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A Documentation on *Dioscorea* spp. (A neglected Wild tuber) with Special Reference to its Domestication and Seasonal Food Security to the Indigenous Forest Dwellers in Tripura, India

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Study Area: Tripur, India

Coordinates: 22°56" to 24°32"N and 90°09" to 92°30"E

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Abstract

Wild *Dioscorea* (Yams) are such type of tuber crop that may be considered as a potential alternative source offering the food security to the indigenous forest dwellers of Tripura, India. This wild tuber crop is one of the major food sources among different tribal communities of Tripura. Till date, total ten *Dioscorea* species have been reported from the state. Among them, eight species are directly exploiting from wild, whereas only two species are found in the home garden of tribal as well as non-tribal dwellers in the state. Six species such as *D. alata*, *D. glabra*, *D. hamiltonii*, *D. oppositifolia*, *D. pubera* and *D. esculanta* var. *spinosa* are consumed as a vegetable by the majority of the communities. The people of all communities keep away themselves from the tuber of *D. hispida* and *D. bulbifera* var. *bulbifera* as vegetable due to its bitter and toxic nature. The most preferred and valuable edibles species are *D. alata* and *D. hamiltonii*. *Dioscorea* species which also play an important role in their daily health care system. *Dioscorea tuber* contains noticeable nutrition content, easy propagation methods, attractive therapeutic properties, and long-term storage capacity.

Introduction:

Nowadays the people are facing various challenges in life out of which food security is considered as one of the major ones as it cannot cope up with the population explosion. Several tropical countries suffer famines and food shortage inspite of having the potentiality to produce sufficient nutritional homeostasis for their populations. A substantial proportion of the indigenous population is still under-nourished and the people living in remote areas cannot produce enough food grains to fulfill their daily requirement. Therefore, a lion- share of such population depends on non-conventional means i.e., consumption of various wild plants and animal resources especially in terms of food scarcity (FAO, 2004; Balemie & Kebebew, 2006). Collection, consumption, and marketing of forest food products are thus an aptitude for a group of people for muddle through and familiarising to poverty with growing food demand and seasonal food scarcity. However, the forest food serving plants are neglected and underutilized due to the deficiency in awareness among the people, minute research devotion, proper commercialization, and

deficient policy frameworks. Among the ethnic forest food plants, the tuberous species play a significant role in supplementing the food requirements of indigenous people in isolated areas through conserved foodstuffs during the time of food shortage. Sometimes the nutritional value of traditional tubers or root vegetables are found to be considerably higher than several known common cultivated ones (Schoeninger et al., 2001; Huang et al., 2007). Most of the wild tuberous vegetables have the potential for increased income generation and making varieties of quality food items. In spite of having easy propagation methods, storage and preservation ability they are unable to compete with cultivated or exotic vegetables due to lack of awareness and proper harvesting. *Dioscorea* Lin. is a genus having over 600 species (Ayensu, 1972) of tuberous herbaceous angiospermic climbers, climbing up to 20 meters by supports. The genus belongs to Dioscoreaceae of Dioscoreales. Species of *Dioscorea* are native throughout the tropical, especially in tropical America, subtropical and warm temperate regions of the world, with only a few species extending into the temperate

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regions (Caddick *et al.*, 2002; Seikh *et al.*, 2009). The genus *Dioscorea* has been the most important food source for tribal people particularly in several parts of West Africa since prehistoric times because its tubers are rich in necessary dietary nutrients (Coursey, 1967; Hladik & Dounias, 1993) and medicinal uses in different part of the world as well as from India (Choudhary *et al.*, 2008; Dutta, 2015; Ghosh, 2014). The impoverished indigenous people of Tripura mostly be relying on forest plant products for their daily livelihood. The traditional knowledge of using plants for their undulating survival is continuing from generation to generation. Each group of tribal people offers unique methods of practice and preservation that were based on their traditional knowledge. At present due to the rapid increase of rubber cultivation, natural habitat in Tripura have been fastly decreasing, the indigenous peoples are losing the sources of wild foods and folk medicines in this remote state. There is no existing literature on *Dioscorea* as an alternative food resource and their respective role in primary health care from the state. Therefore, the present study was designed to document the status of *Dioscorea* species available in the state and to highlight the dependence of study communities on this genus for their seasonal food security and primary health care.

Methodology:

Study area: Tripura, the East Himalayan foothill state of Northeast India, cover 10,491 km² area, is the homeland of 19 primitive groups which comprises 33% of the state population (36,710,321). Majority of this population is mainly residing in the different forest tracks and margin which are naturally isolated from the urban society, where 60% of the area is covered by forest. The temperature of this region ranges from 7° to 37°C with 220cm of average rainfall.

Ethnic communities: a total 13 ethnic communities were selected for this study, viz., Tripuri, Jamatia, Reang, Chakma, Bhil, Halam, Kuki, Munda, Darlong, Mog, Noatia, Debbarma, and Murasing. All these tribal groups of Tripura have their own festivals, rituals, and customs. Living in the various forest patches and remote hilly zones of the State for a long time, specific and unique lifestyle is developed within each group of the tribal community in the State..

Exploration: the survey was conducted in the different district of Tripura during July 2014 to January 2016. Numbers of visits were made to the targetted communities to build up the understanding with the local people and members of the study communities. The information about *Dioscorea* was collected by a discussion with the same communities of Tripura for gathering information about all the species of *Dioscorea* used as a food and vegetable as well as medicines. Different markets were also surveyed to gather information on the market potential of the wild tubers, including their availability and buyer preferences. Analysis of data was made with the help of

group discussions among different age classes of study community that include both the genders of the society. Repeated queries were made for confirmation and data gathered of each plant was cross-checked for further verification. Plants were collected in its flowering and fruiting stage from their natural habitat. Herbarium sheets were prepared (Jain & Rao, 1997) and deposited in The Department of Forestry and Biodiversity. Each plant species was identified using flora of Tripura (Deb, 1983) and flora of Assam (Kanjilal *et al.*, 1939)..

Results and Discussion:

Our study documented ten *Dioscorea* species from the forest floors as well as from the home gardens of tribal and non-tribal communities of Tripura. These ten *Dioscorea* species are *D.alata* L., *D.bulbifera* var. *bulbifera* L., *D.glabra* Roxburgh, *D.hamiltonii* Hook. f., *D.pentaphylla* L. and *D.pubera* Blume., *D.hispida* Dennstedt, and *Dioscorea oppositifolia* L., *Dioscorea wallichii* Hook.f and *Dioscorea esculenta* var. *spinosa* (Roxb. ex Wall.) R. Knuth. Out of these ten *Dioscorea* species, only two species; *D.alata*, and *D.esculenta* var. *spinosa* were commonly noticed in home gardens, as a cultivated species in tribal as well as non-tribal dwellers in the state and other species were found in wild habitat. Tubers, Bulbils and shoot tips of *Dioscorea* species are used as a vegetable by the indigenous people of Tripura. During the present survey it was also found that out of ten *Dioscorea* species; tubers of six species; *D.alata*, *D.pubera*, *D.glabra*, *D.hamiltonii*, *D.esculenta* var. *spinosa* and *D.oppositifolia* are consumed as vegetable by the majority of the communities. Only few communities used tuber of *D.wallichii* and *D.pentaphylla* as vegetable due to its hardness. Young tender shoots of *D.wallichii* are also found to be used as vegetable. However all the communities avoid tuber of *D.hispida* and *D.bulbifera* var. *bulbifera* as a vegetable due to its bitter and toxic nature. The most preferred and valuable edibles species are *D.alata*, *D.hamiltonii* which had the highest market value (60-100 Rs./Kg) in Tripura then other edible species.

Table-1: Comparison of nutrient content between *Dioscorea* tuber and other crops (Kumar *et al.*, 2017)

Nutrient* (g)	Maize /Corn	Rice	Wheat	Potato	Cassava	Soybean green	Yam
Water (g)	10	12	13	79	60	68	70
Protein (g)	9.4	7.1	12.6	2.0	1.4	13.0	1.5
Fat (g)	4.74	0.66	1.54	0.09	0.28	6.8	0.17
Carbohy.(g)	74	80	71	17	38	11	28
Fiber (g)	7.3	1.3	12.2	2.2	1.8	4.2	4.1
Sugar (g)	0.64	0.12	0.41	0.78	1.7	0	0.5

*Component/100gm

Our survey also revealed that most of the *Dioscorea* species regenerate through bulbil, seed, and tuber but some species regenerate through the tuber and seeds because they did not produce bulbil, so it easily propagates. *Dioscorea* tuber possesses a rich source of dietary nutrients

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and remains their ranks fourth as a most important tuber crop in the world after potato, cassava and sweet potato (Lev & Shriver, 1998; Kumar *et al.*, 2017). Sometime *Dioscorea* tuber contains higher nutrient content than the other known vegetables. According to Arnau *et al.* (2010) *Dioscorea* have a superior tuber crop as important medico food by about 300 million people throughout the world because it also possesses highly medicinal properties due to the presence of diverse secondary metabolites.

Table-2: List of traded species with prevailing value

Dioscorea Species	Name of Market/Bazar [Rate/kg (in rupees)]				
	Manu	Lake chowmoni	Natun	Pacharthal	Karbok
<i>D. alata</i>	20-30	40-50	30-35	35-45	30-40
<i>D. hamiltonii</i>	50-60	60-70	40-50	40-50	40-50
<i>D. glabra</i>	30-40	35-40	35-40	30-40	30-40
<i>D. oppositifolia</i>	25-30	30-40	30-35	25-35	20-30
<i>D. pubera</i>	20-25	50-60	30-35	20-30	25-35
<i>D. wallichii</i>	10-15	20-25	15-20	15-20	10-20

Dioscorea species play a significant role in the daily health care system of the residents tribal. Indigenous peoples of Tripura used *Dioscorea* species for the curing of various ailments like tuber of *D. bulbifera* var. *bulbifera* and *D. hispida* used for skin infection, *D. hamiltonii* tuber paste used stomach disorder and Leaf and tuber of *D. oppositifolia* used for snake bite.

Conclusively, the domestication of these wild *Dioscorea* sp. will not only improve the economic condition of the local people but also help in the conservation of biodiversity. Proper care should be taken to conserve these wild germplasm. From this study, it is suggested that domestication of these wild genetic resources may lead to the discovery of alternative food resources.

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References:

- Ayensu, E.S.(1972): **Anatomy of the monocotyledons**, Vol. VI. Dioscoreales. Pub. by: Oxford Press, Oxford. 182 p.
- Arnau, G., Abraham, K., Sheela, M.N., Chair, H., Sartie, A. & Asiedu, R. (2010): Yams, pp 127-148. in Bradshaw, J.E. (Ed.) **Root and Tuber Crops, Handbook of Plant Breeding**, Pub. by: Springer Science Business Media, LLC, Singapore.
- Balemie, K. & Kebebew, F. (2006): Ethnobotanical study of wild edible plants in Derashe and Kucha Districts, South Ethiopia. *J. Ethnobiol. Ethnomed.*, 2(53):1-9.
- Caddick, L.R., Rudall, P.J., Wilkin, P., Hedderson, T.A.J. & Chase, M.W. (2002): Phylogenetics of Dioscoreales based on combined analyses of morphological and molecular data. *Bot. J. Linn. Soc.*, 138(2):123-144.
- Choudhary, K., Singh, M. & Pillai U. (2008): Ethnobotanical survey of Rajasthan-an update. *Am-Eu. J. Bot.*, 1(2):38-45.
- Coursey, D.G.(1967): **Yam: An Account of the Nature, Origins,**

Plate-1: Some of the common *Dioscorea* spp. collected during the survey

Cultivation and Utilization of the Useful Member of the Dioscoreaceae. Pub. by: London: Longmans, Green & Co. Ltd. 224 p.

- Deb, D.B. (1983): **The Flora of Tripura state**, Vol. 2 Pub. by: Today & Tomorrows' Printers and Publishers. New Delhi, India.
- Dutta, B. (2015): Food and medicinal values of certain species of *Dioscorea* with special reference to Assam. *J. Pharmacogn. Phytochem.*, 3(4):15-18.
- FAO (Food & Agriculture Organization of the United Nations). (2004): **The state of food insecurity in the world** (monitoring the progress towards the world food summit and millennium development goals. Ann.Rep.), Rome. 43 p.
- Ghosh, A. (2014): The genus *Dioscorea* L. In Andaman and Nicobar Islands, India. *Indian J Plant Sci.*, 3(3):7-14.
- Hladik, A. & Dounias, E. (1993): Wild yams of the African forest as potential food resources, in Hladik C.M. *et al.* (eds.) **Tropical Forests, People and Food: Biocultural Interactions and Applications to Development**. Pub. by: Paris and the Parthenon Publishing Group, London. 163-176.
- Huang, C.C., Chen, W.C & Wang, C.C.R. (2007): Comparison of Taiwan paddy and upland cultivated taro (*Colocasia esculenta* L.) cultivars for nutritive values. *Food Chem.*, 102:250-256
- Jain, S.K. & Rao, R.R. (1977): **A Handbook of Field and Herbarium Methods**. Pub. by: Today and tomorrow's Printers and Publishers, New Delhi. 157 p.
- Kanjilal, U.N., Kanjilal, P.C., Das, A. & De, R.N. (1939): **Flora of Assam, Dehradun, Vol. III. Caprifoliaceae to Platanaceae**. Pub. by: Government of Assam.
- Kumar, S., Das, G., Shin, H.S. & Patra, J.K. (2017): *Dioscorea* spp. (A Wild Edible Tuber): A Study on Its Ethnopharmacological Potential and Traditional Use by the Local People of Similipal Biosphere Reserve, India. *Front Pharmacol.*, 8:52.
- Seikh, N., Kumar, Y., Misra, A.K. & Pinokiyo, A. (2009): Status documentation of *Dioscorea* L. (Dioscoreaceae) in Meghalaya: an approach towards food security. *Pleione*, 3(1):74-82.
- Schoeninger, M.J., Bunn, H.T., Murray, S.S. & Marlett, J.A. (2001): Composition of tubers used by Hadza foragers of Tanzania. *J. Food Compos. Anal.*, 14:15-25.