

# A Study on Potential and Value Addition of a Rare Medicinal/Culinary Plant *Dioscoria Belophylla*, Tarar (Wild Yam) of Shivalik Belt in Sunderbani Forest Range, District Rajouri

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**Abstract:-** *Dioscorea belophylla* ,Synonym: *Dioscorea glabra* dy-oh-SKOR-ee-uh -- named for Pedanios Dioscorides, 1st century Greek pharmacologist bel-oh-FIL-uh -- spear or arrow-like leaves. The plant is native to India and Pakistan , although the genus *Dioscorea* , a pan-continental genus belonging to the family *Dioscoreaceae*, is found in Africa , Southeast Asia , Australia and tropical America (Jayasurya 1984; Wilkin 1998), with about 630 scientifically described taxa. (Prain and Burkill 1936) reported the occurrence of about 50 different *Dioscorea* in India , largely in the west, east and northeast regions. Many of the *Dioscorea* species serve as a 'life saving or famine food' plant group to marginal farming and forest dwelling communities, during periods of food scarcity (Roy et al. 1988; Arora and Anjula Pandey 1996). Yam (*Dioscorea* spp.) provides food and medicines to millions of people in the world especially in the tropics and sub tropics. It is recognized as the fourth most important tuber crop after potatoes, cassava, and sweet potatoes. It contributes about 10% of the total root and tubers production around the world. Yams also considered as famine food and plays a prime role in the food habit of small and marginal rural families and forest-dwelling communities during the food scarcity periods(Bandana Padhan and Debabrata Panda, 2020)

**Keywords:-** Tarar, Wild Yam, Shivalik Belt, Sunderbani Forest Range, Nowshera Forest Division, *Dioscoria*, devil's bones, famine food.

## I. INTRODUCTION

*Tarar* is a very slender vine that grows wild, mostly in forests of mid-hill region of Western Himalayas upto an altitude of 1800 m. Though it is a very slender vine, which remains active only during the warm growing season, but it produces a long tuber, which is mucilaginous when raw, but loses its mucilage after it is boiled. Tarar tubers are usually harvested around Shivratri festival in Mandi area of Himachal Pradesh, Shiv Khori of Jammu and Kashmir which falls during February – March. As the tubers have a tendency to go deep into the soil, so it is a quite laborious

task to dig tarar root tubers. Probably that is the reason that it is sold at Mandi from 150 – 200 rupees a kilo. *Tarar* is quite important food plant from economic point of view. Every year *tarar* tubers worth several lakh rupees are sold in the market.( Tara Devi Sen Thakur, 2019).

*Dioscoria belophylla* locally known as Tarar (Yam) is anticlockwise twining vine. Twining in thickets, over fences, over trees and shrubs in the woods, in hedges and over bushes, the thin, woolly, reddish-brown stem grows from 5-18 feet long. Wild yam is a perennial vine; the long, slender, knotted, contorted ,woody, tuberous rootstock is crooked and laterally branched and twining stems. Broadly ovate and cordate, the heart-shaped, leaves are from 2-6 inches long and about three-fourths as wide, glabrous on top and finely hairy underneath on long stems. They are usually alternate, but the lower leaves sometimes grow in twos and fours. The tiny, greenish-yellow flowers, cinnamon scented, grow on branched stalks from the axils of the leaves, male and female on separate plants, blooms during June and July, the male flowers in drooping panicles, and the female in drooping spicate racemes. The fruit is a three-winged (triangular) capsule containing winged seeds. The winged seed is used for the propagation of the plant. Tuber of the plant is used as vegetable also known as "Devil's bones". *Dioscorea* tubers have nutritional advantage over other root crops (Shajeela et al., 2011). It contains good source of essential dietary supplements such as protein, well balanced essential amino acids, and many dietary minerals (Baah et al., 2009). *Tarar* is a very slender climbing vine, about 5 mm thick and with heart shaped leaves. It grows on slopes under the trees in forests. *Tarar* plant prefers shady locations and loose soil rich in organic matter. The vines climb on small tree and bushes. *Tarar* plants shed their leaves during winter and remain dormant. The growth starts again in March and continues till October. The vines flower during April-May. These bear small round, fruit like structures which are called *tardoloo* in local dialect. *Tardoloos* are, however, not real fruits. When these structures are planted in the soil, new vines emerge from them. In fact, that is how new plants of tarar can be raised.(Tara Dvi Sen Thakur ,2019).



Fig. 1: Tarar climber in natural habitat



Fig. 2: Tubers of tarar after extraction

(Photo credit Dr. Tara Devi Sen Thakur)

## II. ORIGIN AND DISTRIBUTION OF *DIOSCOREA*

The genus *Dioscorea* is considered as one among the earliest angiosperms originated from Southeast Asia and Indo-Malayan region (Kumar et al., 2017). The major yam species are available in three isolated regions of the World: Southeast Asia, Tropical America, and West Africa (Kumar et al., 2017). These regions are major yam growing centers of the world and represent considerable diversity (Kumar et al., 2017). Out of 600 yam species, only seven are mostly consumed in West Africa, 93 species, and nine varieties are found in China and 14 species and five varieties found in Taiwan (Price et al., 2017). Of these, seven to ten are cultivated species and two (*D. alata* L., *D. cayennensis* Lam. subsp. *cayennensis* and *D. cayennensis* Lam. subsp. *rotundata* (Poir.) J. Miège) are of primary importance as a staple crop, predominately in Western Africa, for over 100 million people (Price et al., 2018). Approximately 50 species are consumed as wild-harvested staples or famine food. The most well-known species is *Dioscorea villosa* L.,

also called wild yam and is native to North America (Avula et al., 2014). The cultivated species *Dioscorea esculenta* (Lour.) Burk was known to originated from China. *D. alata* L. is the most economically important species originated in Southeast Asia specifically, in Tropical Myanmar and Thailand (Tamiru, 2006), and is most diversified and extensively distributed species throughout tropical Asia and the Pacific. *D. bulbifera* L. is the most popular wild *Dioscorea* species is native to Asia, tropical Africa, and Northern Australia (Kumar et al., 2017). Another wild species, i.e., *D. pubera* Blume is native to the Indo-China region (Kumar et al., 2017) and distributed throughout the temperate, tropical Americas, China, wet regions of Himalayas, Central Nepal, Western Malaysia, and Bhutan (Kumar et al., 2017). Whereas *D. pentaphylla* L. is native to Tropical Asia and Eastern Polynesia and is distributed in South-Eastern Asia, Tropical Asia, North America (Kumar et al., 2017). In India, there are more than 50 different species of *Dioscorea* reported in the states like Assam, Tamilnadu, Kerala, Bihar, Odisha, West Bengal, Rajasthan,

Gujarat and Maharashtra (Kumar et al., 2017). Out of 50 species recorded, maximum number of yam species have been recorded from Assam (19) followed by Tamilnadu (16) and Darjeeling and Sikkim (15) (Kumar et al., 2017). The wild species *D. prazeri* Prain & Burkill and *D. deltoidea* Wall. ex Griseb. are found at high altitudes (Saikia et al., 2010). The *Dioscorea* species such as *D. belophylla* (Prain) Voigt ex Haines, *D. wightii* Hook.f. and *D. spicata* Roth are endemic to Western Ghats (Kumar et al., 2017) temperate, tropical Americas, China, wet regions of Himalayas, Central Nepal, Western Malaysia, and Bhutan (Kumar et al., 2017). Whereas *D. pentaphylla* L. is native to Tropical Asia and Eastern Polynesia and is distributed in South-Eastern Asia, Tropical Asia, North America (Kumar et al., 2017). In India, there are more than 50 different species of *Dioscorea* reported in the states like Assam, Tamilnadu, Kerala, Bihar, Odisha, West Bengal, Rajasthan, Gujarat and Maharashtra (Kumar et al., 2017). Out of 50 species recorded, maximum number of yam species have been recorded from Assam (19) followed by Tamilnadu (16) and Darjeeling and Sikkim (15) (Kumar et al., 2017). The wild species *D. prazeri* Prain & Burkill and *D. deltoidea* Wall. ex Griseb. are found at high altitudes (Saikia et al., 2010). The *Dioscorea* species such as *D. belophylla* (Prain) Voigt ex Haines, *D. wightii* Hook.f. and *D. spicata* Roth are endemic to Western Ghats (Kumar et al., 2017).

In Jammu and Kashmir the climber is commonly found in the foothills, ascending to 1400 mt. The tubers are prized for culinary purposes and sold in market under the name "Tarar".

### III. MEDICINAL PROPERTIES

The yams (*Dioscorea* species) are the most important tuber crops in West Africa. They are among the root and tuber crops which are widely distributed throughout the tropics with only a few members in the temperate regions of the world (Eka, 1998; FAO, 1985) Yams are consumed as staple food. Apart from food, yams are mainly used for medicinal purposes for the saponins, glycos of yam. Saponins are important mainly because of their steroid structure. They are precursors for the hemisynthesis of birth control pills (with progesterone and estrogen) as well as similar hormones and corticosteroids (Crabbe, 1979) Yams like higher plants have a complex phytochemical profile. The most predominant phytochemical characteristic of yam is the presence of dioscorine alkaloid and diosgenin saponin. Although dioscorine and diosgenin are traditionally considered as toxic, such toxicity is removed by washing, boiling and cooking (Eka, 1998) Some yam cultivars cannot be eaten raw because of itchiness, bitterness or toxicity of the raw tuber. The bitterness or acute toxicity in yams may be due to its alkaloid content while the saponins and saponinins may constitute the pharmaceutical agent. (Poornima G.N. and Ravishankar Rai V. 2008).

The species was found to contain bioactive compounds comprising saponins (18.46 mg 100-1 g), alkaloids (0.68 mg 100-1 g), flavonoids (8.84 mg 100-1 g), tannins (4.2×10<sup>2</sup> mg 100-1 g) and phenols (2.8×10<sup>3</sup> mg 100-1 g). This yam contained vitamins such as ascorbic

acid, riboflavin and thiamin. The importance of these chemical constituents is discussed with respect to the role of this *Dioscorea*. Yams have been well respected by the herbalist community for generations due to their potency in enhancing fertility in males. This may be due to the presence of steroidal saponins such as diosgenin which have been isolated from yams. Diosgenin from yams have been used as precursors for the synthesis of hormones and corticosteroids which improve fertility in males (Crabbe, 1979; Oliver-Bever, 1989). It should be noted that toxic saponins are removed by washing the tubers before consumption (Eka, 1998). Properties of saponins include formation of foams in aqueous solution, hemolytic activity and cholesterol binding properties and bitterness. Saponins natural tendency to ward off microbes makes them good candidates for treating fungal and yeast infections. These compounds served as natural antibiotics, which help the body to fight infections and microbial invasion (Sodipo et al., 2000). These compounds also appear to greatly enhance the effectiveness of certain vaccines. Plant saponins help humans to fight fungal infections, combat microbes and viruses, boost the effectiveness of certain vaccines and knock out some kinds of tumor cells, particularly lung and blood cancers (Barakat et al., 1993). They also lower blood cholesterol there by reducing heart disease. The most outstanding and exciting prospects for saponins are how they inhibit or kill cancer cells. They may also be able to do it without destroying normal cells on the process, as is the mode of some cancer fighting drugs. Cancer cells have a more cholesterol type compounds on their membranes than normal cells. Saponins therefore bind cholesterol and thus interfere with cells growth and division (Ryam and Shattuck, 1994).

Yams are an excellent source of potassium, with twice the amount as found in a medium sized banana. They are also a good source of vitamin C, B6, folate, iron and magnesium.

### IV. MATERIAL AND METHODS

#### A. STUDY AREA

The present study was conducted in Sunderbani Forest Range of Nowshera Forest Division of Rajouri District of Jammu and Kashmir Union Territory during September 2022 to January 2023. The study area lies between 33.219581 and 32.936094 to 73.311323 and 74.631720. The territorial jurisdiction of Sunderbani Forest Range is managed by four Teritorial Blocks viz: Sunderbani Forest Block, Devak Forest Block, Dharamsaal Forest Block and Kangri Forest Block. Sunderbani is a mountainous region comprising of Lower or Shivalik Chir Pine Forest, Northern Dry mix deciduous forest, Khair Sissoo Forest. Chir Pine, Sissoo, Khair and mixed broad leaved forests are the characteristic vegetation of the study area. The mean sea level elevation of the study area ranges from 291 to 1300 mtr. The study area encompasses mountains, pasture lands, rivers, springs and number of bowlies. The mean annual temperature of the study area ranges between 15 degree Celsius to 44 degree Celsius with mean annual rainfall of 951 mm. Pool frost is one of the characteristic feature of Sunderbani Forest during the winter months from mid December to mid January.

### B. DATA COLLECTION

Primary and secondary data were used for this study. Primary data were collected through interviews and informal discussions, household surveys, and focus groups, while secondary data were collected from the published literature. In total, we reviewed more than 250 articles published in international and national journals, books, and reports focused on Iranian forests. Articles were retrieved mainly from scientific databases, including Scopus, CAB Abstracts, the UN Food and Agriculture Organization (FAO), and Web of Science (WoS). We also used Internet search engines such as Google Scholar. Keywords included “Tarar (Wild Yam)”, “Devil’s Bones” and “Famine Food”. Findings from secondary sources support the descriptions of the situation with Wild Yam in J&K specifically focused on Sunderbani Forest Range. Our study observed three primary species of *Dioscoria* growing in the wild habitat. These species are *D. bulbifera*, *D. deltoidea* and *D. belophylla*. Once upon a time *D. deltoidea* was in high demand due to its medicinal constituent. Now due to lower market price of *D. deltoidea* the extraction is not noticed in entire of the study area. Only *D. belophylla* is extracted for its tubers. Based on the results of the secondary sources, we collected socioeconomic data during the field study on two aspects: quantity of Tarar extracted present in the study area and Tarar used by the people living in the fringes of the forests. Preparation of Tarar for market ready, traditional uses ,harvesting, cultivation ,value addition of Tarar like preparation of pickle, tarar prantha, etc.

### C. TRADITIONAL USE:

In olden days the tubers of the plant were crushed with the help of stone and rubbed over the wet clothes, its leather removes the dirt of the clothes (P C Mehta et al 2005).The tubers of *D. belophylla* & *D. deltoidea*, it’s another species have been found in sufficient quantities in lower Shivaliks and intermediate zone not only in different parts of Jammu but also in adjoining states of Punjab , Himachal & Utranchal. During the winters, its tubers are eaten by locals as vegetable especially during the Shiv Ratri, these tubers are in large demand but now a day’s its supply is on the decline with time and has affected the economy of some rural people especially those who are landless labourers. The reasons for its declining production in the forest are over exploitation by local collectors & lack of knowledge regarding the cultivation methods. Further over grazing, reduction in rainfall, vis-à-vis continuous prevalence of long dry spells especially in lower Shivalik hills also added to its declined production.

#### ➤ Edible portion:

The edible portion of *tarar* vine is the underground flattened tuberous roots. Though the size and shape of the tubers vary with age and soil profile, mostly these are about 8 cm wide and 5 cm thick. The thickening of roots starts after about 50 cm from the ground level. The roots have a tendency to grow straight down into the soil and if not obstructed by rock or stone, can easily go 2 to 3 metres deep. Due to this habit, digging out *tarar* tubers is quite a laborious job and is the only cost involved.



Fig. 3: *Tarar* tubers going deep into the soil.



Fig. 4: Aerial Tubers of tarar

(Photo credit Dr Tara Devi Sen Thakur)

#### D. HARVESTING:

Tarar tubers are best harvested in winter season. As the edible plant parts are either ariel bulbils or underground tubers. Both of these are means of future prorogation. So, need to be harvested in sustainable manner like habitat rotation and keeping some tardolu (bubils) on parent plant for further regeneration. However villagers are skilled enough in this practice of harvesting and regeneration without affecting tarar natural population growth in forests. They normally cut tuber few centimeter from the main radical and left rest of tuber with vine to grow. To ensure sustainable development plant need to be brought into large scale cultivation.

Yam harvesting is labor-intensive and physically demanding exercise. For each 2-10 kilogram tuber harvested, it involves standing, bending, squatting, and sometimes sitting on the ground depending the size of mound, size of tuber or depth of tuber penetration. Care must be taken to avoid damage to the tuber, because damaged tubers do not store well and spoil rapidly. In forested areas, tubers grow in areas where other tree roots are present. Harvesting the tuber then involves the additional step of freeing them from other roots. This often causes tuber damage. Yam is a versatile vegetable. It can be barbecued; roasted; fried; grilled; boiled; baked; smoked and when grated it is processed into a dessert recipe.

During the winter months, its tubers, which are lying very deep in the soil are usually dug out the local villagers. These tuber after washing properly, are sold to local

shopkeepers. It has also been noticed that local venders use to sell it directly at road side for **Rs 100.00 to 150.00 per kg, where as the rate of pickle varies between Rs. 250.00 to 300.00 per Kg.** Our study reveals that about 5 Qtl to 7Qtl raw tubers are sold in the entire jurisdiction of Sunderbani Forest Range. Its market starts during the November to January. This practice is prevalent in all over the Shivalik belt of Jammu, especially when one cross over the Tanda(Akhnoor) National Highway upto Sunderbani, persons with bags full of one kg tuber are directly seen selling the tubers at roadside and earning their livelihood. At some places it has also been noticed that the tubers after thorough washing are **pickled**. Vendors at Sabji Mandi Jammu, Domail, Reasi use to sell it open market and one can also find its pickle at Domel. It is also sold in local market, which is in high demand during winters. It is extracted when its climber gets dry above the ground during winters. It is not an easy job to extract its tubers, it's a laborious job.

#### E. EDIBLE USES: (Dr. Tara Devi Sen Thakur)

The tubers are brittle milky white and a little slimy from inside. They are crisp and taste starchy when eaten raw. Tubers are roasted and eaten with salt. Cooked tarar is eaten or served as a *phalahar* (फलाहार) (non-cereal diet), during *shivratri* fast. A variety of traditional dishes can be prepared from tarar tubers like 'bhale', 'dahin bhale' and 'kachouri' etc Tubers are also pickled to preserve for off season. Vegetable is also prepared like a potato vegetable in the following way.



Fig. 5: Tarar tubers harvested for cooking



Fig. 6: Tubers after washing



Fig. 7: Tarar Sabji

(Photocredits Dr. Tara Devi Sen Thakur)

- **Ingredients:**

*Tarar* tubers, 1 kg; mustard oil, 3-4 table spoons; coriander powder 1 table spoon; fenugreek powder, ½ table spoon; cumin seed, 1 tea spoon; turmeric powder, ½ table spoon; red chillies; 2-3 medium sized chopped onions, 2-4; garlic, 4-5 cloves; ginger paste, ½ table spoon; 1 cup amount chopped green coriander leaves and salt according to taste.

- **Method:**

For preparing *sabji*, the tubers are first boiled and brown peel is taken off. Then these are cut into small pieces and fried in hot oil along with spice listed before in sequence, as is done with potatoes. Garnish the recipe with chopped coriander leaves and serve with chapatis. The preparation tastes very good. If it is to be taken with rice, then add 4 cups of water or curd and cook for another 5 minutes to serve with rice.

To serve as non-cereal food during fasting, simply sauté boiled chopped tubers with coriander powder, red chillies and cumin seed in cow ghee. Then garnish with green chopped coriander leaves and serve.

- **Bhalle:**

- **Ingredients:**

*Tarar* tubers, 1 kg; mustard oil, ½ liter; fenugreek powder, ½ table spoon; cumin seed, 1 tea spoon; turmeric powder, 1-3 table spoon; red chillies; 10-15; garlic, 250 g; grated ginger, 250 g; mustard seed powder, 3-4 table spoon, Chopped green coriander, tirmir (*Zanthoxylum armatum*), mint (*Mentha piperita*) and curry (*Murraya koeingii*) leaves, 2-3 cup amount and salt according to taste.

- **Method:**

Boil tubers till they are soft. Mesh them manually and make paste of mashed tubers and spices listed above in same sequence. Now make small round breadspread with a hole in center with this paste. Put oil in a fry pan and deep fry these breadspread with hole called as *bhalla* traditionally. Repeat this process till whole paste is over. *Bhalle* are ready to serve as snack.

- **Ingredients:**

*Tarar bhalle*, 7-10; curd, ½ kg, black pepper powder, ¼ tea spoon; chopped green coriander leaves, 1 cup amount, salt according to taste.

- **Method:**

Split *bhalle* into small pieces and dip into the curd. Add to it black pepper powder, chopped green coriander leaves and salt according to taste, Mix well and serve.

- **Kachuri:**

- **Ingredient:**

*Tarar* tubers, 1 kg; wheat flour, 7-8 cup amount; yeast, 5-10 g; mustard oil, ½ liter; fenugreek powder, ½ table spoon; cumin seed, 1 tea spoon; turmeric powder, 1-3 table spoon; red chillies; 10-15; grated ginger, 250 g; , Chopped green coriander, tirmir (*Zanthoxylum armatum*), mint (*Mentha piperita*) and curry (*Murraya koeingii*) leaves, 2-3 cup amount and salt according to taste.

- **Method:**

For preparing *kachuri* prepare dough of wheat, flour along with yeast. Allow to rest dough for 3-4 hour. Boil *tarar* tuber till these are soft. Mesh boiled tubers manually and add spices listed above. Mix well into fine paste. Roll dough already made into small disc or round breadspread and stuff it with paste. Give a deep fry to the stuffed disc in hot mustered oil and take them out. Repeat this for whole dough and paste, now *kachuri* is ready to serve.

- **Parantha:**

- **Ingredients:**

*Tarar* tubers, 1 kg; wheat flour, 7-8 cup amount; mustard oil, ½ liter; fenugreek powder, ½ table spoon; cumin seed, 1 tea spoon; turmeric powder, 1-3 table spoon; red chillies; 250 g; grated ginger, 250 g; ajwain (caraway seeds), 1 tea spoon; Chopped green coriander and curry (*Murraya koeingii*) leaves, 2-3 cup amount and salt according to taste.

- **Method:**

Boiled tubers are meshed manually. Mix meshed tubers well with spices and make fine paste. This paste is now stuffed into the wheat flour dough and made into breadspread. Put oil on *tawa* (Flat fry pan) and cook both sides of stuffed breadspread by putting some oil. Repeat this process till whole paste and dough is over. Serve hot with pickle/butter/curd/chutney.

➤ **Tarar Badiyan**

For preparing *badiyan* from *tarar* tubers dip 1kg gram pulse in water overnight, remove skin manually and ground to make fine paste. Add to it spices like ground chillies, black pepper, cumin seeds, ajwain (Caraway) etc. Now grate washed *tarar* tubers and mix well with grated *tarar* tubers. Make small round tablets (*badiyan*) from the paste and dry in full sun light. *Badiyan* prepared in this way are stored for off season in an air tight container. These can be used in famine period when vegetable supply is low like in extreme winter or summer. *Tarar badiyan* can be cooked like any other vegetable and eaten with rice or chapattis. *Tarar badiyan* can also be cooked as *palau* with rice, vegetables and spices.

• **Ingredients:**

*Tarar badiyan* , 250 g; medium sized chopped potato, 2-3 potato, mustard oil, 3-4 table spoons; coriander powder 1 table spoon; fenugreek powder, ½ table spoon; cumin seed, 1 tea spoon; turmeric powder, 1/2 table spoon; red chillies; 2-3 medium sized chopped onions, 2-4; garlic, 4-5 cloves; ginger paste, ½ table spoon; 1 cup amount chopped green

coriander leaves and salt according to taste.

• **Method:**

Roast *tarar badiyan* in low flame . In hot mustard oils saute roasted *tarar badiyan* and chopped potato with spices listed above. Add some water to it and steam cook or cook till these are soft. Garnish with *garam masala* and green coriander leaves. Now recipe is ready serve. Serve with rice or chapattis.

➤ **Pickle:**

• **Ingredients:**

Chopped tarar tubers, 1 kg; mustard oil, 1/2 liter; fenugreek powder, 3-4 table spoon; cumin seed, 1 tea spoon; turmeric powder, 1-3 table spoon; red chillies; 10-15; garlic, 250 g; grated ginger , 250 g; mustard seed powder, 3-4 table spoon and salt according to taste.

• **Method:**

Wrap tubers in a cotton cloth to prepare a pouch. Boil this pouch containing tubers for 10-15 minutes by continuous rotating the pouch, so that all tubers get soft equally, Let them cool down and cut into small pieces. Dry tuber pieces in full sunlight for full day.



Fig. 8: Tarar Pickle



Fig. 9: Tarar Pickle at vendor’s shop, Domail Reasi

(Photocredit Sh. Pawan Kumar Fgd)

**Tarar pickled to ensure its availability in off season**

Saute tubers in hot mustard oil along with spices listed above . Add mustard powder to make pickle sour, mix well and put in a ceramic jar. After 10 to 15 days pickle is ready to eat. It can be preserved for 2 to 3 years.

- **Medicinal Value:** Tuber Tuber juice with hot water is given to treat fever, malaria, headache, and dysentery <sup>1</sup>.

**V. CULTIVATION PROSPECTS**

Very little care was shown towards the cultivation of the species. At some places attempts were made by individuals by pitcher planting as well as large sized (18"x24") polybag planting. It has been noticed by our cultivation attempts in large polybag (18"x24") and pitchers that an average plant can yield 2-3 kg tuber in pitcher planting method as well as poly bagged planting method. It is easy to extract its tubers in artificial cultivation. The need of the hour is to standardise the methods of its cultivation so that the posterity shall be able to taste the medicinally important vegetable.

High price commanded by tarar makes it a very ideal candidate for domestication and to be developed as a new commercial crop. Plants of tarar are very easy to raise by planting those fruit-like structures. The only problem is the tendency of the roots to grow downwards deep in to the soil. This can easily be curbed by growing these in large pots like old coal tar drums or by growing in 40 to 24 cm deep beds, lined with some hard material like cement concrete. This will stop the roots from going down and the digging of tubers will be easy.



Fig. 10: *Tarar* vine grown in clay utensil



Fig. 11: *Tarar* after harvesting

( 1.Photocredit Dr. Tara Devi Sen Thakur ), (2.Sh. Pawan Kumar , Driver)

**(Photocredits: Dr Tara Devi Sen Thakur)**

A few tarar enthusiasts at Mandi and J&K have already managed to grow it by adopting this technique. The tubers are ready to be harvested after two years. The results of these persons have been quite encouraging.





Fig. 12: *Tarar* tubers being sold at Domail Reasi.

The plant can be cultivated by seed, directly collected from the vine during winter months. Fresh seed can be sown in pitcher or polybags with 2:1:1 soil: FYM: sand ratio during March-April. It starts germination after few days. Proper stacking is required, with weeding & watering etc. an average plant can yield 2-3 kg tuber during winter, with sufficient quantity of seed. No special care is required for its cultivation.

## VI. CONCLUSION

The wild yam has various health benefits as they are rich in antioxidants, have antimicrobial properties, hypoglycemic activities rich in potassium, Vit C, B6, folate, iron and magnesium. Scientific cultivation and harvesting of wild yam can increase the productivity and for the local people it will be a source of livelihood. Various other products can also be explored like wafers, fries, Indian chutney, papad and other edible items. Being rich in various properties, wild yam may be used in day to day life for health benefits. Its products could be used in rural haats, melas and other exhibitions so that people come to know about its culinary benefits. Sh. O. P. Sharma IFS, (Retd) Addl. Pr. Chief Conservator of Forests, J&K, a renowned tree talker has taken an initiative to showcase the products of wild yam in his tree talks. Such events should be organized in the near future.

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## REFERENCES

- [1.] Anonymous, Cuisines of Uttarakhand (Uttarakhandi food), Uttarakhand World Wide, Kumaon Garhwal/Global Community, 2008, www.uttarakhand.org.uk.
- [2.] Arora RK and Pandey Anjula, Wild Edible Plants of India, Diversity conservation and Use, NBPGR (ICAR), New Delhi, India, 1996.
- [3.] Atkinson ET, Economic Botany of the Himalayan Region, Cosmo Publication, New Delhi, India, 1882.
- [4.] Avula, B., Wang, Y. H., Ali, Z., Smillie, T. J., and Khan, I. A. (2014). Chemical fingerprint analysis and quantitative determination of steroidal compounds from *Dioscorea villosa*, *Dioscorea* species, and dietary supplements using UHPLC-ELSD. *Biomed. Chromatogr.* 28, 281–294. doi: 10.1002/bmc.3019
- [5.] Avula, B., Wang, Y. H., Wang, M., Ali, Z., Smillie, T. J., Zweigebbaum, J., et al. (2012). Structural characterization of steroidal saponin from *Dioscorea* species using UHPLC-QTOF-MS. *Planta Med.* 78, 1385–1385. doi: 10.1055/s-0032-1321072
- [6.] Baah, F. D., Maziya-Dixon, B., Asiedu, R., Oduro, I., and Ellis, W. O. (2009). Nutritional and biochemical composition of *D. alata* (*Dioscorea* spp.) tubers. *J. Food Agr. Environ.* 7 (2), 373–378.
- [7.] Barakat MZ, Shahab SK, Darwin N, Zahemy EI (1993) Determination of ascorbic acid from plants. *Anal. Biochem.* 53: 225-245.
- [8.] Berlin B. 1992. Ethnobiological classification: categorization of principles of plants and animals in

- traditional Princeton University societies. Press, Princeton, NJ, USA.
- [9.] Bharathi Avula, Yan-Hong Wang, Mei Wang, Zulfiqar Ali, Troy Smillie, Jerry Zweigenbaum, Ikhlal Khan. "Characterization of Steroidal Saponins from *Dioscorea villosa* and *D. cayenensis* Using Ultrahigh Performance Liquid Chromatography/Electrospray Ionization Quadrupole Time-of-Flight Mass Spectrometry", *Planta Medica*, 2014
- [10.] Boham AB, Kocipai DC (1994) Flavonoid and condensed tannins from leaves of Hawaiian *vaccinium vaticulum* and *vicalycimum*. *Pracific Sci.* 48: 458-463.
- [11.] Cheng-Hsin Wang, Chung-Hung Tsai, Hui-Ju Lin, Tse-Cheng Wang, Hsiao-Ling Chen. "Uncooked Taiwanese yam (*Dioscorea alata* L. cv. Tainung No. 2) beneficially modulated the large bowel function and faecal microflora in BALB/c mice", *Journal of the Science of Food and Agriculture*, 2007
- [12.] Chopra Ravi and Pasi Santosh, Where are the empty *thalis* in Uttarakhand? District level food insecurity analysis of Uttarakhand, PSI, Dehra Dun, India, 2002.
- [13.] Crabbe P (1979) Some aspects of steroid research based on natural product from plant origin. *Bull. Soc. Chim. Belg.* 88: 5-7.
- [14.] Debela Hunde Feysa, J.T. Njoka, Z. Asfaw, M.M. Nyangito. "Nutritional Value of *Berchemia discolor*: A Potential to Food and Nutrition Security of Households", *Journal of Biological Sciences*, 2012
- [15.] Dutta, B. (2015). Food and medicinal values of certain species of *Dioscorea* with special reference to Assam. *J. Pharmacogn. Phytochem.* 3, 15–18.
- [16.] Edison, S., Unnikrishnan, M., Vimala, B., Pillai, S. V., Sheela, M. N., Sreekumari, M. T., et al (2006). Biodiversity of tropical tuber crops in India. Chennai. *Natl. Biodivers. Auth.* 1–60.
- [17.] Eka OU (1998) Roots and Tuber crops, in nutritional quality of plant foods. Osagie A, Eka OA (Eds) *Postharvest res. Unit Publ. Univ. Benin.* 1-31.
- [18.] FAO (1985) FAO production year book. Food and Agriculture Organization of United Nations Rome. p. 39
- [19.] Farquer JN (1996) Plant sterols. Their biological effects in humans. *Handbook of lipids in human nutrition.* BOCA Raton FL CRC Press, pp. 101-105.
- [20.] Food and Agricultural Organization (1996), Food for All. FAO, Rome.
- [21.] Jayasurya AHM. 1984. Systematic arrangement of the genus *Dioscorea* (Dioscoreaceae) in Indian Sub-continent, Revised hand book to the Flora of Ceylon IX. Royal Botanic Gardens, Kew Richmond, UK
- [22.] Kumar, S., and Satpathy, M. K. (2011). Medicinal plants in an urban environment: plants in an urban environment; herbaceous medicinal flora from the campus of Regional Institute of Education, Bhubaneswar, Odisha. *Int. J. Pharm. Life Sci.* 2, 1206–1210.
- [23.] Kumar, S., Behera, S. P., and Jena, P. K. (2013). Validation of tribal claims on *Dioscorea pentaphylla* L. through phytochemical screening and evaluation of antibacterial activity. *Plant Sci. Res.* 35, 55–61.
- [24.] Kumar, S., Das, G., Shin, H. S., and 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. doi: 10.3389/fphar.2017.00052
- [25.] Maheshwari JK, Ethnobotanical research and documentation, *Acta University Ups (Symb. Hot Ups)*, 1988, 28 (3), 207-217.
- [26.] Maheshwari JK, Tribal Ecosystem: An overview, *In: Man Development and Environment.* RS Doria et al (Eds), Ashish Publication House, New Delhi, India, 1990.
- [27.] Martin F, Rubeste R (1976) the polyphenol of *Dioscorea alata* Yam tubers associated with oxidative browning. *J. Agric Food Chem.* 14: 67-70.
- [28.] Mehta PS, Kumar Dinesh and Bhatt KC, Wild edible plant species for subsistence in Kumaon Himalaya and associated traditional knowledge, *J Econ Taxon Bot*, 2006, 30, 340-352.
- [29.] Nahapetian A, Bassiri A (1975) Changes in concentration and interrelationship of phytate, P, mg, Cu, Zn, in wheat during maturation. *J. Agric. Food Chem.* 32: 1179-1182.
- [30.] Negi KS and Gaur RD, Principal wild food plants of western Himalaya, Uttar Pradesh, India, *In: Higher Plants of Indian Sub-Continent, Additional series of Indian Forester no. IV* published by Bishen Singh & Mahendra Pal Singh, Dehra Dun, Gupta BK (ed), 1994, pp. 1-178.
- [31.] Obadoni BO, Ochuko PO (2001) Phytochemical studies and comparative efficacy of the crude extracts of some homeostatic plants in Edo and Delta States of Nigeria.
- [32.] Oliver-Bever B (1989) Medicinal plants in Tropical West Africa Cambridge Uni. Cambridge, p. 70.
- [33.] Padhan Bandana & Panda Debabrata. 2020. Potential of neglected and underutilised yams (*Dioscoria* Spp) for improving nutritional security and health benefits. *Frontiers of pharmacology*, Vol. 11 Article 496.
- [34.] Pant RC, A historical perspective of agricultural interaction in Uttarakhand, *In: Asian Agri-history*, 2002, 6 (2), 157-162.
- [35.] Poornima, G. N., and Ravishankar Rai, V. (2009). Evaluation of phytonutrients and vitamin contents in a wild yam, *Dioscorea belophylla* (Prain) Haines. *Afr. J. Biotech.* 8 (6), 971–973.
- [36.] Prabhakar Semwal, Sakshi Painuli, Natália Cruz-Martins. "Dioscorea deltoidea Wall. Ex Griseb: A review of traditional uses, bioactive compounds and biological activities", *Food Bioscience*, 2021
- [37.] Prain D & Burkill IH. 1936. An account of the Genus *Dioscoreae* in the East. *Annals of the Royal Botanical Gardens, Barhingham, London, UK*
- [38.] Price, E. J., Bhattacharjee, R., Montes, A. L., and Fraser, P. D. (2017). Metabolite profiling of yam (*Dioscorea* spp.) accessions for use in crop improvement programmes. *Metabolomics* 13 (144), 1–12. doi: 10.1007/s11306-017-1279-7

- [39.] Price, E. J., Bhattacharjee, R., Montes, A. L., and Fraser, P. D. (2018). Carotenoid profiling of yams: Clarity, comparisons and diversity. *Food Chem.* 259, 130– 138. doi: 10.1016/j.foodchem.2018.03.066
- [40.] Roger GDP (1999) New Life Style, Enjoy it Editorial Safelic SL Saponin, pp. 75-76.
- [41.] Roy B, Halder A.C. & Pal DC . 1988. Plants for human consumption in India. Flora of India series 4: pp. 63-65.
- [42.] Ryam MK, Shattuck AD (1994) Treating aids with Chinese Medicine North SIDE HIV Treatment Centre Chicago U.S.A. Pacific View Press Berkeley USA., pp. 16-364.
- [43.] Saikia, B., Tag, H., and Das, A. K. (2010). *Dioscorea brandisi* Prain et Burkill (Dioscoreaceae) – A new record for India. *Pleione.* 4 (1), 160–161.
- [44.] Shajeela, P. S., Mohan, V. R., Jesudas, L. L., and Soris, P. T. (2011). Nutritional and antinutritional evaluation of wild yam (*Dioscorea* spp.) *Trop.Subtrop.Agroecosyst.* 14, 723–730.
- [45.] Singh CM and Katoch KK (2000), Management of hill and mountain agro-ecosystem, *In: Natural Resource Management for Agricultural Production in India*, JSP Yadav and GB. Singh (Eds.), International conference on managing natural resources for sustainable agricultural production in the 21<sup>st</sup> century February 14-18, 2000, New Delhi, India. pp. 873-921.
- [46.] Sodipo OA, Akiniyi JA, Ogunbanosu (2000) Studies on certain characteristics of extracts of bark of *Pansinystalia macruceras* (K. Schem) Piere. Exbeile. *Global J. Pure Appl. Sci.* 6: 83-87.
- [47.] Tamiru, M. (2006). *Assessing Diversity in yams (Dioscorea spp.) from Ethiopia based on Morphology, AFLP Markers and Tuber Quality, and Farmers' Management of Landraces.* PhD. thesis. (Goettingen: Georg-August- University).
- [48.] Tamiru, M., Mass, B. L., and Pawelzik, E. (2008). Characterizing diversity in composition and pasting properties of tuber flour in yam germplasm (*Dioscorea* spp.) from Southern Ethiopia. *J. Sci. Food Agr.* 88, 1675–1685. doi: 10.1002/jsfa.3263
- [49.] Tara Devi Sen, Sanjeet Singh, Tanuja Thakur, Bhavna Devi. "Chapter 18 Climate Resilient Wild Edible Succulents of Mandi Himachal Pradesh, Their Indigenous Uses and Role in Socio-Economic Development of the Region" , Springer Science and Business Media LLC, 2022
- [50.] Thakur Tara Devi Sen, 2019. [www.himalayanwildfoodplants.com](http://www.himalayanwildfoodplants.com)
- [51.] Tsai-Li Kung, Kuan-Hung Lin, Shun-Fu Lin. " Genetic diversity of germplasm in Taiwan revealed by inter-simple sequence repeat DNA markers " , Plant Genetic Resources, 2015
- [52.] Van-Burden TP, Robinton WC (1981). Formation of complexes between protein and tannin acid. *J. Agric. Food Chem.* 1: 77-82.
- [53.] Velayudhan KC, Muralidharan VK & Amalraj VA, Asha KI. 1998. Genetic resource of yams of Western Ghats. *Indian Journal of Plant Genetic Resources of the Western Ghats* 11(1): 69-80. National Bureau of Plant Genetic Resources, Regional Station, Vellanikkara, Thrissur, India .
- [54.] Velayudhan KC, Muralidharan VK & Amalraj VA, Asha KI. 1998. Genetic resource of yams of Western Ghats. *Indian Journal of Plant Genetic Resources of the Western Ghats* 11(1): 69-80. National Bureau of Plant Genetic Resources, Regional Station, Vellanikkara, Thrissur , India
- [55.] Wilkin P. *Dioscorea quartiniana* A. Rich (Dioscoreaceae). *Kew Bulletin* 54:1-18.
- [56.] Zadoo, B.L. 1997. Field trial of *Dioscorea composita* Hemsl in subtropical regions of Jammu. *Forest Newsletter. Golden Jubilee of Independence.* Feb-Dec. Issue: 14-16.