0	9	33	10	3	1533	3	2	26	1	3	1	0	3	230	100	0
S-390	0	5	35	16	0	1042	3	2	22	1	1	8	0	9	820	500	1
S-395	0	7	33	30	5	5546	3	3	22	1	3	3	0	5	820	200	2
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S-412	0	7	33	10	0	4133	5	2	23	1	3	3	0	3	820	100	1
S-420	0	3	13	36	0	7755	3	3	29	1	1	6	0	3	610	700	0
S-431	0	5	33	30	0	6554	5	2	29	1	3	3	0	7	820	200	2
S-444	0	5	31	36	0	7734	5	7	29	1	3	3	0	9	730	200	0
S-451	0	3	33	35	0	7754	5	2	26	1	1	3	0	7	730	200	1
S-462	5	5	33	30	5	7755	5	3	29	1	3	8	0	3	210	200	1
S-469	0	7	33	10	0	2104	5	3	22	1	1	8	0	3	820	100	1
S-470	0	7	33	10	0	2104	5	3	22	1	1	8	0	3	820	200	1
S-471	0	7	33	36	0	2104	5	3	23	1	1	8	0	3	820	200	1
S-472	0	5	33	30	0	6334	3	2	22	1	3	8	0	3	820	600	2
S-478	0	5	33	30	0	6334	3	2	22	1	1	3	0	5	330	800	2
S-480	0	5	33	10	0	3133	5	2	23	1	1	1	0	7	730	100	1
S-483	0	5	35	10	0	6334	5	2	23	1	3	3	0	3	820	600	1
S-484	0	7	33	10	0	3153	3	4	23	1	1	8	0	5	810	100	1
S-489	0	5	31	10	0	2101	3	2	22	1	3	2	0	3	810	700	1
S-492	0	5	33	10	0	7969	3	2	29	1	3	8	0	9	730	300	1
S-497	0	5	33	36	0	6554	5	3	23	1	1	2	0	5	730	200	1
S-499	0	5	15	36	0	7959	3	7	22	5	3	3	0	3	810	200	1
S-500	0	5	33	10	0	6354	5	2	23	1	1	8	0	5	730	200	2
S-506	0	5	33	30	0	6554	5	3	29	5	3	3	0	3	920	100	1
S-508	0	5	33	10	0	7959	3	2	27	1	3	8	0	5	730	300	2
S-512	0	5	37	10	0	2103	7	2	22	1	3	3	0	3	810	100	2
S-525	0	5	33	10	0	3133	5	3	26	1	1	3	0	5	620	100	1
S-527	0	5	33	30	0	3334	3	2	29	1	3	8	0	7	810	200	1
S-528	0	5	33	30	0	3334	3	2	29	1	3	8	0	7	810	200	1
S-535	0	5	33	10	0	7959	3	2	26	1	1	8	0	7	620	400	0
S-540	0	5	13	36	0	6555	5	4	29	5	1	8	0	1	930	200	1
S-547	0	5	33	10	5	3134	5	2	29	1	1	3	0	3	410	700	1
S-561	0	7	33	30	0	6555	5	2	22	1	1	3	0	5	810	400	1

S-564	0	7	33	10	0	3133	5	3	23	1	1	8	0	7	810	200	2
S-567	0	7	33	10	0	3133	5	3	23	1	1	8	0	3	730	300	2
S-570	0	7	33	35	3	6755	3	2	23	1	1	3	0	5	230	300	2
S-571	0	5	11	30	0	3133	5	2	23	1	3	8	0	5	810	300	1
S-574	3	3	33	30	0	7755	3	2	23	1	1	8	0	3	230	100	1
S-577	3	5	13	15	0	3333	3	2	23	1	1	8	0	3	820	100	0
S-579	0	5	33	30	5	3134	3	2	23	4	1	3	0	9	820	200	1
S-580	0	5	53	30	0	6554	5	2	23	1	3	8	0	5	720	200	1
S-581	0	5	33	15	3	3334	5	3	26	1	1	8	0	5	620	400	1
S-582	0	7	53	10	0	6555	5	2	22	1	3	3	0	7	130	100	1
S-584	0	7	31	10	3	3334	3	2	23	1	3	3	0	7	830	200	0
S-586	0	7	33	30	0	6554	3	2	26	1	1	3	0	5	730	500	2
S-587	0	5	33	36	0	7755	5	3	22	1	3	8	0	5	730	200	3
S-592	0	5	33	10	3	4334	3	2	23	1	3	3	0	5	820	100	2
S-594	0	7	33	10	0	2104	5	2	22	1	3	3	0	7	820	700	3
S-604	0	7	33	30	5	3154	5	2	23	1	1	3	0	3	630	400	2
S-607	0	7	33	10	5	6554	5	2	23	1	1	8	0	3	820	300	1
S-609	0	7	31	60	5	4133	3	3	22	5	1	8	0	3	720	200	2
S-612	0	7	53	30	5	6555	5	2	26	1	3	3	0	5	810	200	2
S-615	0	7	53	30	5	7759	5	3	26	5	1	3	0	3	730	100	1
S-618	0	5	15	10	3	4153	5	2	22	1	1	2	0	5	730	200	1
S-623	0	5	33	30	0	5133	5	4	23	5	1	8	0	5	600	100	0
S-625	0	5	33	36	7	6555	5	4	23	5	1	0	0	0	0	0	0
S-629	0	7	33	10	5	6555	5	2	26	1	3	8	0	5	730	100	0
S-630	0	7	31	30	0	7755	3	4	23	5	1	3	0	3	810	400	0
S-632	0	5	37	36	7	7755	5	7	23	5	3	3	0	3	730	100	1
S-641	0	3	11	30	3	6554	3	7	26	5	1	3	0	3	730	200	1
S-644	0	5	35	30	7	6334	3	5	22	5	1	3	0	3	210	200	0
S-645	0	5	55	70	7	3133	5	7	26	5	1	3	0	7	730	300	1
S-647	0	5	31	10	5	7969	5	2	26	1	3	3	0	5	810	300	2
S-648	0	7	53	30	0	3133	5	2	22	1	3	2	0	3	130	100	1
S-655	0	5	11	30	5	6554	3	6	22	3	1	3	0	3	610	210	1
S-657	0	5	13	30	0	7959	3	7	22	5	1	3	0	5	610	200	2
S-658	0	5	13	30	0	7959	3	7	22	5	1	3	0	5	610	200	2
S-662	0	5	33	10	0	6555	3	7	22	5	3	3	0	7	220	200	0
S-674	0	7	51	60	0	6554	5	7	22	3	3	8	0	7	620	200	1
S-681	0	7	33	30	3	3151	3	2	26	1	3	8	0	1	210	100	1
S-682	0	5	35	30	3	6554	5	7	22	5	3	3	0	5	210	200	2
S-686	0	7	55	10	0	6533	5	2	29	1	3	0	0	0	0	0	0
S-695	0	5	31	60	0	5556	3	3	23	4	1	2	0	3	910	200	1
S-700	0	5	53	36	0	5556	3	7	22	5	1	2	0	5	210	200	0
S-702	0	7	33	46	0	5564	5	4	22	4	1	2	0	3	130	100	0

S-703	0	7	51	30	0	5546	3	3	22	1	3	2	0	3	230	500	0
S-710	0	3	15	60	0	6554	5	3	22	4	3	3	0	5	730	200	2
S-711	0	5	35	30	0	7959	5	7	23	5	1	3	0	3	730	100	0
S-713	0	5	15	10	0	7959	5	2	26	1	3	8	0	3	810	500	2
S-726	0	3	35	10	0	6354	5	2	22	1	3	3	0	5	230	200	0
S-728	0	7	31	30	0	6557	3	3	22	4	1	3	0	5	830	200	1
S-729	0	7	37	60	0	7757	5	7	22	5	1	3	0	5	620	200	1
S-730	0	7	37	60	0	6554	5	7	24	5	1	3	0	5	230	300	0
S-731	0	5	35	60	0	7777	5	2	22	2	1	3	0	3	610	100	0
S-732	0	3	15	60	0	7759	3	2	26	5	3	5	0	3	610	500	0
S-734	0	5	13	60	3	6554	5	3	22	4	3	3	0	5	930	400	1
S-735	0	5	13	16	0	7777	3	3	23	1	1	3	0	3	820	100	0
S-736	0	9	33	36	0	6554	3	3	22	4	1	3	0	3	910	100	1
S-737	0	3	15	30	0	7757	3	7	22	1	1	3	0	3	620	200	2
S-738	9	9	33	30	5	6557	3	3	24	4	1	3	0	3	810	100	2
S-739	0	9	53	30	5	6535	3	2	22	3	1	3	0	3	820	200	0
S-741	0	9	53	35	0	6554	5	3	22	4	1	8	0	9	220	200	0
S-749	0	3	35	10	0	7767	5	2	29	1	3	2	0	7	730	200	2
S-750	0	7	35	10	0	7554	5	2	22	1	3	3	0	3	720	200	1
S-755	0	5	55	16	0	6557	5	2	22	1	1	2	0	3	730	200	2
S-759	0	7	33	10	0	4134	5	2	22	1	3	8	0	7	610	100	2
S-760	3	9	31	30	0	7759	3	2	22	1	3	8	0	7	610	100	2
S-772	0	7	53	15	0	6334	5	2	24	1	3	8	0	3	810	200	2
S-773	0	5	33	30	0	7755	5	2	24	1	3	3	0	3	610	200	1
S-774	0	7	35	36	0	6333	3	2	26	4	3	8	0	3	620	200	3
S-775	0	9	33	36	0	6333	3	4	24	5	5	8	0	3	810	200	1
S-776	0	7	55	10	0	6553	5	2	22	1	3	3	0	3	730	200	2
S-778	0	3	33	10	0	7959	3	1	23	1	1	8	0	3	610	100	2
S-784	0	3	33	10	0	7977	5	7	24	4	3	8	0	3	230	400	1
S-785	0	9	33	10	0	7977	5	7	24	4	3	3	0	5	810	200	2
S-789	0	7	33	30	0	3364	3	2	24	4	3	2	0	5	810	200	1
S-791	0	7	35	30	0	6359	3	2	24	4	3	3	0	7	820	200	1
S-797	0	5	33	10	7	7757	3	2	23	1	3	8	0	5	730	400	2
S-802	5	3	33	35	0	7736	5	2	23	3	1	8	0	3	810	100	2
S-805	0	5	33	30	0	3134	3	7	26	4	3	3	0	5	730	100	1
S-807	0	7	33	30	0	3133	3	7	27	4	3	3	0	3	730	267	0
S-808	3	7	31	30	0	3133	3	2	22	4	3	1	0	3	130	200	1
S-809	0	7	33	10	0	6353	3	2	22	1	3	2	0	3	630	300	1
S-811	0	5	33	30	0	7736	5	7	29	4	3	3	0	3	930	200	1
S-814	0	5	77	30	0	7757	3	3	22	4	1	3	0	3	730	200	2
S-818	0	3	33	30	0	7756	5	2	22	4	1	3	0	3	710	100	1
S-819	0	5	35	36	0	7757	5	4	24	4	3	3	0	3	620	293	1

S-821	9	5	31	30	0	3134	3	7	29	4	1	3	0	3	920	200	1
S-822	7	5	33	30	0	3133	3	2	24	4	1	8	0	3	920	100	1
S-825	0	5	33	30	0	7756	5	2	26	4	3	8	0	5	920	200	0
S-826	0	7	33	36	0	3153	3	7	24	3	3	3	0	7	610	200	2
S-828	0	9	55	30	0	3133	3	2	27	3	3	3	0	5	610	100	0
S-830	7	5	11	30	0	3133	3	2	27	1	3	3	0	9	220	200	0
S-832	0	3	37	35	7	7757	5	5	29	1	1	3	0	3	610	200	0
S-835	0	3	33	10	7	7959	3	2	24	1	3	3	0	3	610	400	0
S-837	3	5	33	10	0	6355	5	2	23	1	1	8	0	5	730	200	2
S-842	0	9	53	30	3	4134	3	7	29	4	3	3	0	5	730	200	0
S-843	0	7	33	10	3	6334	3	2	23	1	3	3	0	3	510	200	0
S-844	0	5	51	10	0	6354	3	3	24	1	1	3	0	3	610	500	1
S-845	0	5	33	15	0	4134	3	2	23	1	1	3	0	5	810	300	1
S-846	0	5	33	10	0	7755	3	2	24	1	1	0	0	0	0	0	0
S-850	0	9	31	16	5	7756	3	3	22	1	3	0	0	0	0	0	0
S-853	0	3	33	10	0	7959	3	2	27	1	3	3	0	3	820	300	2
S-854	0	3	13	10	0	7755	5	3	22	1	3	3	0	1	810	100	2
S-855	0	9	33	10	5	6556	3	3	22	1	3	3	0	3	620	100	2
S-857	0	5	33	10	0	7969	3	2	27	1	3	8	0	3	620	400	1
S-858	0	9	31	16	0	6335	3	2	22	1	1	2	0	3	230	100	2
S-861	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	2
S-862	0	3	35	15	0	4333	3	5	22	1	1	3	0	3	810	100	1
S-865	0	3	33	15	3	7955	3	2	22	1	1	3	0	5	810	100	1
S-867	0	5	35	90	0	7734	5	7	23	9	3	3	0	3	810	200	1
S-868	0	5	31	35	0	3134	3	7	27	1	3	2	0	3	810	100	1
S-872	0	5	33	10	0	3153	3	2	26	1	3	2	0	5	210	200	1
S-873	0	3	13	10	0	7955	3	2	22	1	3	8	0	5	830	100	2
S-874	0	5	33	10	0	3134	3	2	22	1	1	2	0	5	820	200	1
S-876	0	7	53	10	0	4133	5	2	23	1	3	3	0	3	820	200	1
S-877	0	9	53	10	0	6353	5	2	22	1	3	8	0	3	820	200	2
S-878	0	3	15	15	0	6554	5	2	22	1	1	3	0	5	810	100	1
S-881	0	5	37	10	0	6333	5	3	22	1	3	3	0	3	730	100	1
S-887	7	7	55	30	0	4134	5	2	24	1	1	2	0	3	220	200	5
S-890	0	3	33	10	0	7759	5	2	24	1	1	3	0	5	810	100	1
S-893	0	9	31	10	0	3133	3	3	22	1	1	3	0	1	820	200	1
S-900	0	5	53	35	0	4153	3	2	23	1	1	3	0	3	610	200	2
S-903	0	3	33	16	5	7759	3	2	22	1	1	3	0	3	610	300	2
S-905	5	5	33	10	0	7959	3	3	26	1	3	2	0	3	220	300	1
S-909	0	9	33	10	0	6354	3	2	26	1	1	3	0	3	820	100	1
S-910	0	3	13	10	0	7759	3	3	22	1	3	8	0	7	220	100	-
S-914	5	3	15	10	0	6333	5	3	22	1	1	9	0	3	210	100	3
S-915	0	5	33	10	0	3133	3	2	23	1	3	3	0	5	210	100	2

S-922	0	7	53	10	0	4133	5	2	23	1	3	3	0	3	820	200	2
S-931	0	3	33	30	3	3133	3	5	23	1	1	3	0	1	220	100	1
S-933	0	5	35	60	0	7759	5	7	23	4	1	3	0	1	810	100	1
S-934	0	5	31	10	0	6353	3	3	24	1	3	3	0	1	210	100	1
S-935	0	5	13	10	0	6333	5	3	22	1	3	2	0	3	810	100	2
S-936	0	9	35	10	0	3153	5	2	22	1	3	8	0	3	210	100	3
S-941	0	7	53	10	0	4153	5	2	22	1	3	3	0	3	810	300	1
S-943	0	7	33	10	0	4153	5	2	23	1	3	3	0	3	720	400	2
S-945	0	7	31	15	0	4153	3	3	26	1	1	3	0	5	810	200	2
S-946	0	3	33	15	3	4153	3	2	22	1	3	3	0	3	510	100	3
S-947	0	3	53	10	0	4153	5	2	23	1	1	3	0	3	220	200	3
S-950	0	7	33	10	0	3133	3	2	23	1	3	3	0	5	730	200	3
S-952	0	9	31	15	0	4133	3	2	23	1	3	3	0	5	730	100	2
S-954	5	5	55	35	0	4153	5	2	22	1	1	3	0	3	810	200	3
S-955	0	9	33	10	0	3134	3	2	23	1	3	3	0	3	810	500	3
S-956	0	9	33	10	0	3153	5	2	23	1	3	3	0	5	220	100	3
S-958	0	5	53	10	0	3133	5	2	23	1	3	3	0	5	210	100	3
S-959	0	5	31	10	0	3153	5	3	22	1	3	2	0	3	820	500	0
S-962	0	5	55	15	0	4133	5	2	23	1	3	3	0	3	810	200	3
S-968	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	1
S-970	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	1
S-971	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	1
S-972	0	5	31	60	0	6353	3	7	22	5	3	3	0	3	220	100	2
S-978	0	3	35	10	3	7979	5	2	26	1	1	3	0	5	220	200	2
S-986	0	9	33	10	0	3134	5	2	23	1	5	2	0	5	730	400	1
S-992	0	3	13	70	0	2103	3	5	22	9	3	3	0	5	230	300	1
S-995	0	5	13	10	3	2103	5	7	26	1	3	3	0	3	620	800	0
S-1000	0	9	33	10	0	3133	5	7	22	1	3	3	0	5	810	100	1
S-1008	0	5	33	10	0	3354	5	2	26	3	3	8	1	3	620	100	3
S-1009	0	5	35	10	3	3133	5	2	23	1	3	3	1	3	910	400	2
S-1010	0	3	35	10	5	3133	5	5	26	1	3	5	0	5	810	579	2
S-1018	0	5	13	15	0	4135	3	3	22	1	1	3	0	5	820	300	1
S-1021	9	3	33	10	5	6554	3	3	22	1	3	3	0	3	220	100	2
S-1022	0	5	33	10	0	3153	3	3	22	1	3	2	0	1	730	700	2
S-1023	7	5	33	10	5	6553	5	3	22	1	3	2	0	3	220	400	1
S-1025	0	3	33	30	0	3134	5	3	22	1	3	3	0	3	820	200	2
S-1027	0	3	33	30	3	3133	3	5	23	1	1	3	0	1	220	100	1
S-1028	0	5	13	70	3	7769	5	3	23	9	5	3	0	3	920	100	1
S-1030	0	5	35	60	7	7959	5	7	22	-	3	3	0	3	620	200	1
S-1031	0	5	15	90	5	7759	5	7	22	9	1	3	0	3	410	500	3
S-1032	0	3	11	16	5	7959	3	7	22	1	3	2	0	3	220	400	1
S-1034	0	3	33	30	0	6559	5	2	23	6	1	3	0	5	630	200	1

S-1035	0	3	35	30	5	7756	5	6	22	1	1	2	0	5	620	651	1
S-1036	0	7	13	30	3	6559	5	7	22	4	3	8	0	7	810	443	1
S-1039	0	5	35	10	0	7759	5	2	22	1	1	3	0	3	510	100	0
S-1057	0	3	33	30	0	6164	5	7	22	8	3	3	0	5	810	200	0
S-1064	0	5	37	35	7	7755	5	7	23	5	3	3	0	3	730	100	1
S-1065	0	3	33	30	3	2103	5	7	26	8	3	3	0	5	210	100	1
S-1074	0	3	13	10	0	6556	5	3	22	1	1	3	0	5	830	200	3
S-1078	0	3	13	10	5	7969	3	2	26	1	3	8	0	5	730	400	2
S-1082	0	3	15	10	3	4133	5	7	22	1	1	3	0	5	730	600	1
S-1083	0	3	13	10	0	6534	5	3	23	1	3	3	0	5	810	200	2
S-1087	0	3	33	10	3	6353	3	2	22	1	3	3	0	3	810	600	3
S-1088	0	5	33	36	0	7959	3	7	24	1	3	3	0	7	730	343	1
S-1091	0	3	13	10	0	7969	3	2	26	1	3	8	0	3	730	456	1
S-1092	0	3	13	10	3	7969	3	2	26	1	3	8	0	7	236	400	3
S-1094	0	5	13	10	0	6554	3	2	22	1	1	3	0	5	610	400	2
S-1097	0	3	13	36	0	7739	5	2	29	1	3	8	0	3	920	100	2
S-1098	0	5	13	36	0	7739	5	2	29	1	3	8	0	3	920	100	5
S-1099	0	5	33	10	7	6334	5	2	29	1	3	3	0	5	210	200	1
S-1100	0	5	31	10	3	6553	3	3	24	1	3	3	0	3	210	100	1
S-1114	0	5	33	10	0	6333	3	3	23	1	3	3	0	3	210	100	1
S-1117	0	5	35	62	5	2103	5	6	22	1	3	3	0	9	830	633	1
S-1118	0	5	33	16	5	3133	5	3	22	1	1	8	0	7	810	600	2
S-1119	0	5	35	10	0	2103	5	7	22	1	1	8	0	5	610	200	1
S-1120	0	3	13	16	0	4133	5	7	22	1	3	3	0	9	830	400	1
S-1121	0	5	33	10	0	6354	5	2	23	1	1	8	0	5	730	200	2
S-1125	7	5	33	10	0	6354	5	6	22	3	3	3	0	3	220	100	3
S-1128	0	5	15	10	3	6334	5	2	22	1	3	3	0	5	730	700	1
S-1131	0	5	33	15	0	4134	5	2	23	1	3	1	0	5	610	400	1
S-1132	0	5	11	30	0	6554	5	2	23	1	3	3	0	5	820	600	2
S-1137	0	7	33	36	3	6354	5	2	23	1	3	9	0	5	610	100	2
S-1150	0	5	11	10	0	7119	5	2	22	1	1	9	0	3	820	100	1
S-1151	0	5	33	30	0	6354	5	2	23	1	3	9	0	3	810	100	1
S-1152	0	5	13	10	0	6354	5	2	23	1	3	9	0	5	820	100	1
S-1156	0	3	13	36	0	5334	5	3	23	3	3	4	0	5	730	633	3
S-1163	0	5	15	10	0	6754	5	3	22	3	3	8	0	5	210	100	1
S-1166	0	5	35	10	0	3654	5	2	33	1	3	8	0	5	830	200	1
S-1168	0	7	35	40	0	4172	5	5	33	3	3	3	0	9	820	800	1
S-1170	0	5	55	60	0	7955	3	3	23	4	3	3	0	3	810	498	1
S-1171	0	5	13	46	0	7955	5	3	23	4	3	8	0	5	820	200	1
S-1174	0	5	15	10	0	3154	5	2	33	1	3	9	0	5	730	200	2
S-1175	0	5	55	30	0	6354	5	2	22	1	3	8	0	3	730	100	1
S-1176	0	7	13	30	0	6354	5	2	33	5	3	8	0	3	810	200	1

S-1180	0	7	13	10	0	6354	5	2	33	1	3	3	0	3	720	800	1
S-1183	0	5	33	30	0	6354	5	2	23	1	1	8	0	3	730	100	2
S-1184	0	3	13	30	0	6354	5	2	23	1	1	8	0	7	730	200	1
S-1185	0	5	33	30	0	6374	5	5	21	3	3	8	0	5	220	100	2
S-1186	0	5	33	15	0	6354	5	5	23	3	3	8	0	3	720	200	2
S-1188	0	5	15	30	3	3114	5	8	33	4	3	3	0	3	620	400	2
S-1189	0	3	11	46	0	6754	5	2	23	5	5	2	0	7	820	100	2
S-1190	0	5	13	46	0	4154	5	2	23	5	5	2	0	7	820	100	2
S-1191	0	3	11	46	0	6754	5	3	23	4	3	3	0	3	910	400	1
S-1193	0	3	13	40	5	6554	5	5	23	3	3	4	0	3	810	500	2
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S-1204	0	7	31	40	0	4174	5	2	33	5	1	8	0	5	730	100	1
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S-1224	0	7	33	10	3	6354	5	6	23	3	3	3	0	5	210	100	3
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S-968	7	1	4	3	7	1	5	7	0	3	1	1	1	7	1	3	3
S-970	7	1	4	5	7	2	7	1	5	2	1	1	1	3	1	5	1
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S-972	7	1	4	1	3	2	5	7	0	1	1	1	1	3	1	1	1
S-978	7	1	4	1	7	1	5	5	0	1	1	1	3	3	1	3	1
S-986	7	1	4	3	7	1	7	1	5	1	1	1	3	1	1	3	1
S-992	7	1	4	3	5	1	5	3	0	2	5	1	1	3	3	5	1
S-995	7	5	4	3	3	1	5	5	5	1	1	1	1	5	3	3	5
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S-1348	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
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S-1357	3	9	4	3	7	1	5	7	0	1	1	1	3	5	3	3	3
S-1360	3	1	4	3	7	1	5	7	0	1	1	1	1	5	1	3	1
S-1361	3	1	4	3	3	1	5	1	0	1	1	1	1	-	1	3	1
S-1362	-	1	4	3	3	1	7	7	0	2	1	1	3	3	3	3	3
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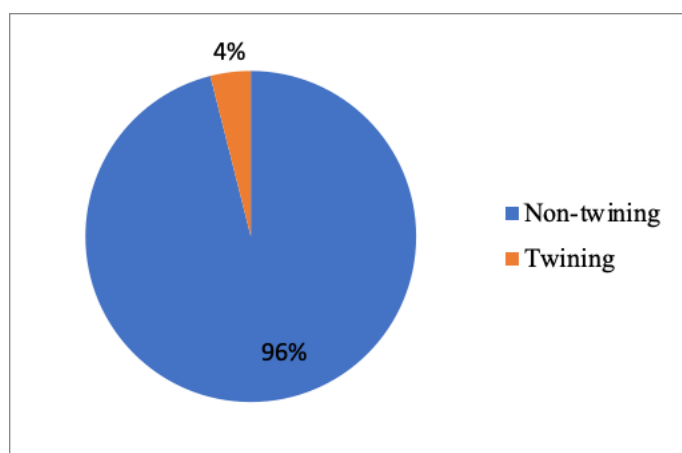
“- ” (6.1 to 6.7): Non-tuberization types; “- ” (7.1 to 7.16): Non-flowering types

VARIABILITY FOR MORPOLOGICAL TRAITS

VINE CHARACTERS

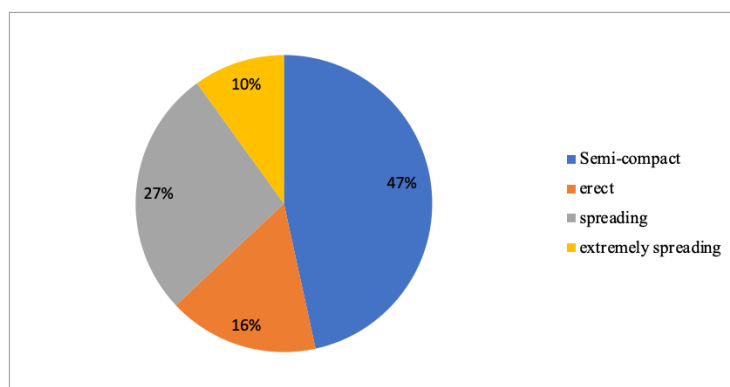
TWINING

Out of 482 accessions, 96.05 % were of non-twining nature while 3.94% were twining.



PLANT TYPE

Majority of the accessions (46.47%) had semi compact plant type. The other types of growth habit included erect (16.39%), spreading (26.97%) and extremely spreading type (9.95%) having vine length above 250 cm.



VINE INTERNODE LENGTH & DIAMETER

A two digit code was used for describing the internode length and diameter together. Various combinations of internode length & diameter were discernible. The majority of the accessions had short and thin internodes (61.2%) followed by short and intermediate type of internodes

(43.46%). Twelve other combinations of internode length and diameter under different groups are also observed.

VINE PIGMENTATION

The basic green colour of the vines in various combinations of green and purple were found. In about 69.4% of the accessions the predominant colour of the vine is green (Score 1,0) without any secondary pigmentation. Various combinations of green with purple pigmentation were seen. 0.82% of the accessions had mostly purple pigmented vines. Only 7 accessions had totally dark purple pigmented vines.

VINE TIP PUBESCENCE

The degree of hairiness of immature leaves is recorded from the apex of the vines and is an important descriptor for identifying accessions. The majority (73.86%) of the accessions did not have hairs at the apex of the vines, while 15.35% of accessions had very little amount of hairs, and 10.78% of accessions had hairs at the apex of the vines with moderately to heavy pubescence.

MATURE LEAF SHAPE

Described by the most common expression of the general outline of leaf (Scores 1 to 7), type of leaf lobe (Scores 0 to 9), average total number of lobes (Scores 0 to 9) and the shape of central lobe (Scores 0 to 9) and described by a 4 digit number. The most common mature leaf shape observed is '6154' type (in 80%) i.e. general outline '6' (Lobed), type of lobbing '1' (Very slight teeth), number of lobes '5' and shape of central lobe '4' (Semi-elliptic). The next group is '3333' (general outline '3' cordate, type of lobbing 3 'slight', number of lobes- 3 and shape of central lobe 3-Semi-circular). The 3rd category was '7505' followed by several other combinations of different categories based on the scores with varying number of accessions under each group. Thus leaf shape is the trait with maximum variability in sweet potato germplasm.



Fig. Mature leaf shape variants

MATURE LEAF SIZE

Categorized into four types, score '3' small (<8.0 cm), '5' medium (8.0-15.0 cm), '7' large (>15.0 cm) and very large (>25cm). The majority of accessions come under the group, 5-medium (63.90%) and 3 small (35.48%). Only 3 accessions had large leaves measuring >15 cm.

ABAXIAL LEAF VEIN PIGMENTATION

The most frequent expression of the distribution of anthocyanin (purple) pigmentation present in the veins of the lower surface of the leaves is described. Score 2 'Green' without any purple pigment on the veins on the lower side of leaves was the most common type shown in 55.60% of accessions. 10.99% accessions had all vein partially purple, and 2.49% accessions had all veins mostly or totally purple.



Fig. Abaxial leaf vein pigmentation variants

FOLIAGE COLOUR

The overall foliage colour considering the colour of the fully expanded mature and immature leaves of several leaves from one accession was recorded. It is described by a 2 digit code of mature leaf colour along with immature leaf colour with scores 0 to 9 for both. '2, 3' type of accessions i.e. with green mature leaf colour and green with purple edge immature leaf colour was the most frequent type followed by scores '2,2' green mature leaf colour + green immature leaf. 14 other combinations of colours of mature and immature leaves were also observed. The mature leaf colour ranges from yellow green to green + purple on edge only while the young leaf colour ranges from yellow green to purple on both sides.



Fig. Immature leaf colour variants

PETIOLE COLOUR AND LENGTH

Only 7 accessions had totally or mostly purple petiole (1.45%) and majority had green pigmentation (69.08%). The combination of green and purple pigments in various proportions was observed in the rest of the accessions. Regarding petiole length, in more than 60% of accessions, short petioles measuring 10-20 cm were predominantly observed while 32.78% have very short petioles (<10 cm long). One accession had ‘long’ petiole.



Fig. Petiole colour variants

STORAGE ROOT CHARACTERISTICS

The storage root of sweet potato is the commercial part of the plant. Varietal variation in the size and shape of the storage root was commonly observed.

STORAGE ROOT SHAPE

The variants of the shape of storage roots found in the germplasm were round, round elliptic, elliptic, obovate, ovate, oblong, long oblong, long elliptic and long irregular or curved. Majority of the accessions have elliptic shape (45.85%) followed by long elliptic (25.93%). The obovate, ovate and oblong types were rarely seen.

STORAGE ROOT DEFECTS

The root surface of most of the accessions was smooth and without any defects. When the harvest is delayed the roots show over-bulging and develop cracks of various kinds.

STORAGE ROOT SKIN COLOUR

The skin colour of the storage roots of sweet potato ranged from white to reddish purple or very dark purple. The intensity of the colour is dependent up on the environmental conditions under which the plant grows. The root skin colour was represented by a three digit code indicating the predominant skin colour, intensity of predominant skin colour and the secondary skin colour. The majority of accessions belonged to the group '830' i.e. accessions having predominant skin colour purple-red of intensity 'dark' with no secondary skin colour followed by '710' (predominant skin colour 'red' with intensity 'pale' and no secondary colour). Altogether 28 different combinations of skin colour are observed.

STORAGE ROOT FLESH COLOUR

The flesh colour of sweet potato can be white, cream, yellow, orange or combination of these colours with orange red or purple red pigments distributed in different degrees. The components of the trait flesh colour consisted of predominant flesh colour, secondary flesh colour and distribution of secondary flesh colour denoted by a three digit code. Majority of the accessions (36.0%) comes under the category '200', 2 denoting the predominant flesh colour cream and 0,0 showing the absence of any secondary flesh colour. 6.84 % of the accessions have white flesh colour without any secondary flesh colour. 7.05% of the accessions have pale, intermediate or dark orange as primary flesh colour with cream, dark cream or pink pigments as secondary flesh colour and distributed in various patterns in the flesh. Altogether 40 different combinations of flesh colour were noted in the sweet potato germplasm of ICAR-CTCRI.



Fig. Tuber skin and flesh colour variants

STORAGE ROOT ARRANGEMENT

The formation of storage roots may be in clusters around the stem or depending upon the length and position of the origin of storage root stalks, the arrangement of roots may be in closed cluster, open cluster, dispersed or very dispersed. ‘open cluster’ and ‘very disperse’ were the most common types observed.

ROOT LATEX

Majority of the collections had low latex or medium latex in the storage root flesh.

FLORAL CHARACTERS

Sweet potato cultivars differ in their ability to flower. Flowers are solitary or in inflorescence called ‘cyme’. Flowers are bisexual. Besides the calyx and corolla, they contain the stamens which is the male organ or androecium and the pistil that is the female organ or gynoecium. The gynoecium consisted of a pistil with a superior ovary and style which is short and ends in a broad stigma. The stigma is receptive in early morning and bees are the main pollinators. The floral traits are denoted by the following descriptors.

FLOWERING HABIT

Under ICAR-CTCRI conditions, most of the accessions flowered. Only 2.07% were of non-flowering type followed by scarcely flowering (0.21%) and moderately flowering found in 39% of accessions. The profusely flowering types were 10.37% of accessions.

FLOWER COLOUR

The majority of the genetic stocks (91.07%) have flowers having pale purple limb with purple throat. 5.6% of the genetic stocks have purple flowers and only 8 accessions produced white flowers.



Fig. Flower colour variants

FLOWER LENGTH

In majority of the accessions, the flower length was medium (76.55%) followed by short (13.48%) and long (12.65%).

SHAPE OF LIMB

In sweet potato, the basal portion of the corolla with 5 petals is joined to form a tube. The shape of the tip of the corolla is of three types, semi-stellate, pentagonal and rotates. The 'rotate' type of limb predominated (67.21%) followed by the pentagonal type (23.44%) and semi stellate type (6.84%).



Fig. Flower limb shape variants

EQUALITY OF SEPAL LENGTH, SHAPE, APEX AND PUBESCENCE AND COLOUR OF SEPALS

The calyx of the sweet potato flower consisted of 5 sepals, two outer and three inner. The sepals are of unequal length. The major group under sepal length is the 'outer two shorter' type in 88.59% of the collections. In the other 9.33% of the accessions all the sepals were of equal length. The shape of sepal is categorized into 5 groups- ovate, elliptic, obovate, oblong and lanceolate, of which the obovate type (69.91%) was the predominant one, 44.81% of the accessions possessed acuminate apex while the other groups were acute (3.94%), obtuse (24.48%) and caudate (22.4%). Regarding pubescence, in most of the accessions is it absent (92.32%). The colour of sepals varied from green to totally pigmented. 64.52% of the genetic stocks had green sepals, while only 1.65 % had totally pigmented (purple) sepals.

COLOUR OF STIGMA AND STYLE

In majority of the accessions (94.39%) the stigma and style were white in colour while partially or fully purple/ dark purple types were rare.

STIGMA EXSERTION

Denoted by the relative position of the stigma as compared to the highest anther. The germplasm accessions were categorized into four types. Inserted – Stigma well below the

level of anthers, stigma same height as the highest anther, slightly exerted- stigma slightly above the level of the anthers and exerted- stigma well above the level of anthers. The first two types promote self-pollination and the other two types are favourable for cross pollination.

The flowers with inserted type of stigma predominated (45.43%). However, because of the self-incompatibility mechanism prevailing in sweet potato self-pollination under natural conditions was rare. 28% have stigma with same height as the highest anther, 12.86% with slightly inserted and 10.78% were with completely exerted stigma.

SEED CAPSULE SET

In sweet potato, each capsule contains one to four seeds that are slightly flattened on one side and convex on the other. No fruit set was observed in 12.86% of the accessions. In 43.77% of the genotypes the capsule set was sparse, 21.36% moderate and in 17.43% the formation of capsules and seed was heavy.

LENGTH OF PEDUNCLE

The length of the axis on which the flowers are borne were categorized into short, medium and long. In the sweet potato germplasm characterized, the short type predominated and accessions with long peduncled inflorescence exceeding 15cm was 7.88%.

LENGTH OF PEDICEL

Indicates the length of individual flower stalk. Majority (53.73%) of the collections had flowers with medium pedicel length and 13.48% of them possessed long pedicels (>15cm).

NUMBER OF BUDS/ INFLORESCENCE

The number of flower buds per inflorescence in sweet potato varied from 1-10. In more than 50.0% of the collections number of buds come under the category low with 1-3 buds/cyme. In 7.05% of the accessions the production of buds was high (>6 Nos).

IDENTIFICATION OF DUPLICATES IN SWEET POTATO GERMPLASM OF ICAR - CTCRI, THIRUVANANTHAPURAM

Duplicates in sweet potato germplasm can be defined as samples of the same cultivar collected from different places. The same cultivars may have different names in different localities and will be collected as new ones. In National gene banks, the genetic resources are usually maintained as Field Gene Bank. The field maintenance of gene banks is expensive due to the periodical replanting required (two times per year). Mixtures of different accessions also occur due to the creeping growth habit and occurrence of volunteer plants sprouting from the storage roots of previous season. Hence morphological characterisation of the accessions is essential not only to have a description of the accessions but also to use the information to identify duplicates. Huaman (1999) emphasized the need for duplicate identification of the sweet potato germplasm and pointed out that:

- Identification of duplicates will result in the reduction in the number of accessions to be clonally propagated to a manageable size.
- A decrease in maintenance cost in expenses for labour, manures, fertilizers etc.
- More chances of survival of all the different cultivars available in the collection.

PROCEDURE

- Accessions from indigenous and exotic sources should be collected and established in a field gene bank using vine cuttings, grown under uniform experimental and environmental conditions.
- Storage roots should be harvested 90–105 days after planting.
- Roots must be thoroughly washed and grouped by skin colour using a standard colour chart (e.g., CIP chart).
- Within each skin colour group, accessions should be sorted by root shape.
- Tubers must then be classified by flesh colour by examining transverse sections for predominant and secondary colours, their intensity, and distribution. Colour codes should be recorded using the colour chart.
- Classified storage roots (based on skin, shape, and flesh colour) should be packed separately and kept for two weeks to observe sprout colour for final classification.
- Sprouts from each group should be planted in pots for further grouping based on leaf and vine traits.

- Stem cuttings from each accession must be planted in the field, maintaining the previously defined groups.
- Morphological traits of vines and leaves should be recorded using standard descriptors to identify duplicates.
- Data should be collected from all accessions grown in the same season, field, and plant density.
- Leaf and vine traits are to be recorded from 70–80-day-old plants, preferably from the middle section of mature main stems. Observations should be averaged across 3–5 plants per accession.
- For large collections or new additions, data should be recorded under similar conditions, including reference cultivars to enable year-to-year comparison.
- Morphologically similar groups should be verified for data consistency.
- Data must be processed using cluster analysis software to group accessions by morphological similarity.
- Groups identified through cluster analysis should be replanted for detailed morphological comparison and confirmation.
- Accurate identification of duplicates depends on:
 - Consistent field data collection (preferably by the same personnel).
 - Accurate data entry for processing.
 - Validation by side-by-side comparison of grouped accessions.

List of key characters for duplicate identification of sweet potato germplasm

4.1	Twining	5.5.1	Petiole pigmentation
4.2	Plant type	5.5.2	Petiole length
4.3	Vine Internode length/diameter	6.1	Storage root shape
4.4	Vine pigmentation 1.Predominant vine colour 2.Secondary vine colour	6.2	Storage root defects
4.5	Vine tip pubescence	6.3	Storage root cortex thickness
5.1	Mature leaf shape 1.General outline of the leaf 2.Type of leaf lobes 3.Number of leaf lobes 4.Shape of central lobe	6.4	Storage root skin colour
5.2	Mature leaf size	6.5	Storage root flesh colour
5.3	Abaxial leaf pigmentation	6.6	Root latex
5.4	Foliage colour 1.Mature leaf colour 2.Immature leaf colour		

DUPLICATE ACCESSIONS IDENTIFIED BASED ON DESCRIPTORS

Based on comparison of scores of descriptors used for cataloguing, 19 duplicate groups were identified.

Acc. No.	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5.1	5.5.2	6.1	6.2	6.3	6.4	6.5	6.6
657	0	5	13	30	0	7959	3	7	22	5	1	3	0	5	610	200	7
658	0	5	13	30	0	7959	3	7	22	5	1	3	0	5	610	200	7
197	0	5	33	10	0	6354	5	2	23	1	1	8	0	5	730	200	7
500	0	5	33	10	0	6354	5	2	23	1	1	8	0	5	730	200	7
837	0	5	33	10	0	6354	5	2	23	1	1	8	0	5	730	200	7
1121	0	5	33	10	0	6354	5	2	23	1	1	8	0	5	730	200	7
223	0	5	15	10	0	7959	5	2	26	1	3	8	0	3	810	500	7
713	0	5	15	10	0	7959	5	2	26	1	3	8	0	3	810	500	7
52	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	7
861	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	7
968	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	7
970	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	7
971	0	7	33	15	0	4133	3	2	24	1	3	3	0	3	820	200	7
876	0	7	53	10	0	4133	5	2	26	1	3	3	0	3	820	200	7
922	0	7	53	10	0	4133	5	2	26	1	3	3	0	3	820	200	7
70	0	9	53	10	0	4133	5	2	23	1	3	8	0	3	810	210	3
71	0	9	53	10	0	4133	5	2	23	1	3	8	0	3	810	210	3
931	0	3	33	30	0	3133	3	5	23	1	1	3	0	1	220	100	7
1027	0	3	33	30	0	3133	3	5	23	1	1	3	0	1	220	100	7
1233	0	5	33	10	0	6354	3	6	33	3	1	9	0	3	810	200	3
1253	0	5	33	10	0	6354	3	6	33	3	1	9	0	3	810	200	3
1189	0	3	11	46	9	6754	5	3	23	4	3	7	0	5	820	200	7
1315	0	3	11	46	9	6754	5	3	23	4	3	7	0	5	820	200	7
101	0	5	33	20	0	7959	3	7	22	4	3	3	0	3	230	200	3
200	0	5	33	20	0	7959	3	7	22	4	3	8	0	3	230	200	3
1183	0	5	33	30	0	6354	5	2	23	1	1	8	0	3	730	100	7
1219	0	5	33	30	0	6354	5	2	23	1	1	8	0	3	730	100	7
68	0	5	33	36	0	7755	5	3	22	1	3	8	0	5	730	200	3

587	0	5	33	36	0	7755	5	3	22	1	3	8	0	5	730	200	3
1128	0	5	15	10	3	6334	5	2	22	1	3	3	0	5	730	700	7
1280	0	5	15	10	3	6334	5	2	22	1	3	3	0	5	730	700	7
1234	0	7	33	10	3	6354	3	7	23	3	1	9	0	5	730	100	7
1243	0	7	33	10	3	6354	3	7	23	3	1	9	0	5	730	100	7
10	0	7	53	30	0	3153	5	3	26	5	3	3	0	5	810	200	3
612	0	7	53	30	0	3153	5	3	26	5	3	3	0	5	810	200	3
35	0	9	33	10	0	3153	5	2	22	1	3	8	0	3	210	100	3
936	0	9	33	10	0	3153	5	2	22	1	3	8	0	3	210	100	3
112	5	9	55	10	3	3133	5	2	22	1	3	3	0	5	210	200	3
361	5	9	55	10	3	3133	5	2	22	1	3	3	0	5	210	200	3
308	0	7	13	10	0	3133	5	2	23	1	3	8	0	7	220	100	7
235	0	7	13	10	0	3133	5	2	23	1	3	8	0	7	220	100	7
1064	0	5	37	36	7	7755	5	7	23	5	3	3	0	3	730	100	7
632	0	5	37	36	7	7755	5	7	23	5	3	3	0	3	730	100	7

CORE COLLECTION

The potential use of plant genetic resources contained in large germplasm collections could be greatly enhanced by constituting sub samples called core collections. A core collection should include the maximum of genetic variation contained in the whole collection with the minimum of duplication (Frankel, 1984). A preliminary attempt was made to form a core collection of sweet potato germplasm after the identification and elimination of apparent duplicates. 57 accessions were included as core collection are as follows:

Table. List of 57 accessions included as core collection

S-131	S-221	S-1078	S-1237	S-1290	S-1343
S-133	S-222	S-1031	S-1257	S-1297	S-1344
S-154	S-574	S-1156	S-1262	S-1083	
S-183	S-647	S-1168	S-1267	S-1309	
S-189	S-703	S-1170	S-1273	S-1312	
S-207	S-734	S-1186	S-1275	S-1313	
S-214	S-766	S-1190	S-1220	S-1318	
S-215	S-775	S-1191	S-1221	S-1326	
S-216	S-1010	S-1192	S-1281	S-1333	
S-217	S-1092	S-1201	S-1284	S-1341	
S-220	S-1137	S-1212	S-1288	S-1342	

CONCLUSION

The first volume of the Catalogue on “Genetic Resources of Sweet Potato- Volume 1” is a comprehensive compilation for 34 morphological descriptors pertaining to 482 accessions of sweet potato germplasm maintained as field gene bank at ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram. In this catalogue, emphasis was also given on identification of duplicated as suggested by Huaman (1999). Using morphotype grouping, 19 sets of duplicates were identified. A core collection of 57 accessions was developed covering the broad spectrum of variation in sweet potato field gene bank. The catalogue will serve as the foundation for the need based utilization of variability in sweet potato breeding programmes in future.

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