



Original Research Article

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Ethnobotanical Uses and Survey of *Dioscorea* Species of North East India: Its Conservation and Sustainable Utilization

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Abstract

Dioscorea L. commonly known as yam is the large genus in the family Dioscoreaceae with 602 species distributed in the tropical and subtropical regions. It is an important food crop next to cereals and grains due to high yield storage of carbohydrates which form an important place in the dietary habits of small and marginal farmers especially in the food security of tribal population. The tubers are also rich source of various secondary metabolites including Diosgenin, a commercially important bioactive sapogenin used as a precursor in the manufacturing of sex hormones, oral contraceptives and other pharmaceutically important steroidal drugs. Despite of its huge diversity only few species are recognised to be useful for medicinal and edible purposes. About 50 species of *Dioscorea* are distributed in India. The North East India, one of the hotspot of biodiversity is particularly rich in tropical root and tuber crops. *Dioscorea* species are in luxuriant growth in wild habitat in this region. The present study mainly addressed to explore the ethnomedicinal uses of *Dioscorea* in North East India and also focused on safe conservation and sustainable uses of various wild relatives of *Dioscorea* species present in this region.

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Introduction

The North east India (located between 87°32'E to 97°52'E latitude and 21°34'N to 29°50' N latitude) forms a distinct part of the Indo-Burma hotspot which rank the 6th among 25 biodiversity hotspot of the world is climatically, ecologically and ethnically very diverse. It is estimated that half of the Indian floristic diversity of higher plants (about 7510 species, out of a total of 15000 species) is concentrated in this region. The region is largely dominated by tribals such as Naga, Khasi, Mizo, Miri, Adi, Aka, Apatani, Maripa, Mushard, Garo, Tagin Naga and Singpho who are socio-

culturally different. The North east region, besides having large floral biodiversity, is yet not fully explored. The forest resources available in this area are most often ill managed due to lack of awareness and anthropogenic activities. Various wild roots and tuber crops are consumed by the indigenous group of North East India which have very less scientific documentation although.

As wild tuber crops available in North East India, *Dioscorea* species play a prime role in providing food and medicinal requirements for the indigenous communities of this region. Hence the present paper analyses the extent of available *Dioscorea* species with

ethnobotanical importance, their conservation strategies and sustainable utilization in North East India.

Materials and Methods

The present work is based both on a review of literature and field survey in north-eastern India. Various species of *Dioscorea* (Figure 1) having ethno medicinal properties were collected during field survey with the help of local informants and through interviews from the local people. The plant materials collected during the field studies were pressed, preserved and dried following the standard method of preparation of herbarium techniques (Jain & Rao 1997).

Results and Discussion

Ethnobotanical uses of genus Dioscorea in North east region of India

Several species of Yams (*Dioscorea*) is edible and counted next to potato in its food value. Apart from starch, the tubers of *Dioscorea* species also contain protein, fats, fibres and among minerals nutrients potassium, sodium, Phosphorus, calcium, Magnesium, copper, Magnesium, copper, Iron, Manganese etc. (Bandari et al., 2003). Diosgenin obtained from its root-stock which is one of the costliest and important steroidal drug used worldwide.

Prain and Burkill (1936) reported the occurrence of about 50 different *Dioscorea* species in India. 28 species have been found in North eastern region (Sharma & Hore, 1995) out of which 21 species was recorded to have ethno medicinal importance (Table 1).

Various parts of *Dioscorea* species such as tubers, bulbils, leaves and young stem are used as vegetables, medicine or for both (Table 2 and Table 3). Mostly tubers have been utilized as vegetables and medicines than bulbil or young leaves and stem (Fig. 2 and Fig. 3). *D. alata* L., *D. esculenta* (Lour) Burkill and *D. bulbifera* L. are mostly cultivated in this region for their tubers which are rich source of starch.

Few species are rare in occurrence such as *D. orbiculata* Hook. f., *D. floribunda* Mart. & Gal., *D. deltoidea* Wallich ex Hook. f. and *D. prazerii* Prain & Burkill. *D. deltoidea* Wallich ex Hook. f. and *D. prazerii* Prain & Burkill are endangered and also included in IUCN red list due to over exploitation for its economically medicinal value.

Yam Conservation and sustainable utilization in North East India

The main approaches conducted for yam conservation is *in situ* and *ex situ* conservation. In *in situ* conservation the tuber crops germplasm are conserved in their original habitat. Tribals of most North Eastern states play an important role in the *in situ* conservation of wild species of tuber crops like *Dioscorea* species. Tubers of *Dioscorea* species have the ability of vegetative propagation. Even though the tubers are consumed, they mostly leave a piece of tuber in the cavity from which the collection is made, to ensure its availability for the next season. Species such as *D. alata*, *D. bulbifera*, *D. esculenta* and *D. pentaphylla* are conserved in this way. This type of conservation is very old and has been implemented since ages for roots crops like *Dioscorea*, zinger etc. But such type of conservation is highly susceptible to natural calamities like forest fires, extreme weather conditions and sometimes by insects. On the other hand, conservation of some wild species of *Dioscorea* such as *D. deltoidea*, *D. floribunda* and *D. prazerii* extremely difficult due to their rare occurrence. These species have been exploited mostly than other wild species of *Dioscorea* due to its medicinal values. Hence conservation of such species by *in situ* method would not be applicable. *Ex-situ* conservation is generally carried out through field gene banks.

The collections of rare species from forests fail to survive in open field because of their specific adaptation and requirements. Hence a special technique such as *in vitro* techniques is needed for conservation of such rare species even if it fails to acclimatized in open fields. IITA and IPGRI have recommended the use of *in vitro* techniques for yam conservation (Hanson, 1986) which were successfully carried out in two cultivated species edible species (*D. alata* and *D. bulbifera*), a medicinal yam (*D. floribunda*) and one wild edible type (*D. wallichii*).

Conclusion

Tubers and root crops are important so far as their uses are concerned. Tuber crops are cultivated by tribals and poor farmers from time immemorial. Among the tuberous wild edible and medicines plant, *Dioscorea* species are economically important. The plant parts are quite useful in treatment of different types of diseases and disorders due the presence of a numbers of bioactive compounds.

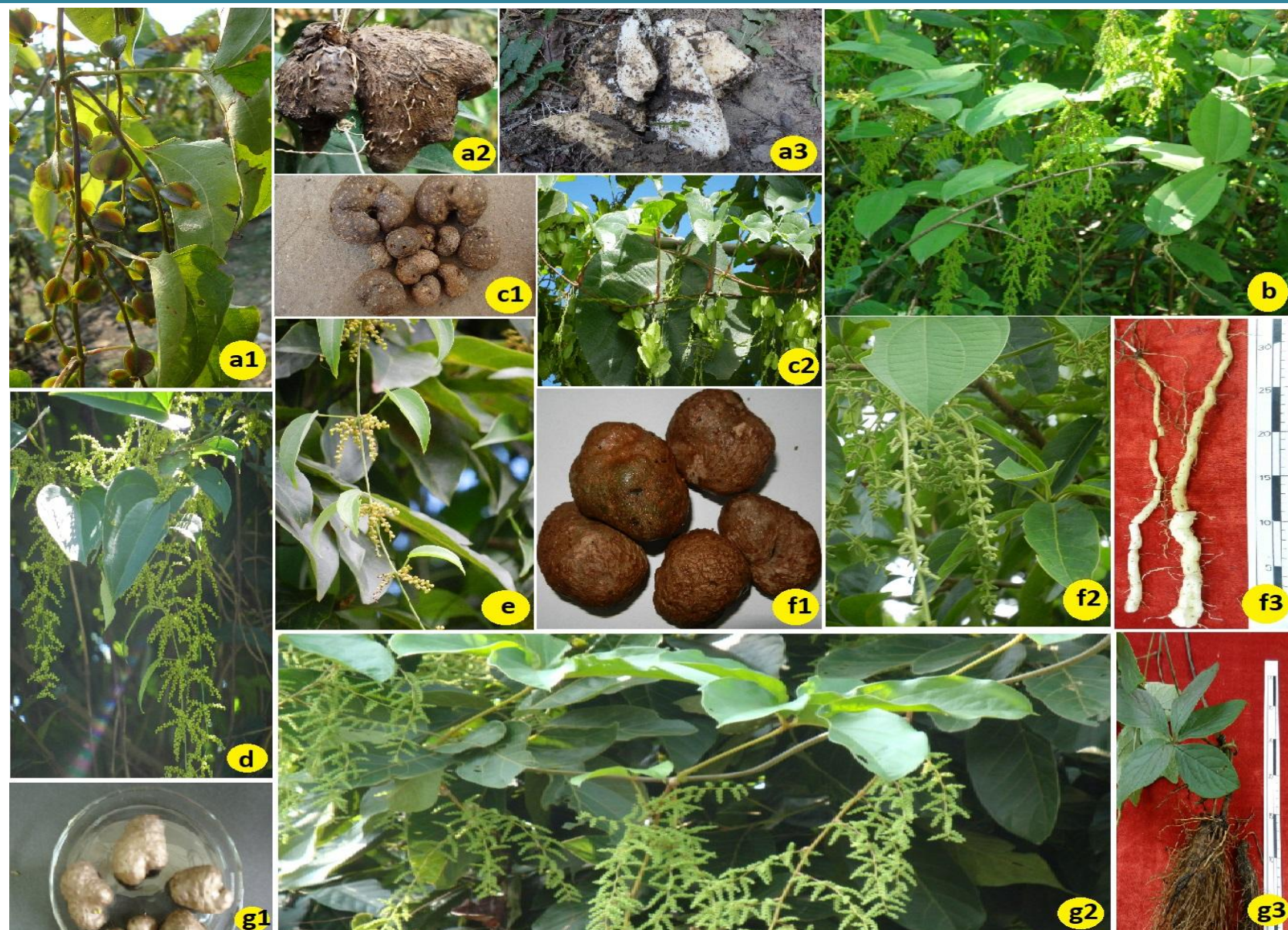


Fig.1: a1, a2, a3- female plant, bulbils, tubers of *D. alata*; b- male plant of *D. oppositifolia* ; c1,c2- bulbils, female plant of *D. bulbifera*; d- male plant of *D. glabra*; e- male plant of *D. trinervia*; f1,f2, f3- bulbils, female plant, tubers of *D. pubera*; g1,g2,g3- bulbils, male plant, tuber of *D. pentaphylla*

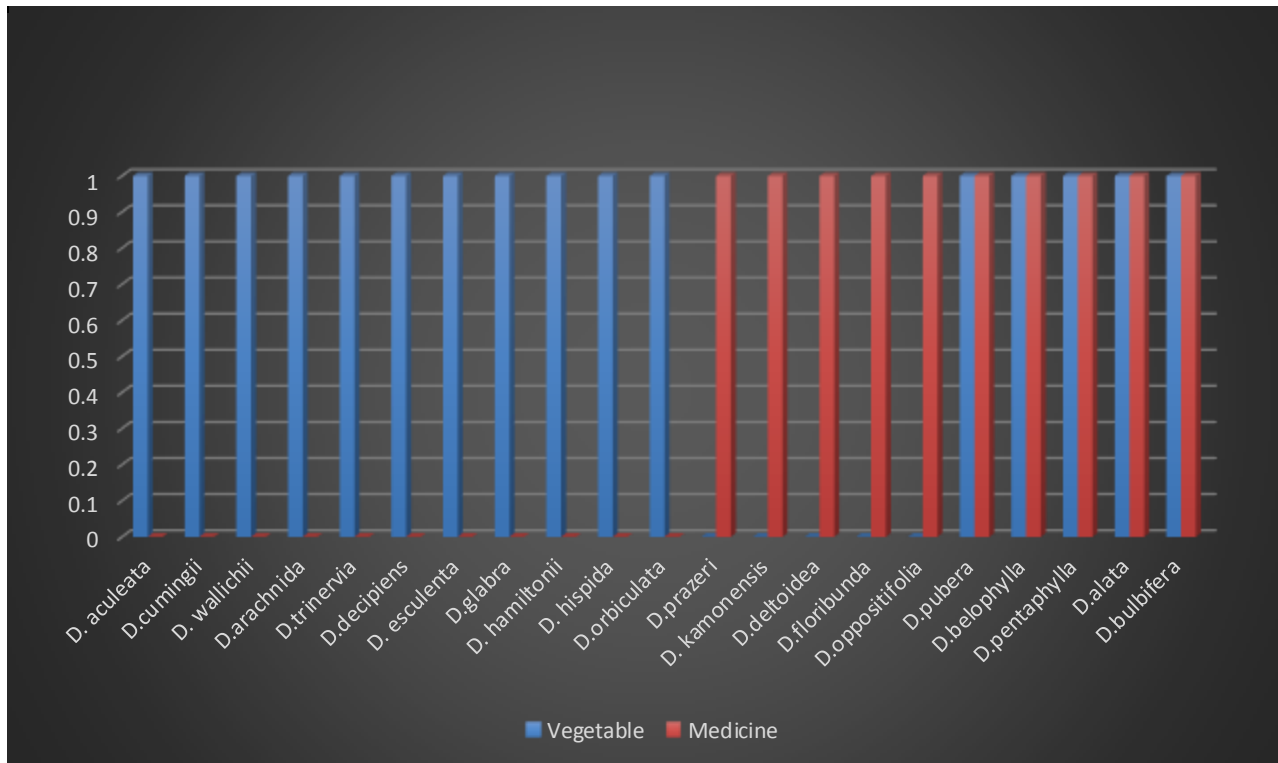


Fig. 2: Tubers of different species of *Dioscorea* used as vegetable/ medicine or both

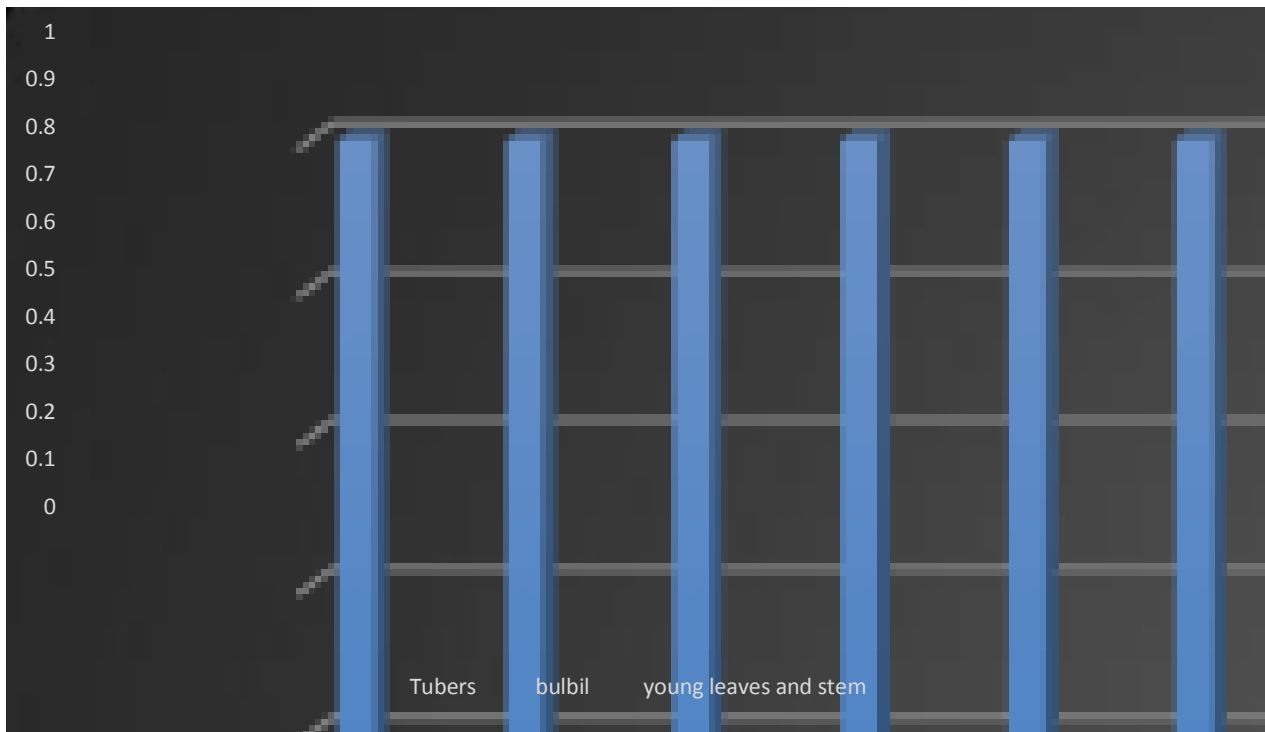


Fig. 3: Different parts of *Dioscorea* species used for ethnobotanical evaluation.

Table 1. Edible and useful species of *Dioscorea* growing in North East India

Species	Part used	Potential uses
<i>Dioscorea alata</i> L.	Tuber/bulbil	Tuber edible (Prasad et al., 2002); tuber taken orally for treatment of piles and leprosy (Lalfakzuala et al., 2007)
<i>Dioscorea bulbifera</i> L.	Tuber/bulbil	Tuber edible (Borthakur, 1996); one teaspoonful of tuber powder is given orally with water as single dose to cure abdominal pain. (Punjani, 2007)
<i>Dioscorea aculeata</i> L.	Tuber	Tuber edible (Abhyankar, 2011)
<i>Dioscorea floribunda</i> M. Martens & Galeotti	Tuber	Tuber used for medicinal uses and extraction of Diosgenin (Kaul and Staba, 1968)
<i>Dioscorea cumingii</i> Prain & Burkill	Tuber	Tuber edible as vegetables. (Burkill, 1951)
<i>Dioscorea wallichii</i> Hook. f.	Tuber	Boiled and cooked tuber is edible (Jain, 1991)
<i>Dioscorea arachidna</i> Prain & Burkill	Tuber	cooked tuber is edible (Borthakur, 1996)
<i>Dioscorea trinervia</i> Roxburgh ex Prain & Burkill	Tuber	Boiled and cooked tuber is edible (Sinha, 1996)
<i>Dioscorea decipiens</i> Hook. f.	Tuber	Softer part of the tuber used as food (Prain and Burkill, 1938)
<i>Dioscorea deltoidea</i> Wallich ex Grisebach	Tuber/young leaves/stems	Tubers are useful as uterine sedative, haemostatic, diuretic and expectorant. The herbs is used to expel worms from the body (Humayun, 2007)
<i>Dioscorea esculenta</i> (Lour) Burkill	Tuber	Boiled and cooked tuber is edible (Kulkarni and Kumbhojkar, 1993)
<i>Dioscorea glabra</i> Roxb.	Tuber	Boiled and cooked tuber is edible (Elanchezhian et al., 2007)
<i>Dioscorea hamiltonii</i> Hook., f.	Tuber	Boiled and cooked tuber is edible (Jain, 1991)
<i>Dioscorea hispida</i> Dennstedt	Tuber	Boiled and cooked tuber is edible (Jain, 1991)
<i>Dioscorea komoonensis</i> Kunth	Tuber	Tubers are used in the treatment of arthritis and rheumatism (Edison, 2006)
<i>Dioscorea oppositifolia</i> L.	Tuber/leaves	Leaves paste is used as antiseptic for ulcers; The roots are chewed to cure toothache (Felix et al., 2009)
<i>Dioscorea orbiculata</i> Hook. f.	Tuber	Used as pig fodder and sometimes as vegetables (Abhayankar, 2011)
<i>Dioscorea pentaphylla</i> L.	Tuber/young shoot and stem	Tuber taken as vegetable (Kulkarni and Kumbhojkar, 1993). Leaf paste mixed with mustard oil is rubbed on the effected part to treat rheumatism (Rahman et al., 2007)
<i>Dioscorea prazerii</i> Prain & Burkill	Tuber	Tuber used for medicinal uses and extraction of Diosgenin (Kaul and Staba, 1968)
<i>Dioscorea pubera</i> Blume	Tuber/ bulbil	Tuber is eaten as vegetable (Jain, 1991). Tuberous rhizome and bulbil are cooked and given to cure colic pain (Pandey & Rout, 2006)
<i>Dioscorea belophylla</i> (Prain) Haines	Leaves/tuber	Boiled and cooked tuber is edible, fresh leaves juice is given to treat jaundice, fresh leaves extract in hot water is given twice daily to treat mumps (Rahman et al., 2007)

Table 2. Tubers of *Dioscorea* species used as vegetables/medicine or both.

Serial no.	Species of <i>Dioscorea</i>	Tubers used as vegetables	Tubers used as medicines
1	<i>D. aculeata</i>	1	0
2	<i>D. cumingii</i>	1	0
3	<i>D. wallichii</i>	1	0
4	<i>D. arachnida</i>	1	0
5	<i>D. trinervia</i>	1	0
6	<i>D. decipiens</i>	1	0
7	<i>D. esculenta</i>	1	0
8	<i>D. glabra</i>	1	0
9	<i>D. hamiltonii</i>	1	0
10	<i>D. hispida</i>	1	0
11	<i>D. orbiculata</i>	1	0
12	<i>D. prazeri</i>	0	1
13	<i>D. kamonensis</i>	0	1
14	<i>D. deltoidea</i>	0	1
15	<i>D. floribunda</i>	0	1
16	<i>D. oppositifolia</i>	0	1
17	<i>D. pubera</i>	1	1
18	<i>D. belophylla</i>	1	1
19	<i>D. pentaphylla</i>	1	1
20	<i>D. alata</i>	1	1
21	<i>D. bulbifera</i>	1	1

Key: 1= used; 0= not used.

Table 3. Different parts of *Dioscorea* species used for ethnobotanical evaluation.

Serial no.	Species of <i>Dioscorea</i>	Tubers	Bulbils	Young leaves and stem
1	<i>D. aculeata</i>	1	0	0
2	<i>D. cumingii</i>	1	0	0
3	<i>D. wallichii</i>	1	0	0
4	<i>D. arachnida</i>	1	0	0
5	<i>D. trinervia</i>	1	0	0
6	<i>D. decipiens</i>	1	0	0
7	<i>D. esculenta</i>	1	0	0
8	<i>D. glabra</i>	1	0	0
9	<i>D. hamiltonii</i>	1	0	0
10	<i>D. hispida</i>	1	0	0
11	<i>D. orbiculata</i>	1	0	0
12	<i>D. prazeri</i>	1	0	0
13	<i>D. kamonensis</i>	1	0	0
14	<i>D. deltoidea</i>	1	0	1
15	<i>D. floribunda</i>	1	0	0
16	<i>D. oppositifolia</i>	1	0	1
17	<i>D. pubera</i>	1	1	0
18	<i>D. belophylla</i>	1	0	1
19	<i>D. pentaphylla</i>	1	1	1
20	<i>D. alata</i>	1	1	0
21	<i>D. bulbifera</i>	1	1	0

Key: 1= used; 0= not used.

Various wild relatives of *Dioscorea* species are still unexplored in wild habitat of North east region which could serve as a potent source of food and medicines. So emphasis should be also given on proper documentation and collection of the wild relatives of *Dioscorea* species. Conservation and sustainable utilization of yam resources in North east region will open up new avenues in the study of germplasm conservation, pharmacology and many other maiden fields of research in plant science.

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Conflict of interest statement

Authors declare that they have no conflict of interest.

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