

Chapter 8

Dioscorea wallichii Hook. f. (Dioscoreaceae): a tribal medico-food of India

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Abstract: There are numbers of neglected tuberous plants are available in India. They have food and medicinal values along with scope in commercial cultivation. *Dioscorea wallichii* is one such tuberous plant having sound ethnomedicinal and food values but comes under neglected tuberous plant due to less documentation. Therefore, an attempt has been made to document their potential as medico-food agent. Authors have discussed their importance and scope in commercialization. The chapter brings attention towards the importance of neglected tuber crops.

Keywords: Neglected tuberous plants, communities, yam, future food

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Introduction: *Dioscorea* L. is an herbaceous monocotyledonous genus. It is the largest genus of the Dioscoreaceae family, distributed in tropical and subtropical regions of

the world. The species of this genus are important both taxonomically and economically (Paul et al. 2017; Present study). These plants are climbing herbs or shrubs; stems annual, twining either to right or to left, sometimes with auxiliary aerial bulbils, with underground tubers and rhizomes; leaves alternate, rarely opposite, simple and compound, often cordate with reticulate venation (Present study). *Dioscorea* tubers are renowned for their ethnobotanical, nutritive, antioxidant, and biological potentiality that ensure the quality of daily nourishment of the indigenous people (Paul et al. 2020). Due to the great nutritional value of its underground tubers, they are an important source of energy for human populations worldwide (Wilkin et al. 2005). These tuberous plants have maximum uses among the tribal people and are less documented in their food and medicinal values (Kumar et al. 2017). Most species contain steroid saponins and also sapogenins, such as diosgenin, which is the starting material for the synthesis of many steroidal hormones used as anti-inflammatory, androgenic estrogenic, and contraceptive agents. The members of the genus *Dioscorea* are one of the oldest tuber crops, cultivated or harvested from the wild throughout the world and constitute one of the major food items for many ethnic communities (Dutta 2015). It is also the most important ingredient in the cosmetics and pharmaceutical industries. They have the potential for curing different diseases and ailments like cough, cold, stomach ache, leprosy, burns, fungal infections, dysentery, skin diseases, rheumatism, arthritis, and are also used as a birth control agent (Kumar et al. 2017; Salehi et al. 2019). Yams are grown on 5.36 million hectares in about 47 countries, with Nigeria as the leading producer of these tuberous plants (Aihebor et al. 2016). There is still a huge need for more research and information on the food, nutraceutical, and medicinal value of *Dioscorea* species worldwide. Among the *Dioscorea* species, *D. wallichii* is very common showing wide distribution throughout the world. It is native to Southeast Asia, India, and China. Very less documentations are available on this yam. Therefore, an attempt has been made to document the food, ethnomedicinal, pharmacological, and economic values of *D. wallichii* through literature and field surveys. Field surveys were made under different projects in India during 2014-2022.

Morphological characters: The key morphological characters of *D. wallichii* are (Saxena and Brahman 1995; Plate 1): Stem twining to the right, smooth or scarcely prickly towards the base. Leaves are orbicular, bluntly acuminate, widely cordate at base; nerves 10-12 pairs from the base, glabrous, intercostae parallel; petiole up to 14 cm long. It has separate male and female plants. The female inflorescences (flowering structures) hang down from the vine, each one containing up to 22 flowers. Female flowers: perianth lobes fleshy, outer ones ovate, inner ones broadly ovate. Capsule (immature) not reflexed, drying blackish, oblate, glabrous, base truncate, apex emarginate to truncate; wings 1.7-2.2 cm wide. Tubers are palmately branched, cylindric. Round capsules contain flat, brown seeds with a thin, marginal wing. Seeds inserted near the middle of the capsule in the flower and winged all round (Present study).



Plate 1: *D. wallichii* in wild habitat (fruits & leaves)

Habit & Habitat: It is a climber and grows on various large shrubs or trees in mixed deciduous, evergreen forests, on mountain slopes, occurs in disturbed areas along roadsides and margins of cultivated lands.

Global distribution: Bangladesh, China South-Central, East Himalaya, India, Malaya, Myanmar and Thailand (Paul et al. 2017).

Distribution in India: Andhra Pradesh, Kerala, Maharashtra, Odisha etc. (Present study)

Food values: During the rainy season, many tribal communities collect the tuber of *D. wallichii* and use it as a food supplement. It plays a vital role among the tribal communities by serving as food in their daily diet. It is commonly known as Suta aalu in Odisha (Guchhait et al. 2022; Present study). It serves as a main source of carbohydrates (Maneenoon et al. 2008). In Tripura, young aerial shoots and soft parts of tuber are used as a vegetable by most of the ethnic communities (Paul et al. 2017). Boiled and cooked tubers are also edible (Sheikh et al. 2017). Tubers are also roasted and used as a delicacy. After successive boiling, tubers are cooked as a curry. Tender leaves and shoots are boiled and cooked (Padhan and Panda 2016).

Ethnomedicinal values: The tuber of *D. wallichii* is commonly used as a fiber supplement. Powdered tuber is mixed with honey and taken orally for refreshment and to increase physical fitness. Janmatia and Reang communities of Tripura use the tuber against stomach pain (Paul et al. 2017). Boiled and cooked tubers are also used against stomach pain (Present study). The tuber juice of *D. wallichii* is used to treat stomach pain and jaundice (Gavad and Khade 2021). Many South Asians use syrup of the root to get relief from labour pain and also physicians recommend it to patients with colic pain, asthma, rheumatism and gastric problem related to alcoholism. Powdered tubers were used as an ingredient of medicines for cholera and constipation. Tubers are also used as carminative (Kumar et al. 2013; Mustafa et al. 2018), flatulence and as a de-appetizer (Kumar et al. 2017).

Bioactive compounds: Phytochemical analysis of *D. wallichii* leaves showed the presence of alkaloids, flavonoids, coumarins, phenols, tannins, saponins, terpenoids, quinones and catechins (Irulandi et al. 2016). Diosgenin obtained from its rootstock which is one of the costliest and most important steroidal drugs used worldwide. It has been used in the pharmaceutical industry as a chemical model in the development and complete synthesis of hormonal drugs. This metabolite is also reported to reduce oxidative stress damage, may protect the myocardium from ischemia-induced injury and modulates the intestinal microbiota. Dioscin and gracillin are also very important metabolites of this plant (Adomeniene and Venskutonis 2022).

Pharmacological values: Many researchers have documented the pharmacological values of *D. wallichii*. Irulandi et al. (2016) found the methanol extract of leaf of *D. wallichii* exhibited the highest radical scavenging activity. The results revealed significant free radical scavenging activity of methanolic leaf extracts of *D. wallichii*. According to their results, it was concluded that plant extracts of *D. wallichii* have potent antioxidant activity. Padhan et al. (2020) reported that results of DPPH radical scavenging activities revealed that, most of the yam extracts showed higher

scavenging activity. The antimicrobial activity of methanol, ethyl acetate and acetone leaf extracts of *D. wallichii* leaves against Gram positive bacteria, Gram negative pathogenic bacteria and fungus are carried out by Irulandi et al. (2016). Results revealed that the methanol extract showed the potent inhibitory effect against *E. coli* and *S. aureus* compared to positive control. Methanol and ethyl acetate extract did not show any inhibitory effect against *C. albicans*. Acetone extract showed minimum antimicrobial activity against all test microbial organisms with zone of inhibition ranges of 9.0-18.33 mm.

Economic values: *D. wallichii* is one of the potent medicinal tuberous plants against diverse diseases and disorders along with rich nutrition, but there is very less or no documentation is available on its economic values. As the tubers have both food and medicinal values, it could be used as a source of livelihood as well.

Future aspects: The world population is growing day by day, indicating the urgent need to get sufficient food and medicine to get rid of food problems and fatal pandemics. Yam is one of the leading staple foods for millions of people in tropical and subtropical countries. They possess food, medicinal, pharmacological as well as economic values. Tubers are rich in starch, and are often incorporated into the human diet. The tuber not only stores food but also many of the plants' secondary metabolites, which are commonly referred to as antinutritional factors. *D. wallichii*, an unexplored species of Yam, plays a vital role in the rural and tribal communities of different regions throughout the world. The antioxidant, antimicrobial activities and rich content of tannin, saponin, and total phenols in *D. wallichii* make it a strong nutraceutical food vine. The presence of Diosgenin in the tuber makes it an important ingredient in many local formulations as well as a prime component in the pharmaceutical industry. There is a major need for research in this unexplored yam species, its cultivation and also marketing. As there are very less or no reports on the economic values of this yam species prior to this present study, hence there is a need to create awareness, to document and to explore this species further among the local and tribal people. This vine could be a better nutraceutical in the future. There is still no clear classification and in-depth studies on the chemical components of *D. wallichii* and their activities, so the pharmacological mechanism has not been understood well. Further studies are needed to evaluate and to explore more potent bioactive compounds present in different parts of *D. wallichii* which might be specifically applied to pharmacology and clinical applications. The biological features, cultivation, development and utilization should be strengthened for this plant. In this pandemic period, as people are giving greater importance to their food and health, this chapter would be valuable for promoting the development of *D. wallichii* as a safe modern nutraceutical.

Conclusion

D. wallichii is one of the major sources of food and medicines, containing bioactive compounds like alkaloids, flavonoids, coumarins, phenols, tannins, saponins, terpenoids, quinones catechins etc. and also used in traditional therapeutic practices like used in stomach pain, jaundice etc. Despite their great importance in human life, they are enlisted in the neglected tuber crops till date. The present study gives a way

for additional scientific research and field survey exploration works to lead to the discovery of new sources of drugs from this unexplored tuberous plant.

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