

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(5): 171-179
www.biochemjournal.com
Received: 01-02-2025
Accepted: 05-03-2025

Euphemia Shylla
Department of Horticulture,
Assam Agricultural University,
Jorhat, Assam, India

Sheriful Alam
Department of Horticulture,
Assam Agricultural University,
Jorhat, Assam, India

Nayanmoni Buragohain
Department of Horticulture,
Assam Agricultural University,
Jorhat, Assam, India

Corresponding Author:
Euphemia Shylla
Department of Horticulture,
Assam Agricultural University,
Jorhat, Assam, India

Morphological evaluation of some indigenous cultivars of greater yam (*Dioscorea alata* L.) of North East India

Euphemia Shylla, Sheriful Alam and Nayanmoni Buragohain

DOI: <https://www.doi.org/10.33545/26174693.2025.v9.i5c.4304>

Abstract

Twenty seven accessions of greater yam (*Dioscorea alata* L.) were collected throughout North East India. The accessions were being maintained in the Experimental Farm of Department of Horticulture, Assam Agricultural University, Jorhat, under AICRP on Tuber Crops. The accessions were evaluated for different morphological characters during 2020-21 and 2021-22, following International Plant Genetic Resources Institute's (IPGRI) descriptors for yam. A wide range of variation was observed for morphological characters of both young and mature stem viz. stem colour, absence/presence of wings, wing colour, absence/presence of spines of young stem, colour and absence/presence of ridges of mature stem. Leaf characters viz. leaf lobation, colour, leaf vein colour, leaf margin colour, waxiness, leaf shape, leaf apex shape, distance between lobes, petiole colour, petiole wing colour of matured leaf exhibited a wide variation. Variations were not found for stem cross section at the base and position of leaf. For underground tubers, variations were observed in most of the morphological characters. Variation in morphological characters of greater yam cultivars could be used as an index in varietal identification of greater yam for developing high yielding cultivars.

Keywords: Cultivar, greater yam, indigenous, morphology, North East India

Introduction

Greater yam (*Dioscorea alata* L.) is a monocotyledonous tuber crop, herbaceous climbing plant, belonging to the family of Dioscoreaceae and it is reported to be an old crop species native to South East Asia (Burkill, 1951 and Coursey, 1967) ^[9, 10]. It is also known as 'winged yam' or 'purple yam'. It is the most important tuber crop due to its wider distribution, adaptability, usefulness and greater yield potential. It is the third most important tropical root and tuber crop after cassava and sweet potato (Fu *et al.*, 2005) ^[14]. It is also an important staple food in many parts of the world (Nedunchezhiyan *et al.*, 2002) ^[19].

Based on data provided by All India Coordinated Research Project on Tuber Crops, the gross cultivated area under different yams come to approximately 27000 ha with an average productivity ranging between 15-30 t ha⁻¹ in India (AICRPTC, 2016) ^[2]. *Dioscorea alata* is cultivated in Assam, Arunachal Pradesh, Meghalaya, Mizoram and other parts of North-East, Kerala, Andhra Pradesh, West Bengal, Bihar, Odissa, Uttar Pradesh, Tamil Nadu, Gujarat, Maharashtra, Andaman and Nicobar Islands. The yams are commonly grown in multiple cropping systems in homestead garden and in tribal areas. In India freshly harvested yam tubers are consumed as boiled, baked or fried vegetable, *D. alata* is also known for its high nutritional content, with crude protein content of 7.4 percent, starch content of 75-84 percent and Vitamin C content ranging from 13 to 24.7 mg per 100 gm and steroids which have pharmaceutical value. A few yam species are grown and used as health food and for medicinal purposes (Farombi *et al.*, 1997; Albrecht and McCarthy, 2006) ^[13, 3].

Dioscorea alata is the most polymorphic species in the genus Dioscoreaceae (Martin and Rhodes, 1973, Martin and Delpin, 1978) ^[16, 17]. The cultivars of *D. alata* are known to vary in shape, colour of stem, leaves and tubers (Purselove, 1972) ^[22]. *Dioscorea alata* tubers have variable shapes, the majority being cylindrical. Its tubers vary in number from one to five. The colour of the flesh of the tuber ranges from white to purplish (FAO, 1994) ^[12]. Typically, *Dioscorea alata* can be easily distinguished from the other species in the genus by its

quadrangular winged stems. However, much confusion on identification exists among the cultivated varieties of the species (Onwueme and Ganga, 1996) ^[20] due to the presence of hundreds of variants carrying numerous complexes and overlapping characteristics.

For proper cataloguing, characterization and evaluation of plant cultivars, knowledge of the gross aspect of plant morphology is the basic requirement of a biologist. Study of morphological traits helps the plant breeder to eliminate duplication of varieties and also identification of genotypes. The study of external morphology and plant structure has also become an integral part of crop improvement programme particularly in producing genotypes more responsive to better management. The present work will also contribute in increasing the knowledge regarding the genetic resources of *Dioscorea alata* available in North East India as in many cases the resources are threatened due to genetic erosion which is comparatively faster due to changing cropping pattern, crop preferences and changing food habits of human all over. So, the detailed study of morphological characterisation of *Dioscorea alata* cultivar was considered as the objectives in the present investigation. Most of the researchers have classified the species based on different morphological characteristics. The characters contributing largely to the intra and inter-specific variability are related to the shape, size, flesh colour of underground tubers, shape and colour of aerial tubers; position, shape, size and vein colour of the leaves, petiole colour, shoot growth rate, number of days for shoot to germinate, tuber quality parameters and the cooking quality. The success of any breeding program depends to a large extent on the amount of genetic variability present in the population. Several attempts have been made to classify and catalogue the immense genetic variability encompassed by the species (Burkill, 1917; Gooding, 1960; Bourret, 1973) ^[8, 15, 7]. The study of the extent of genetic variation and genetic parameters would help in formulating effective breeding programme. Keeping all these in view, the present investigation was carried out.

Materials and Methods

The experimental material comprised of 27 cultivars of *Dioscorea alata* (L.) collected from Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. Each cultivar was given a code no. for easy identification. The codes were CV1, CV2, CV3 etc. The detail list of cultivar's name, Genotype collected from and place of collection are presented in Table 1.

The experiment was conducted under the agro-climatic condition of Jorhat (Assam) in the Experimental farm of the Department of Horticulture, Assam Agricultural University, Jorhat during 2020-21 and 2021-22. The geographical location of the farm is 26°47'N Latitude and 94°12'E longitude having an elevation of 86.6 metres above the mean sea level. The experimental material was analyzed in Randomized Block Design with two replications. The plot size was 3.6 m x 1.2 m with spacing of 120 cm x 120 cm. Yam setts or cut pieces weighing 200-250 g each were planted in pits of size 45cm x 45cm x 60 cm. The collections were characterized and evaluated using plant descriptor published by IPGRI (International Plant Genetic Resource Institute), 1997. Morphological characters of

mature leaf and underground tubers were studied to establish the varietal differences on various aspects. All these traits were recorded through visual observation from each of the sampled plants. Mature leaf characters were assessed at maturity stage.

Results

Qualitative characters are considered as important markers in describing the physical appearance of a plant. In this study the characters of young stem, mature stem and mature leaf and underground tuber were evaluated to know the morphological variability of the cultivar.

Young stem character

The young stem was evaluated for four qualitative characters viz. stem colour, presence or absence of wings, wing colour and presence/absence of spines at the base (Table 2). In respect to stem colour, three classes of variation were observed among the cultivars studied. Most of the cultivars (CV3, CV4, CV5, CV7, CV8, CV9, CV10, CV11, CV14, CV16, CV18, CV19, CV20, CV24, CV25, CV26, CV27) had purplish green colour stem, few (CV1, CV2, CV6, CV12, CV13, CV15, CV21, CV22, CV23) had green colour and only one cultivar, CV17 had purple colour stem. All the cultivars were found to possess wing except CV22 and based on the intensity of wing colour, cultivars were characterized into green with purple edges group (16 cultivars), purple (7 cultivars) and green (3 cultivars). Cultivar CV1, CV11, CV17, CV19 and CV22 had spines at the stem base whereas all the other cultivars had no spines at the stem base.

Mature stem character

Stem colour, stem cross section shape and absence or presence of ridges was considered as important characters of mature stem for characterization of the greater yam cultivars (Table 2). Two distinct types, green colour (11 cultivars) and purplish green (16 cultivars) were observed with respect to matured stem colour. Based on the stem cross section at the base all the cultivars had square stem cross section and all the cultivars had ridges.

Mature leaf Characters

In matured leaf, characters like leaf lobation, leaf colour, leaf vein colour, leaf margin colour, waxiness, leaf shape, leaf apex shape, distance between lobes, petiole colour and petiole wing colour were studied (Table 3). With respect to leaf lobation, the greater yam germplasm were grouped into shallowly lobed (6 cultivars) and deeply lobed (20 cultivars). Regarding leaf colour three types of variation were observed among the cultivars, of which, 4 cultivars were pale green in leaf colour, 16 cultivars were green in colour and the remaining 7 cultivars were dark green.

Based on the leaf vein colour, the most common group was green (26 cultivars) and only 1 cultivar (CV 17) had purple leaf vein. Two types of variation were observed for leaf margin colour, of which, 6 cultivars had purple margin colour and the remaining 21 cultivars had green margin colour.

The cultivars were divided into two group with respect to waxiness of leaf, of which, 16 cultivars exhibited waxiness on the upper surface of leaf and the remaining 11 cultivars

exhibited waxiness on both upper and lower surface of leaf. Four types of variation were observed regarding the leaf shape, of which, 14 cultivars were cordate shape, 6 cultivars were cordate long, 4 cultivars were cordate broad and 3 cultivars had sagittate long leaf shape. Most common group of leaf apex shape were of acute type (25 cultivars) and only two cultivars showed obtuse apex shape *viz.*, CV 7 and CV10. Based on the distance between lobes, the cultivars were classified into three groups of which 14 cultivars were of no measurable distance, 9 cultivars were intermediate, and the remaining 3 cultivars were grouped under very distant category. Based on the intensity of petiole colour, cultivars were categorized into green, green with purple ends, purplish green with purple base, green with purple base, and green with purple leaf junction. Among them, 2 cultivars (CV6 and CV23) were under green group, 10 cultivars were fall under green with purple ends, 4 cultivars in purplish green with purple base, 7 cultivars in green with purple base, 3 cultivars were under green with purple leaf junction group. Variation were observed for petiole wing colour, three classes of variation were observe, 2 cultivars had green petiole wing colour, 10 cultivars had purple colour and 14 cultivars had green with purple edges except CV22 which had no wing.

Underground tuber characters: The underground tubers characters were number of tubers per hill, relationship of tubers, tuber shape, roots on the tuber surface, tuber skin thickness, tuber skin colour beneath the bark, skin colour at the head of tuber constituted some distinguishing characters to know the variability of the germplasm (Table 4). With respect to number of tubers per hill, the greater yam cultivars were grouped into three categories of which 10 cultivars were under one (1) group, 8 cultivars were under few (2-5) and 9 cultivars were placed under group several (>5) number of tubers per hill. Based on the relationship of tubers three types of variation were observed among the cultivars, of which 9 of them were completely separate but close together, 12 cultivars were completely separate and distant and 6 cultivars were fused at the neck region. Tuber shape is an important character for varietal identification. In the present study, Seven types of variation was observed of which 5 cultivars were categorized under cylindrical group, 8 cultivars under oblong, 7 cultivars under oval oblong, 2 cultivars each under oval, forked and flattened while only 1 cultivar under round shape. Roots on tuber surface classified the cultivars into two groups *viz.*, few and many. Among them, 15 cultivars were placed under few group and 12

cultivars in the second group *i.e.* many group. Depending upon the skin thickness, cultivars were classified into two groups, <1 mm and >1 mm group of which 16 cultivars were grouped under <1 mm group and the remaining 11 cultivars were under >1 mm group. Tuber skin colour beneath the bark as a discriminating parameter divided the 27 cultivars into six groups which included purple, light purple, brown, light brown, offwhite and maroon colour where in 3 cultivars fall under purple group, 3 cultivars in light purple, 8 cultivars under brown group, 6 cultivars under light brown, 6 cultivars in offwhite group and only 1 cultivar fall under maroon group. For skin colour at head of the tuber, cultivars were grouped into yellowish white or offwhite (14 cultivars), white (12 cultivars) and only 1 cultivar (CV2) in purple group.

Discussion

Wide range of variation was observed in various morphological characters used in the characterization of the greater yam. If morphological observations differ consistently from all others then a cultivar is considered to be distinct. Athira *et al.*, (2017) ^[5] evaluated 45 accessions of greater yam for various morphological traits like tuber shape, tuber flesh colour, tuber skin texture, tuber cortex colour, leaf shape and young leaf colour and found all these parameters to be of great importance in distinguishing the accessions. Morphological variation among 70 accessions of greater yam for shape, size and flesh colour of underground tubers, shape and colour of aerial tubers and position, shape, size and vein colour of the leaves were also reported by Sayed *et al.*, (2008) ^[24]. Rao *et al.*, (2019) ^[23] reported high variation among 27 genotypes of greater yam in terms of shape of leaf, position of leaf, distance between lobes, colour of wing, stem and leaf, pigmentation of petiole on leaf base, formation of aerial tuber, skin and flesh colour of underground tuber, shape of tuber, presence of hairiness on tuber and spines on stem. Significant variation for number of tubers per plant was also reported by Muluaem and Ayanew, (2012) ^[18], Adigbe *et al.* (2015) ^[1], Bassey and Akpan, (2015) ^[6] and Panja *et al.*, (2016) ^[21]. In the diversity pattern study of *D. alata* in Brazil by Siqueria *et al.*, (2014) ^[25] three tuber shapes, namely irregular, oblong and round were found. Here more than three number tuber shapes indicates more variability found in North East India. Similar observations have been reported in the studies done by Demuyakor *et al.*, (2013) ^[11], Anokye *et al.*, (2014) ^[4] and Tiama *et al.*, (2016) ^[26].





Fig 1: Underground tuber of greater yam



Fig 2: Categories of mature leaf colour of greater yam cultivars

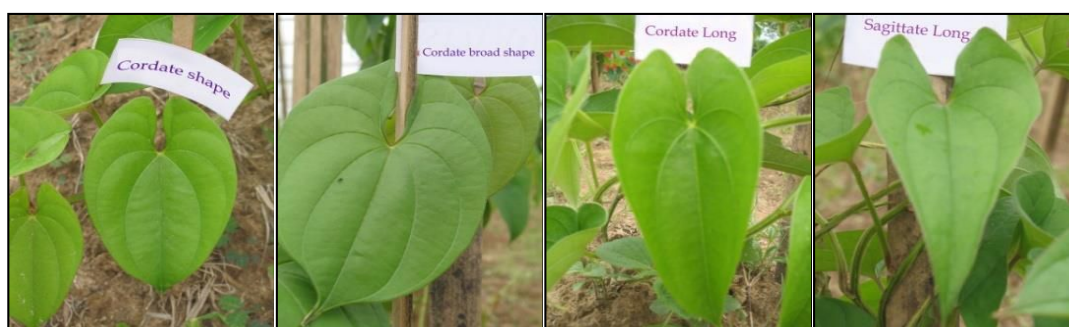


Fig 3: Categories of leaf shape of greater yam cultivars



Fig 4: Categories of distance between lobes of greater yam cultivars



Fig 5: Categories of leaf apex shape of greater yam cultivars

**Fig 6:** Presence of wing in greater yam cultivars**Fig 7:** Presence of spine in greater yam cultivars**Table 1:** List of cultivars

Materials	Source	Materials	Source	Materials	Source
CV1	Assam	CV11	Assam	CV21	Nagaland
CV2	Arunachal Pradesh	CV12	Assam	CV22	Assam
CV3	Assam	CV13	Assam	CV23	Mizoram
CV4	Meghalaya	CV14	Assam	CV24	Manipur
CV5	Manipur	CV15	Assam	CV25	Assam
CV6	Mizoram	CV16	Assam	CV26	Mizoram
CV7	Assam	CV17	Assam	CV27	Tripura
CV8	Meghalaya	CV18	Assam		
CV9	Arunachal Pradesh	CV19	Assam		
CV10	Assam	CV20	Assam		

Table 2: Distinguishing stem characters of greater yam cultivars

Cultivar	Young stem				Mature stem		
	Stem colour	Absence/presence of wings	Wing colour	Absence/presence of spines	Stem colour	Stem cross section at base	Absence/presence of ridges
CV1	Green	Present	Purple	Present	Purplish green	Square	Present
CV2	Green	Present	Green with purple edges	Absent	Green	Square	Present
CV3	Purplish green	Present	Purple	Absent	Purplish green	Square	Present
CV4	Purplish green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV5	Purplish green	Present	Green	Absent	Purplish green	Square	Present
CV6	Green	Present	Green	Absent	Green	Square	Present
CV7	Purplish green	Present	Purple	Absent	Green	Square	Present
CV8	Purplish green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV9	Purplish green	Present	Green with purple edges	Absent	Green	Square	Present
CV10	Purplish green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV11	Purplish green	Present	Purple	Present	Green	Square	Present
CV12	Green	Present	Purple	Absent	Purplish green	Square	Present
CV13	Green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV14	Purplish green	Present	Green with purple edges	Absent	Green	Square	Present
CV15	Green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV16	Purplish green	Present	Purple	Absent	Purplish green	Square	Present
CV17	Purple	Present	Green with purple edges	Present	Green	Square	Present
CV18	Purplish green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV19	Purplish green	Present	Green with purple edges	Present	Purplish green	Square	Present
CV20	Purplish green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV21	Green	Present	Purple	Absent	Green	Square	Present
CV22	Green	Absent	-	Present	Green	Square	Present
CV23	Green	Present	Green	Absent	Purplish green	Square	Present
CV24	Purplish green	Present	Green with purple edges	Absent	Green	Square	Present
CV25	Purplish green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV26	Purplish green	Present	Green with purple edges	Absent	Purplish green	Square	Present
CV27	Purplish green	Present	Green with purple edges	Absent	Green	Square	Present

Table 3: Distinguishing mature leaf characters of greater yam cultivars

Cultivar	Position of leaves	Leaf lobation	Leaf colour	Leaf vein colour	Leaf margin colour	Waxiness	Leaf shape	Leaf apex shape	Distance between lobes	Petiole colour	Petiole wing colour
CV1	Alternate at base/opposite above	Deeply lobed	Dark green	Green	Purple	Waxy upper surface	Cordate long	Acute	No measurable distance	Green with purple ends	Green with purple edges
CV2	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Both on upper and lower surface	Cordate long	Acute	Intermediate	Green with purple ends	Green with purple edges
CV3	Alternate at base/opposite above	Deeply lobed	Dark green	Green	Green	Waxy upper surface	Cordate broad	Acute	No measurable distance	Purplish green with purple base	Purple
CV4	Alternate at base/opposite above	Deeply lobed	Dark green	Green	Green	Waxy upper surface	Cordate	Acute	No measurable distance	Purplish green with purple base	Green with purple edges
CV5	Alternate at base/opposite above	Shallowly lobed	Green	Green	Purple	Waxy upper surface	Sagittate long	Acute	Intermediate	Green with purple ends	Green with purple edges
CV6	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Both on upper and lower surface	Cordate long	Acute	No measurable distance	Green	Green
CV7	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Both on upper and lower surface	Cordate broad	Obtuse	No measurable distance	Green with purple ends	Purple
CV8	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Waxy upper surface	Cordate long	Acute	No measurable distance	Green with purple base	Green with purple edges
CV9	Alternate at base/opposite above	Shallowly lobed	Green	Green	Green	Both on upper and lower surface	Cordate	Acute	No measurable distance	Green with purple leaf junction	Purple
CV10	Alternate at base/opposite above	Deeply lobed	Dark green	Green	Green	Waxy upper surface	Cordate broad	Obtuse	No measurable distance	Green with purple ends	Green with purple edges
CV11	Alternate at base/opposite above	Shallowly lobed	Green	Green	Green	Waxy upper surface	Cordate	Acute	Intermediate	Purplish green with purple base	Purple
CV12	Alternate at base/opposite above	Deeply lobed	Pale green	Green	Purple	Waxy upper surface	Cordate	Acute	No measurable distance	Green with purple ends	Green with purple edges
CV13	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Waxy upper surface	Cordate	Acute	No measurable distance	Green with purple ends	Green with purple edges
CV14	Alternate at base/opposite above	Deeply lobed	Dark green	Green	Green	Both on upper and lower surface	Cordate	Acute	No measurable distance	Green with purple base	Purple
CV15	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Waxy upper surface	Cordate long	Acute	No measurable distance	Green with purple ends	Green with purple edges
CV16	Alternate at base/opposite above	Shallowly lobed	Green	Green	Green	Waxy upper surface	Cordate	Acute	Intermediate	Green with purple base	Purple
CV17	Alternate at base/opposite above	Deeply lobed	Dark green	Purple	Purple	Both on upper and lower surface	Cordate	Acute	Intermediate	Green with purple ends	Purple
CV18	Alternate at base/opposite above	Shallowly lobed	Green	Green	Purple	Waxy upper surface	Cordate	Acute	No measurable distance	Green with purple leaf junction	Green with purple edges
CV19	Alternate at base/opposite above	Deeply lobed	Pale green	Green	Green	Both on upper and lower surface	Cordate broad	Acute	No measurable distance	Green with purple base	Purple
CV20	Alternate at base/opposite above	Deeply lobed	Dark green	Green	Green	Waxy upper surface	Cordate	Acute	No measurable distance	Green with purple leaf junction	Green with purple edges
CV21	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Waxy upper surface	Cordate	Acute	No measurable distance	Green with purple base	Purple
CV22	Alternate at base/opposite above	Shallowly lobed	Pale green	Green	Green	Both on upper and lower surface	Cordate	Acute	Very distant	Purplish green with purple base	-
CV23	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Both on upper and lower surface	Sagittate long	Acute	Very distant	Green	Green
CV24	Alternate at base/opposite above	Shallowly lobed	Green	Green	Green	Both on upper and lower surface	Cordate long	Acute	Intermediate	Green with purple ends	Green with purple edges
CV25	Alternate at base/opposite above	Deeply lobed	Green	Green	Purple	Both on upper and lower surface	Sagittate long	Acute	Intermediate	Green with purple base	Purple
CV26	Alternate at base/opposite above	Deeply lobed	Pale green	Green	Green	Waxy upper surface	Cordate	Acute	Very distant	Green with purple ends	Green with purple edges
CV27	Alternate at base/opposite above	Deeply lobed	Green	Green	Green	Waxy upper surface	Cordate	Acute	Intermediate	Green	Green with purple edges

Table 4: Distinguishing underground tuber characters of greater yam cultivars

Cultivar	No. of tubers per hill	Relationship of tubers	Tuber shape	Roots on the tuber surface	Tuber skin thickness	Tuber skin colour (beneath the bark)	Skin colour at the head of the tuber
CV1	Several(>5)	Completely separate but close together	Cylindrical	Few	<1 mm	Purple	Yellowish white (offwhite)
CV2	Several(>5)	Completely separate but close together	Cylindrical	Many	<1 mm	Light purple	Purple
CV3	Few(2-5)	completely separate and distant	Oblong	Few	≥1 mm	Light brown	White
CV4	Few(2-5)	completely separate and distant	Cylindrical	Few	<1 mm	Light brown	White
CV5	One	completely separate and distant	Oval oblong	Few	≥1 mm	Brown	Yellowish white (offwhite)
CV6	Several(>5)	Completely separate but close together	Flattened	Few	≥1 mm	Offwhite	Yellowish white (offwhite)
CV7	Few(2-5)	Completely separate but close together	Oval oblong	Few	<1 mm	Offwhite	White
CV8	One	Completely separate and distant	Oval oblong	Few	<1 mm	Brown	Yellowish white (offwhite)
CV9	Few(2-5)	Completely separate and distant	Oval oblong	Few	≥1 mm	Offwhite	White
CV10	Several(>5)	Completely separate but close together	Oblong	Many	<1 mm	Offwhite	White
CV11	Several(>5)	Fused at neck	Forked	Many	<1 mm	Purple	Yellowish white(offwhite)
CV12	One	Completely separate and distant	Oblong	Few	≥1 mm	Offwhite	Yellowish white (offwhite)
CV13	One	Completely separate and distant	Oval oblong	Many	≥1 mm	Light brown	White
CV14	Few(2-5)	Completely separate but close together	Oblong	Few	<1 mm	Light brown	Yellowish white (offwhite)
CV15	One	Completely separate and distant	Oval oblong	Few	<1 mm	Brown	Yellowish white (offwhite)
CV16	One	Completely separate and distant	Oblong	Many	<1 mm	Brown	White
CV17	Few(2-5)	Completely separate and distant	Cylindrical	Few	≥1 mm	Brown	Yellowish white (offwhite)
CV18	One	Completely separate but close together	Oblong	Many	<1 mm	Brown	White
CV19	One	Completely separate but close together	Oblong	Many	<1 mm	Brown	Yellowish white (offwhite)
CV20	Few(2-5)	Completely separate and distant	Oblong	Many	≥1 mm	Brown	White
CV21	Several(>5)	Completely separate but close together	Oval oblong	Few	≥1 mm	Offwhite	Yellowish white (offwhite)
CV22	Several(>5)	Fused at neck	Forked	Many	≥1 mm	Light purple	Yellowish white (offwhite)
CV23	One	Fused at neck	Round	Many	<1 mm	Maroon	Yellowish white (offwhite)
CV24	Several(>5)	Fused at neck	Oval	few	<1 mm	Light brown	White
CV25	Few(2-5)	Fused at neck	Flattened	Many	<1 mm	Light purple	Yellowish white (offwhite)
CV26	Several(>5)	Fused at neck	Oval	Few	<1 mm	Light brown	White
CV27	One	Completely separate and distant	Cylindrical	Few	<1 mm	Purple	White

In this study the 27 cultivars exhibited wide variation for most of the morphological characters and were classified into distinct group. There were no duplicate accessions identified based on the morphological classification and it can be maintained as core collection because it depicts wide range of variability. Variation in morphological characters of greater yam cultivars could be used as an index in varietal identification of greater yam and to detect duplication of varieties. Present study provides a scope for the selection of desirable parents for hybridization programs.

References

1. Adeigbe OO, Ilorian CO, Adewale BD. Phenotypic diversity and ploidy level of some *Dioscorea dumetorum* genotypes. IOSR Journal of Agriculture and Veterinary Science. 2015;8(3):47-52.
2. AICRP TC. Annual Report 2015-16. ICAR-All India Coordinated Research Project on Tuber Crops. James George, Sunitha S, Sheela Immanuel, editors. ICAR-CTCRI; 2016. p. 208.
3. Albrecht MA, McCarthy BC. Seed germination and dormancy in the medicinal wood and herbs *Collinsonia canadensis* L. (Lamiaceae) and *Dioscorea villosa* L. (Dioscoreaceae). Flora. 2006;201:24-31. doi:10.1016/j.flora.2005.04.001
4. Anokye M, Tetteh JP, Otoo E. Morphological characterization of some water yam (*Dioscorea alata* L.) germplasm in Ghana. Journal of Agricultural Science and Technology. 2014;4:518-32.
5. Athira J, Sheela MN, Krishna NR, Irfa A, Vijayaraghava K, Abhilash PV. Morphological characterization of greater yam (*Dioscorea alata* L.)

- landraces in Kerala. *Journal of Root Crops*. 2017;43(1):3-10.
6. Bassey EE, Akpan US. Evaluation of Guinea white yam (*Dioscorea rotundata* Poir.) for yield and yield components in Nigeria. *American Journal of Experimental Agriculture*. 2015;8(4):216-23.
 7. Bourret D. Etude ethnobotanique des Dioscoreaceae alimentaires. Thèse. Faculté des Sciences; 1973. Paris, France. p. 135.
 8. Burkill IH. A report on the races of the greater or ten-months yam *Dioscorea alata* cultivated in the Botanic Gardens, Singapore. *Gardeners' Bulletin Straits Settlements*. 1917;1:71-396.
 9. Burkill IH. The rise and decline of the greater yam in the service of man. *Advances in Science*. 1951;7(28):443-8.
 10. Coursey DG. Yams: An account of the nature, origins, cultivation and utilization of the useful members of the Dioscoreaceae. London: Longman; 1967.
 11. Demuyakor B, Dukrogand TM, Chikpah SK. Yam germplasm in Ghana-A survey on varietal identification and characterization of *Dioscorea rotundata-alata* in northern region of Ghana. *International Journal of Agronomy and Plant Production*. 2013;4(4):719-26.
 12. Onwueme IC, Charles WB, editors. Tropical root and tuber crops: Production, perspectives and future prospects. FAO Plant Production and Protection Paper. Rome: FAO; 1994. p. 126.
 13. Farombi EO, Nwankwo JO, Emerole GO. Possible moderate effect of browned yam flour diet on chemically induced toxicity in the rat. *Food Chemistry and Toxicology*. 1997;35:975-9.
 14. Fu YC, Huang PY, Chu CJ. Use of continuous bubble separation process for separating and recovering starch and mucilage from yam (*Dioscorea pseudojaponica* Yamamoto). *LWT-Food Science and Technology*. 2005;38(7):735-44.
 15. Gooding HJ. West Indian *Dioscorea alata* cultivars. *Tropical Agriculture (Trinidad)*. 1960;37:11-30.
 16. Martin FW, Rhodes AM. Correlations among greater yam (*Dioscorea alata* L.) cultivars. *Tropical Agriculture*. 1973;59:183-92.
 17. Martin FW, Delpin H. New, superior varieties of *Dioscorea alata*, the Asian greater yam. *Journal of Agricultural University, Puerto Rico*. 1978;62:64-75.
 18. Mulualem T, Ayenew B. Correlation and path coefficient analysis of cassava (*Manihot esculenta* Crantz) at Jimma, southwestern Ethiopia. *Journal of Natural Scientific Research*. 2012;2(9):1-7.
 19. Nedunchezhiyan M, Misra MRS, Naskar SK, Swakumar PS. Yams and aroids: Potential intercrops in plantation and horticultural crops. In: Abstracts of Invited and Contributed Papers. International Conference on Vegetables for Sustainable Food and Nutritional Security in the New Millennium; 2002 Nov 11-14; Bangalore, India.
 20. Onwueme IC, Ganga ZN. *Dioscorea alata* L. In: Flach M, Rumawas F, editors. Plant Resources of South-East Asia No. 9: Plants Yielding Non-Seed Carbohydrates. Bogor, Indonesia: PROSEA Foundation; 1996. Database record: prota4u.org/prosea.
 21. Panja P, Sharma A, Singh B. Studies on physico-chemical constituents in different cultivars of sweet potato under West Bengal condition. *International Journal of Agriculture, Environment and Biotechnology*. 2016;9(6):979-84.
 22. Purseglove JW. Tropical Crops: Monocotyledons. Vol. 1. London: Longman Group Limited; 1972. p. 102.
 23. Rao GK, Patel NB, Patel AI, Desai KD, Ahlawat TR, Kapadia C. Characterization of greater yam (*Dioscorea alata* L.) genotypes using morphological markers. *International Journal of Chemical Studies*. 2019;7(3):4961-7.
 24. Sayed MZH, Andrew AN, Ramisaha MS, Norizan M. Morphological variability of greater yam (*Dioscorea alata* L.) in Malaysia. *Plant Genetic Resources*. 2008;6(1):52-61.
 25. Siqueira MV, Bonatelli ML, Günther T, Gawenda I, Schmid KJ, Pavinato VA, *et al.* Water yam (*Dioscorea alata* L.) diversity pattern in Brazil: An analysis with SSR and morphological markers. *Genetic Resources and Crop Evolution*. 2014;61(3):611-24.
 26. Tiama D, Zoundjiekpon J, Sawadogo N, Nebie B, Bationo P, Sawadogo M. Agro-morphological characterization of yams (*Dioscorea* sp.) of Passoré in Burkina Faso. *Journal of Applied Environmental and Biological Sciences*. 2016;6(1):6-16.