CONSERVATION AND CULTIVATION POSSIBILITIES OF *DIOSCOREA DELTOIDEA* (A THREATENED SPECIES) IN VILLAGE BUDOGI, DISTRICT TEHRI GARHWAL, UTTARAKHAND, INDIA

L.R. Dangwal, Amit Singh and Amandeep Singh

Herbarium and Plant Systematic Laboratory, Department of Botany, H.N.B. Garhwal University (A Central University), S.R.T. Campus, Badshahi Thaul, Tehri Garhwal, Uttarakhand
Email:-drlrdangwal@gmail.com

Abstract: The district Tehri Garhwal, Uttarakhand have a rich and diverse form of vegetation with medicinal as well as aromatic plants. Varying soil, geology and occurrence of different climatic and microclimatic zones of the region provide suitable conditions to grow a different diversity of medicinal and aromatic plants. But some medicinal plants are becoming threatened due to unsustainable use and overexploitation, out of these medicinal plants a very important threatened medicinal plant is *Dioscorea deltoidea* in the region. The present study deals with conservation and cultivation possibilities of *Dioscorea deltoidea* from an altitudinal range 1300m to 2000m, domesticated in the village Budogi, district Tehri Garhwal, Uttarakhand, India. The preliminary data showed that in the region *D. deltiodea* plant properly grow and can provide baseline information of selection of suitable cultivation sites, conservation and developing agro-techniques for this species.

Keywords: Medicinal Plant, Cultivation, Conservation, Threatened

INTRODUCTION

In the Uttarakhand state district Tehri Garhwal is highly enriched vegetation including wild edible, rhizomes, tubers and different types of wild fruits, occurrence in different climatic and microclimatic zones in different soils. In the district local inhabitants play a significant role as a supplementary and nutritious food consumed from wild tubers and fruits (Bhandari *et al*., 2003). One of the important climbing plant species *Dioscorea deltoidea* belongs to the family Dioscoreaceae. Locally known as Singli-mingli or wild yam or tairu. The genus *Dioscorea* L., a monocotyledon climbing plant. It comprises 350-400 species (Caddick L.R., Wilkin P., Rudall, TAJ Hedderson, M.W. Chase; 2002), and is distributed throughout the tropics and subtropical regions, mainly in Western part of Africa, Central America and Caribbean etc. In the Pacific Islands and South East Asia *Dioscorea deltoidea*, is naturally found in temperate to subalpine regions of the Himalaya ranging from 1000-3100m in India, south west China, Pakistan and Nepal (Olsen & Larsen, 2003). It is a perennial climber, growing to 3 m (10 ft). It is a hairless vine, twinning clockwise. Rhizomes are ligneous, irregular, alternately arranged. Leaves simple, 5-11.5cm long, 4-10.5cm broad, triangular ovate, often heart-shaped, 7-9 nerved, long pointed, glabrous above, velvety on the nerves beneath, leaf petioles 5-10 cm long, slender. Spikes of male flowers present solitary in leafs axils, simple or sometimes branched, slender, lax, 7.5-25 cm long. Flowers smaller in sizes, distant clusters; stamens 6, anther inferior. Rhizomes are horizontal and zinger like shaped. The rhizomes of *Dioscorea deltoidea* are useful for the treatment of different diseases like diarrhea, abdominal pain, irritability, wounds, burns, digestive disorders. Tubers are also believe to possess activities like antioxidant, antimicrobial (Shui, Leong., 2002), hypoglycimic and stomachic activities (Maga, 1978). The main constituent of *Dioscorea deltoidea* rhizome is diosgenin was reported by Chakravarti *et al*., 1960; and Singh *et al*. (1978). From 1951-1960 Chakravarti and his colleagues started surveying for the diosgenin yielding plants which includes Himalayan *Dioscorea* species. They found that yield of himalayan *Dioscorea* species growing in the Himalayan regions contains high amount of diosgenin as compared to other species. Based on their recent findings a new industry had emerged in the country *i.e.* Indian steroidal hormonal Industry. A number of firms like Cipla, Ciba, Johnwyeth had started manufacturing steroidal intermediates from *Dioscorea deltoidea* (Chakravarti *et al.* 1963). *Dioscorea deltoidea* is the good source of diosgenin it was exploited mercilessly from the Himalayan hills and the leading pharmaceutical manufacture play a leading role in this work and it was depleted throughout the Himalayan regions (N.C. Shah, 2010).

Cultivation of medicinal plants is viewed as the most viable long term alternative ensuring sustainable supply of raw material without threatening their existence in wild habitats (IUCN, 1993). The cultivation and improvement of this plant is seriously handicapped. Realizing the threat of extinction there is needed to develop propagation protocols, conservation strategies and commercial cultivation of this plant. The present study deals the conservation of *Dioscorea deltoidea* at an altitude of 2000m in Village Budogi, District Tehri Garhwal, Uttarakhand, India. The plant rhizome is very well acclimatized in this area and the climbers properly grow. So the cultivation as well as conservation possibility is suitable for this plant in this region. The present study provides baseline information of selection of suitable cultivation sites, conservation and developing agro-techniques for the species.

METHODOLOGY

The plant material *i.e.* rhizome as well as average 20cm plant of *Dioscorea deltoidea* was bought from Nagni up to 1300m for the experiment in the village Budogi up to 2000m (figure -2). The plants were grown at the site of village Budogi (District Tehri Garhwal, Uttarakhand) from an elevation of 2000m in between latitude 30º21'48.86"N and longitude 78º13'08.40"E. The soil are taken from the nearby forest of village mixed with cattle dung, kept in plastic buckets with plants and poured water in between 2, 3 and 5, days respectively. The studies were started from the month of May to October 2013. Three plant replicates were used for the observation of the length and width of the plant, number of leaves and their size, number of veins and their size were measured weekly with the help of scale and standard size of tape. For the experiments following things were essentially required shown in table-I.

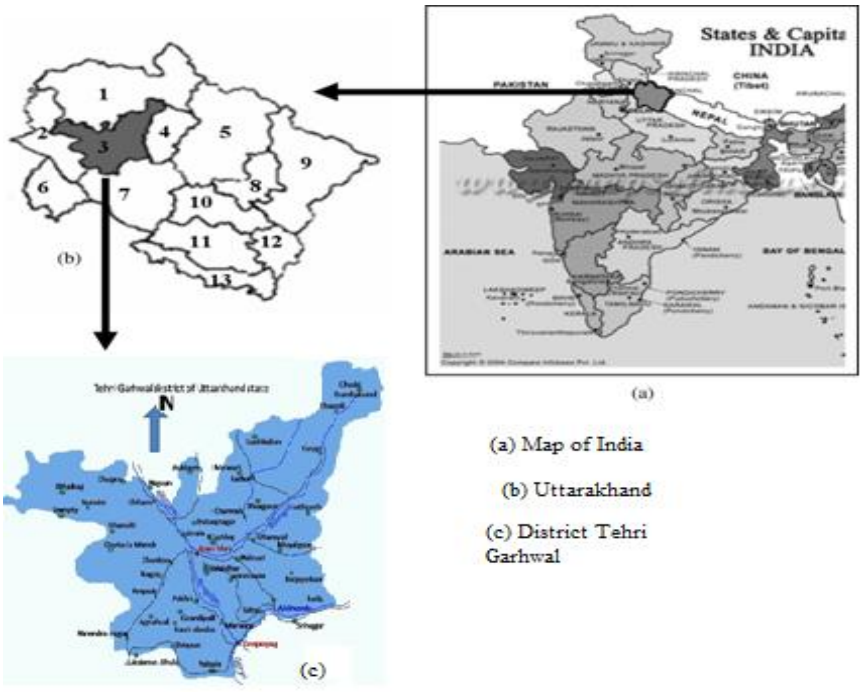
Table1: Soil, cattle dung and water required for three plants replicates for growth.

Plant replicate	Weight of soil (in Kgs)	Cattle dung (in gms)	Water requirement (in days)
P1	5	500	Fifth day
P2	5	250	Second day
P3	5	125	Third day

1- Plant 1, P2- Plant 2, P3-Plant 3

Climate

The study area shows different climatic and adaphic conditions. The climate varies from cold temperate, tropical to subtropical. According to long-term climatologically data of the district, it is calculated that January is the coldest month with average maximum temperature of 19.5°C and the average minimum temperature of 4.5°C. Temperature becomes highest usually during June, having average minimum and average maximum temperatures of 32.6°C and 36.5°C respectively. Relative Humidity in the area increases rapidly with the onset of monsoon and reaches maximum (85% in the morning and 84% in the evening) during the month of August, when peak monsoon period takes place. However, relative Humidity is minimum during the months of summer (from April to June), with May being the driest month (47% in morning and 25% in evening). Skies are heavily clouded during the monsoon months and for short spells when the district is affected by western disturbances. Rainfall in the districts occurs almost throughout the year. Maximum rainfall is recorded during the monsoon period *i.e.* July to September (Central ground water board, Dehradun.2011).



(a) Map of India

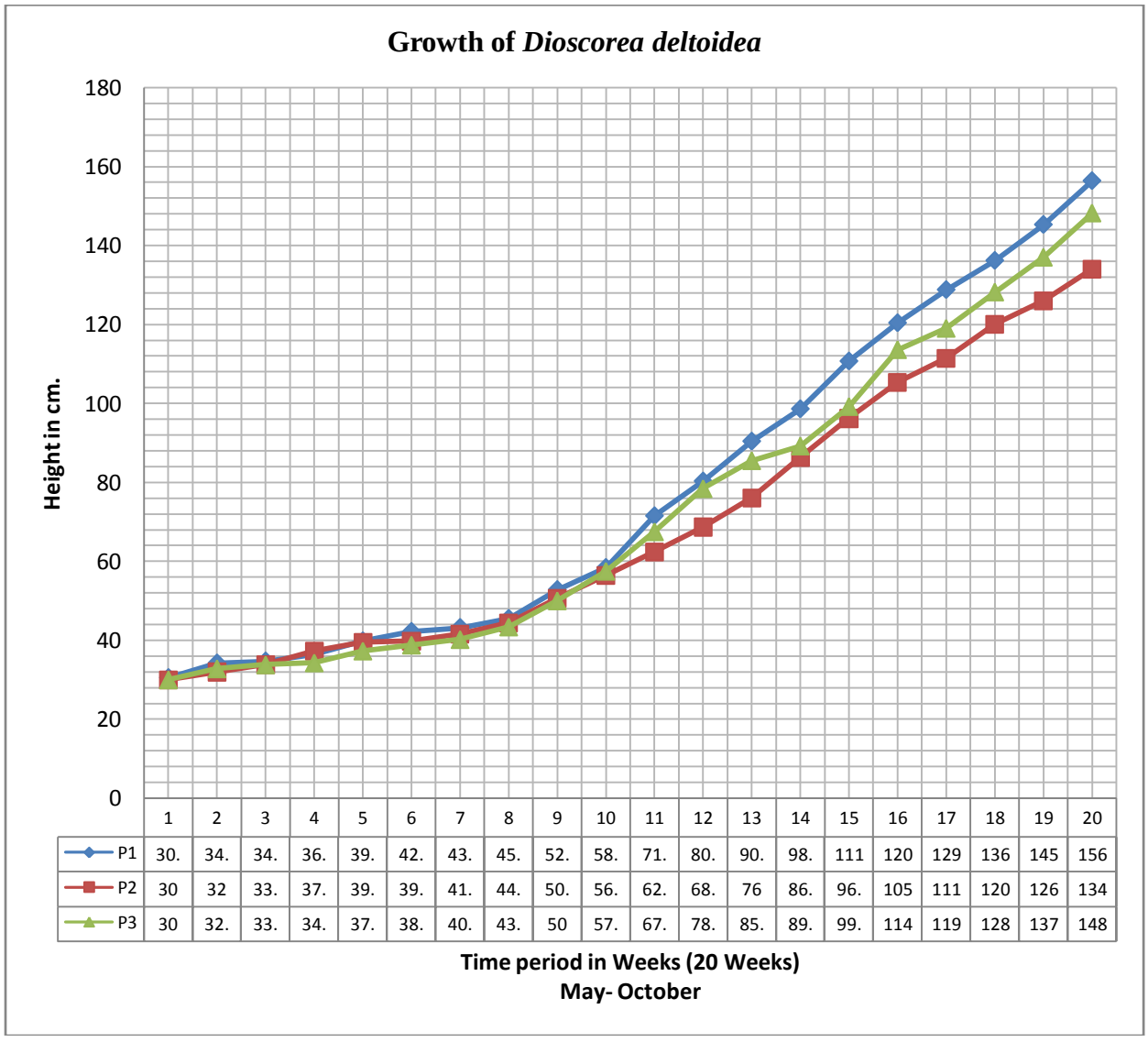
(b) Uttarakhand

(c) District Tehri Garhwal

Figure 1: Map of District Tehri Garhwal.

Figure 2: (A) Collection of Plant samples.

(B) *Dioscorea deltoidea* plant natural habitat.
(C) After growing at another site *i.e.* Village Budogi
(D) *Dioscorea deltoidea* Natural Habitat (E) Matured leaf of *Dioscorea deltoidea.*



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P1	30.	34.	34.	36.	39.	42.	43.	45.	52.	58.	71.	80.	90.	98.	111	120	129	136	145	156
P2	30	32	33.	37.	39.	39.	41.	44.	50.	56.	62.	68.	76	86.	96.	105	111	120	126	134
P3	30	32.	33.	34.	37.	38.	40.	43.	50	57.	67.	78.	85.	89.	99.	114	119	128	137	148

Figure 3: Growth of *Dioscorea deltoidea* at study site.

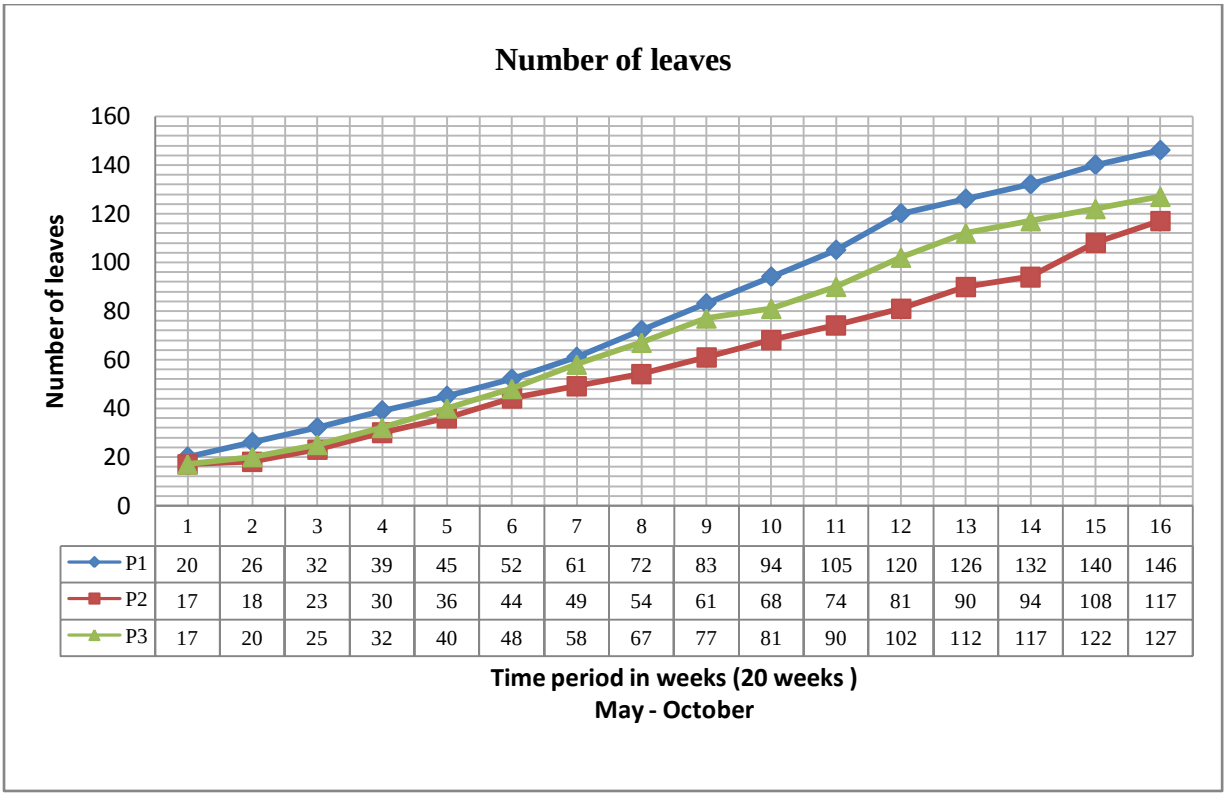


Figure 4: Number of leafs (weekly observations).

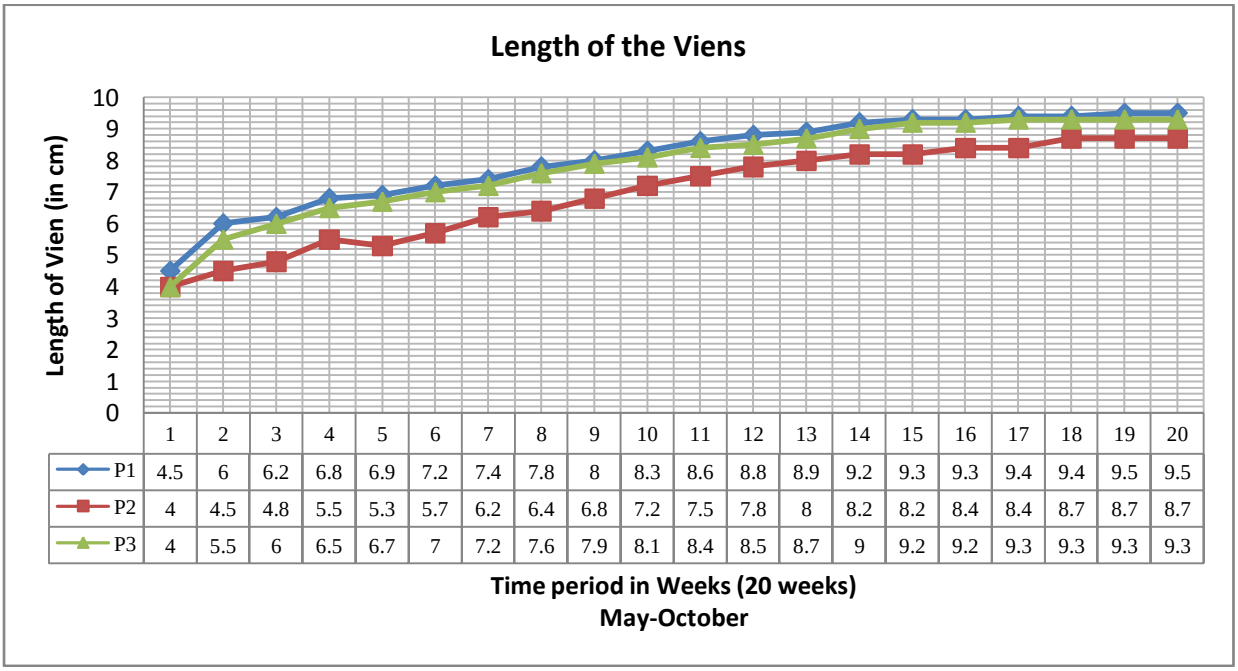


Figure 5: Vein Size (in centimeters).

Table 2: Plant showing average height, number of leaves and the size of the vien.

Plant	Average Height in Cm.	Average number of Leaves	Average size of Veins in Cm.
P1	77.82	66.00	8.05
P2	69.59	50.00	6.92
P3	73.19	58.00	7.83

RESULT AND DISCUSSION

The growth of *Dioscorea deltoidea* were observed during the study period and is compiled in figure 3, 4 and 5 and in table-2.The experimental data show well germination percentage of *Dioscorea deltoidea* plant mainly increasing in height of plant, number of leaves, midrib and size of veins. The experimental study was started from the month of May to October 2013. By the help of experimental data it is calculated that the site which are selected for the conservation and cultivation is best cultivation site for *Dioscorea deltoidea*.

In the experiment maximum average height of plant was 77.82cm, and maximum average of number of leaves was 66 and average length of veins percentage is 8.05cm observed in plant P1. Because in plant P1 sample adequate 500 gm animal dung with 5kgs soil for the natural experimental trail. Minimum height of plant was 69.59 cm, and minimum number of leaves were 50.65 and average veins percentage is 6.92 cm observed in sample P2, in this sample low amount of cattle dung was added and water was sprinkled in every second day, due to excessive sprinkling of water the plant sample get dry and desiccated in the first and second week of July (Figure.3) because in natural conditions *Dioscorea deltoidea* grows mainly in shady and moist places and the plant not require excessive amount of water. The P3 sample shows medium growth rate between P1 and P2. In the sample P3 125gms of cattle dung was adequate in 5kgs soil and the average height of plant was 73.19 cm, and numbers of leaves were 58.7 and average veins percentage is 7.83 cm were observed in the plant. Overall the P1 sample has best growth rate result as compared to the plant P2 & P3. The overall growth rate of P1, P2 and P3 sample was gradually low during the month of June to July (Figure -3). Because in these months the rainfall percentage is high as compared to other months. Due to excessive amount of water it cannot tolerate maximum amount of water and the rate of growth of plant were checked for few weeks. Overall growth rate of the plants P1, P2 and P3) were slow during the 4^{th}, 5^{th}, 6^{th} and 7^{th} week of the experiment of the months June-July (< 4 cm per week), and simultaneously increasing during the month of August to September (4-6 cm per week) and the growth rate relatively high in the month of October (8-10 cm per week).

CONCLUSIONS

The experiment indicated that the natural habitat of *Dioscorea deltoidea* is suitable for the conservation of the plant but it can be grown in the places up to 2000m. resulted high percentage of growth rate as well as yield.

The experimental study highlights the general pattern of growth in *Dioscorea deltoidea* from growing till the adjustment of the plants, the growth is somewhat slower, but after the successful adjustment with surrounding environment, the growth is progressive toward higher rate. Based on the results of the experimental work it is suggested that the *Dioscorea deltoidea* species is very well adapted under domesticated at an altitude of 2000meters. The *Dioscorea deltoidea* is very important and threatened medicinal plant which needs conservation and cultivation, so if farmers of this area take initiative for the conservation & cultivation of this species, it may be protected from unsustainable use and overexploitation. Awareness programmes should be very helpful to educate local inhabitants. Finally the study provides primary information for selection of suitable cultivation sites and conservation and management practices for this species. Further, concentrated scientific studies need to be carried out to improve understanding this project.

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