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Review article

DESCRIPTORS FOR ROSELLE (*Hibiscus sabdariffa* L.)

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ABSTRACT

Roselle [*Hibiscus sabdariffa* L., Malvaceae] is an important leafy vegetable all over the world; Africa in general and Nigeria in particular is endowed with numerous accessions of this crop. Therefore, there is need for an improved standard descriptor to enhance the collection, conservation, characterisation, documentation, evaluation and utilization of roselle germplasm. These procedures are very important and are prerequisite for the future improvement of the crop. Comprehensive information about genetic variability among individuals and (or) groups of accessions can be of great help for management and utilization of germplasm collections. Therefore, descriptors assist for proper management of the resources in gene banks as well as accurate documentation of information about the origin, characterisation and performance of germplasm. Descriptors is very important in developing international standards and a *lingua franca* that will be understood universally. Thus, this guideline was developed to apply to all accessions of roselle, both cultivated and wild types. It is targeted at curators, farmers and breeders of the crop who aimed at characterizing the available genetic resources of the crop at their disposals. It was developed after a series of research conducted on the available germplasm of the crop in Nigeria over the years. It will also assist in determining and ascertaining the genetic diversity of the crop accessions as well as those stored in the gene banks.

Keywords Leafy vegetable, germplasm, accessions, characterisation, Descriptor

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INTRODUCTION

Hibiscus sabdariffa L. commonly known as Roselle, razelle, sorelle, red sorrel, Indian sorrel, Guinea sorrel [1] belongs to the family Malvaceae. It is a member of genus *Hibiscus* which contains about 300 species

some of which are widely distributed as tropical herbs and shrubs [2], or as annual erect, bushy, herbaceous sub-shrub [3]. Some authors opined that this crop was originated from Asia (India to Malaysia) or Tropical Africa [1]. [1] reported that the plant is widely grown in the Tropics, Central America, India, Africa, Brazil, Australia, Hawaii, Florida and Philippines as home garden crop.

[2] opined that Roselle plant was probably brought to the western hemisphere by slaves from Africa and its use in Jamaica was noted as early as 1707. However, the crop is said to be native of India but was introduced to other parts of the world such as Central America, West Indies and Africa [5]. [6] was of the view that roselle is native to Africa. [7] further stressed that the plant could have originated from Central Africa. In relation to this view, [8] have earlier observed that the occurrence of many wild relatives of roselle in Nigeria suggested that it could be considered as the secondary place of origin of the crop in Africa. On the other hands, due to the presence of several cultivated and wild relatives in Nigeria, [9], further stressed that Tropical Africa seemed to be the secondary centre of origin of the crop.

Hibiscus sabdariffa are tall plants which can grow up to 3.5 m and has a deep penetrating taproot system. It has a smooth or nearly smooth, cylindrical, typically dark-green to red stems [3]. The leaves are alternate, 7.5 – 12.5 cm long, green, reddish, or purplish colour with reddish to greenish veins and long or short petioles. Leaves of young seedlings and upper leaves are shallow or deeply lobed (3 to 5 or even 7-lobes) and the margins are toothed. In some accessions, the leaves are simple without any lobe. Flowers are borne singly in the leaf axils and are showy, up to 12.5 cm wide, yellow, white, pink or buff with a rose or maroon eye that turn pink as they wither at the end of the day.

The typically red calyx consists of 5 large sepals with a collar (epicalyx) of 6 -12 slim, pointed bracteoles around the base. The fruit is a velvety capsule, 2-5 cm long, which can be green, red, deep red or purplish in colour. The fruits possess 5-valves, with each valve containing 3-4 seeds which usually have high percentage of oil [10]. Seeds are kidney-shaped, light-brown, 3-5 mm long and covered with minute, stout and stellate hairs [11]. It propagated by seed.

Roselle tolerates a warm and humid tropical and subtropical climate and is susceptible to damage from frost. It can tolerate little shade and can be grown in greenhouse, but normally grows best in field under the full sunlight. It prefers a well-drained sandy loamy soil which are permeable and friable with humus being preferable [12].

The importance of roselle cannot be over emphasized, it is an important green leafy vegetable in many countries of the world. Studies have shown that diets rich in plant foods are associated with lower risk of chronic diseases like cardiovascular disease, and some forms of cancer [13]. The crop is used for many different purposes; the common of which are fibres, refreshing beverage [7], jams and preserves [1]; as well as in medicine ([14]; [12]). [15] observed that *H. sabdariffa* showed *in vitro* activities against *E. coli*. A recent review stated that specific extracts of *H. sabdariffa* exhibit activities against atherosclerosis, liver disease and cancer [16], diabetes and other metabolic syndromes [17]. The phytochemical analysis of the leaf of roselle revealed that it contains protein, fat, carbohydrate, fibre, ash, calcium, phosphorus, iron, thiamine, β-carotene, riboflavin, niacin and ascorbic acid. The flower yields a coloured dye; the major pigment is identified as daphniphyllin [1]. The plant contains flavonoids and the dried calyces contain the flavonoid possypetine and sabderatin [18]. The seeds contain protein (18.8 – 22.3 %), fat (19.1- 22.8 %), and dietary fibre (39.5 – 42.6 %) contents which are found to be high. [3] stated that the fruit of

roselle contains more ascorbic acid (vitamin C) than black currant (*Ribes nigrum*) and nine times more than orange (*Citrus sinensis*).

Roselle is grown in various parts of the Sudan; it is one of the major cash crops cultivated by local farmers in Kordofan and Dafur states under rain-fed conditions [19]. China and Thailand are also major producers of roselle and control much of the world's supply. The world's best roselle comes from the Sudan, but the quantity is very low and poor processing hampers quality. [20] reported that there is an increase in demand for roselle over the past decades. It is said that approximately 15,000 metric tons enter international trade each year [21]. [22] reported that Benin, Burkina Faso, Cote D'Ivore, Niger, Nigeria and Sudan are the major areas of roselle production in Africa. Whereas, India, Java, and Philippines are the world major producers of roselle [23].

Genetic diversity study is important for sustainable production in crop species since greater losses of characteristics in many population may limit its chances of survival and requires greater human efforts for successful production [24]. Thus, gathering and sharing information about our agricultural biodiversity is crucial to its conservation and utilization for farmers, scientists, and breeders [25]. Information about genetic variability among different roselle accessions can be helpful for management, utilization and conservation of the germplasm collection. [9] collected the germplasm of roselle in Nigeria and opined that Nigeria has a rich collection of the crop that cut across different agro-ecological zones of the country.

Therefore, descriptor of this kind for such crop will assist breeders to improve their ability to describe, store, manage and share information about the plant genetic resources, either stored in genebanks, available with the growers or growing in their natural environments. It is also a veritable and an important tool to allow information sharing for the crop as well as uniformity in data description. In addition, it provides an international format and a universally understood language for plant genetic resources data [26]. They are targeted at farmers, breeders, and users to facilitate the exchange and use of resources [27]. Descriptors are, therefore, the basis of FAO World Information and early warning system [28].

This descriptor for roselle (*H. sabdariffa* L) was developed at the Department of Plant Biology, Federal University of Technology, Minna, Nigeria. This is based on thorough research work over the years on characterization of the available germplasm of the crop as well as detailed general review of literatures on roselle. Both sources were studied and compared adequately to arrive at this. It was further sent to experts for their comments and amendments.

DESCRIPTOR FOR ROSELLE

Characterisation

1. Plant Data/Descriptor
   - 1.1 Vegetative
     - 1.1.1 Stem colour
       - 1 Deep red
       - 2 Red
       - 3 Brown
       - 4 Light red
       - 5 Green
       - 6 Pink
       - 99 Other
     - 1.1.2 Stem width (cm)
       Average stem thickness of single representative tiller from ten selected plants is taken as width of stem at mid-height of plant at maturity (or at early fruit initiation stage).
     - 1.1.3 Number of branches
       It is the average of number of branches from basal nodes taken from ten representative plants that are selected

randomly at maturity or at 100 % flowering stage

1.1.4 Stem hairiness
- 1 Smooth/Absent of hairs/glabrous
- 2 Glutinous
- 3 Hairy with prickly hairs
- 4 Hairy with smooth hairs
- 5 Glutinous and hairy
- 99 Other (Specify)

1.1.5 Early plant vigour

To be recorded after three weeks of sowing:
- 1 Poor
- 2 Good
- 3 Very good

1.1.6 Plant growth habit
- 1 Erect
- 2 Medium
- 3 Procumbent

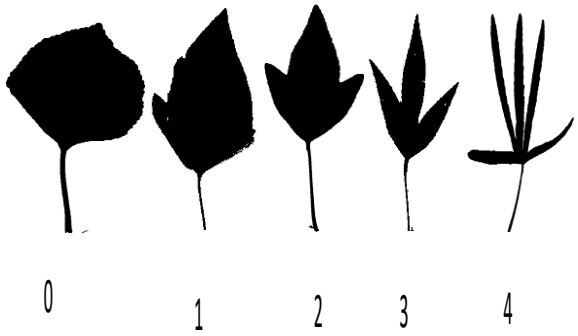
1.1.7 Branching from higher nodes
- 1 Non-branching
- 2 Very weak
- 3 Weak
- 4 Moderate/intermediate
- 5 Strong
- 6 Very strong

1.1.8 Branching habit
- 1 Low
- 2 Profuse

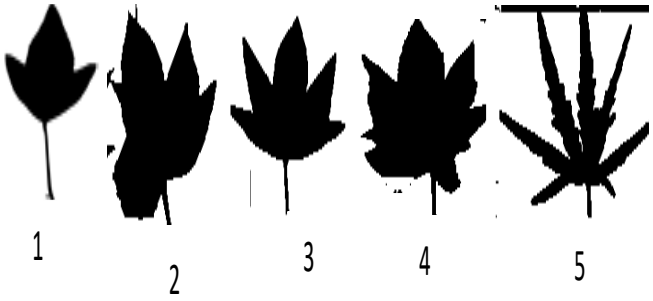
1.1.9 Plant height (cm)

The mean of ten selected plants, selected at random, are to be measured at 100 % flowering (or maturity) from ground level to the tip of the plant.

1.1.10 Types of leaf
- 1 Unlobed
- 2 Slight/shallow lobe
- 3 Moderate lobe
- 4 Deep lobe
- 5 Very deep lobe



1.1.11 Number of parted lobes
- 1 Two
- 2 Three
- 3 Four
- 4 Five
- 5 Six



1.1.12 Leaf colour
- 1 Green
- 2 Light green
- 3 Dark green
- 4 Purple
- 5 Purplish-green
- 6 Red
- 7 Light red
- 8 Deep red
- 99 Others (Specify)

1.1.13 Leaf vein colour
- 1 Green
- 2 Light green
- 3 Dark green
- 4 Purple
- 5 Red
- 6 Light red
- 7 Deep red

1.1.14 Leaf petiole colour
- 1 Green
- 2 Light green
- 3 Pink
- 4 Red
- 5 Light red
- 6 Deep red

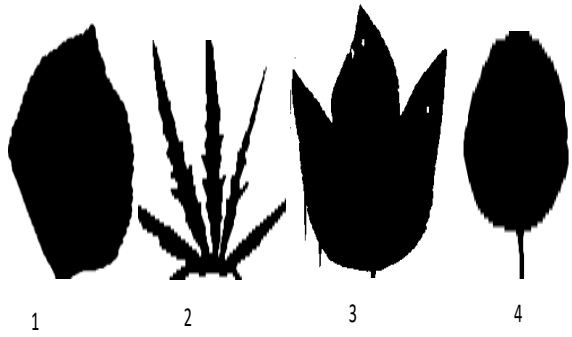
1.1.15 Leaf hairiness
- 1 Glabrous
- 2 Pubescent with smooth hairs
- 3 Pubescent with prickly hairs

1.1.16 Leaf petiole hairiness
- 1 Smooth hairs
- 2 Prickly hairs

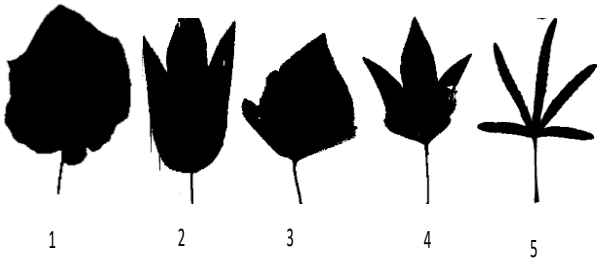
1.1.17 Leaf petiole length

This should be determined by comparing the length of the leaf blade with the length of the petiole. If the leaf blade is shorter than the petiole, petiole length is long; if the leaf blade is the same length with the petiole, it is intermediate; if the leaf blade is longer than the petiole, then the petiole is short.
- 1 Short
- 2 Intermediate
- 3 Long

1.1.18 Leaf margin
- 1 Crenate
- 2 Biserrate
- 3 Denticulate
- 4 Serrulate
- 99 Others (Specify)



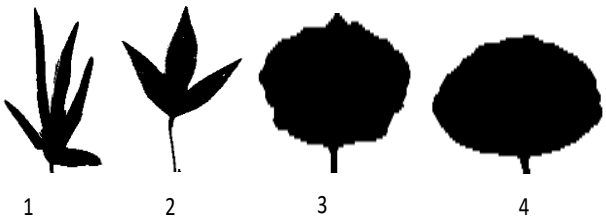
1.1.19 Leaf base shape
- 1 Cordate
- 2 Rounded/obtuse
- 3 Truncate
- 4 Acute
- 5 Linear



1.1.20 Stipule
- 1 Exstipulate (Absent)
- 2 Stipulate (Present)

1.1.21 Stipule colour
- 1 Green
- 3 Red
- 4 Deep red
- 5 Purple

1.1.22 Leaf apex shape
- 1 Very acute
- 2 Acute
- 3 Acuminate
- 4 Obtuse



1.2 Inflorescence and fruit

1.2.1 Days to 50 % flowering

It is the number of days from sowing to the time when 50 % of plants have started to flower

1.2.2 Days to maturity

It is the number of days from sowing to the stage when more than 90 % of the fruits have formed

1.2.3 Petal colour
- 1 Pink
- 2 Yellow
- 3 Orange
- 4 White
- 5 Purple

1.2.4 Colour of the 'eye' (inner colour) of the flower
- 1 Maroon
- 2 Golden yellow
- 3 Deep red
- 4 Yellow

1.2.5 Petal shape
- 1 Funnelform
- 2 Rosaceous

1.2.6 Sepal colour
- 1 Green
- 2 Light green
- 3 Deep red
- 4 Red
- 5 Pink
- 6 Reddish green

1.2.7 Sepal shape
- 1 Lanceolate
- 2 Linear
- 3 Triangular

1.2.8 Length of pedicel
- 1 Short
- 2 Intermediate
- 3 Long

1.2.9 Pedicel hairiness
- 1 Glabrous
- 2 Villous

2.2.10 Number of flowers per inflorescence

This is determined by finding the average of ten randomly selected plants

2.2.11 Number of epicalyx segments
- 1. From 5-7
- 3 From 8-10
- 4 More than 10

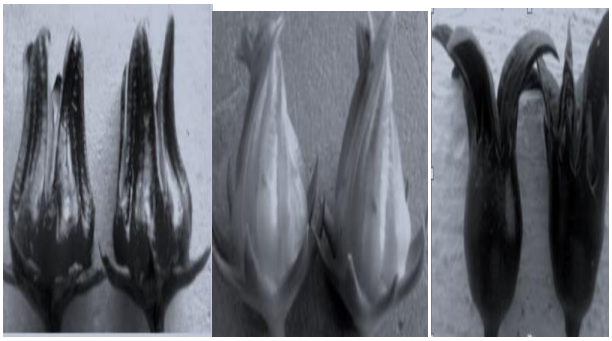
1.2.12 Number of fruits per plant

To be recorded during full range of harvesting (add all picking)

1.2.13 Number of ridges on fruit
1. From 5-7
2. From 8-10
3. More than 10

99. Others (Specify)

1.2.14 Fruit Shape at maturity
- 1 Conical with opened mouth
- 2 Conical with closed mouth
- 3 Funnel shape



1 2 3

1.2.15 Fruit hairiness

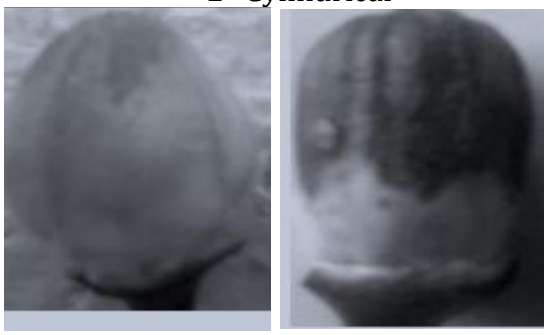
This should be recorded as presence and type of pubescence on surface of fruit at harvest
- 1 Glabrous
- 2 Hairy
- 3 Bristled

1.2.16 Fruit dehiscence
- 1 Absent
- 2 Present

1.2.17 Days to maturity

This is to be recorded as number of days from planting to harvest

1.2.18 Capsule shape
- 1 Conical
- 2 Cylindrical



1 2

1.3 Seed Morphology

1.3.1 Seed Shape
- 1 Reniform
- 2 Sub-reniform
- 3 Angular
- 99 Others (specify)



1 2 3

1.3.2 Seed coat colour
- 1 Brown
- 2 Grey
- 3 Black
- 99 Others (specify)

1.3.3 Weight of 1000 seeds (g)
This is to be weighed after harvesting, threshing and drying of seeds to 10 % moisture content.

1.4 Stress susceptibility

1.4.1 Biotic Stress susceptibility

The type of infestation or infection is to be specified using any of the standard scale between 1 and 9. It should be noted that additional information as common name(s) of disease(s)/pest(s) and causal organism(s) be appended in the biotic descriptor.

- 1 Very low
- 2 Low
- 3 Moderate
- 4 High
- 5 Very high

1.4.2 Abiotic Stress susceptibility

This is to be scored under artificial and/or natural conditions, which should be clearly specified. These should be coded on a standard susceptibility scale from 1-9.

- 1 Very low
- 2 Low
- 3 Moderate
- 4 High
- 5 Very high

CONCLUSION

This guideline applies to all wild and cultivated species of Roselle (*Hibiscus sabdariffa* L.); the information were gathered from series of research works conducted over the years on both wild and cultivated Roselle germplasm. The guideline is a very important tool that will enable gathering and sharing of information about the biodiversity of the crop for farmers as well as breeders, scientists and conservationists. It will also assist in determining and ascertaining the genetic diversity of the crop accessions as well as those stored in the gene banks.

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