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INDIGOFERA GLANDULOSA WENDLE (BARBADA) AN OVERLOOKED NUTRITIONAL PLANT: A CRITICAL REVIEW

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Abstract:

In the present paper the research articles related to Indigofera glandulosa wendl. belonging to family Fabaceae were selected to critically review on various aspects, as per the articles accessed it can be concluded that, Indigofera glandulosa Wendle. is small herb, familiar as a nutritional plant with a number of vernacular names. It is widely distributed in India, Indonesia and North Australia. It produces seeds rich in valuable food ingredients such as carbohydrates, protein, vitamin, and essential amino acids. It described as a nourishing food for humans and possess a qualities of a tonic in Indian medicine. The green part of plant can be used as a forage for domestic animals. In India, tribal collect the seeds from wild population and use it as famine food. The seed flour is use by locals and tribal for making chapattis or bread roasted rotti. This literature survey indicated that, Indigofera glandulosa Wendl. is nutritionally beneficial but unfortunately it is neglected underutilized plant species. Due to lack of attention the potential value is underestimated and may not properly exploited.

Key words: *Indigofera glandulosa Wendl.*, Medicinal, Nutrition, Traditional Use.

Introduction:

Fabaceae is one of the major family of Angiosperms and agriculturally important. It contains more than 19,400 known species and 730 genera. The family is widely distributed and it is third largest land plant family (Rahman and Parvin 2015). Most of the plants in this family are shrubs, tropical herbs or twining vines. Family Fabaceae has ability to fixed atmospheric nitrogen for protein synthesis that's why it has great nutritional value. (Molares and Ladio 2011). Family fabaceae is also called as Leguminosae, it plays an important role in both human welfare and ecological aspects. This family is traditionally categorized into three sub-families namely Mimosoideae, Caesalpinioideae and Faboideae (Papilionoideae). Hutchinson had recognized these three sub-families as independent families as Mimosaceae, Caesalpiniaceae and Fabaceae. (Bandyopadhyay 2018). *Indigofera* is a large genus of flowering plants belonging to the family *Fabaceae.* Species of this genus is very useful to the mankind. It occurs throughout the tropical and subtropical regions of the world, with a few species reaching the temperature zone in eastern Asia. (Prabakaran 2011). *Indigofera glandulosa wendl.* is a perennial herb belongs to the order Fabales and family Fabaceae (Leguminoceae). ***Indigofera glandulosa Wendl.*** is commonly known as "Barbada". It is an annual herb growing up to 20 to 50 cm tall. Stem of the plant is erect, much branched and covered with long hairs. Leaves are generally trifoliate; it has 1 to 1.5 cm long stalk. (Narayanasamy et.al. 2019). Flowers are red in colour and present at the stalk less heads in leaf axis. Flowering Period of the plant is usually September. It is native of Indian subcontinent Andaman and Nicobar Island, Java to Australia. In India it is found in Maharashtra, Tamilnadu, Madhya Pradesh, Jammu Kashmir etc. ***Indigofera glandulosa Wendl.*** is used as a medicinal plant in India. The plant is harvested from the Wild for local uses as a nutritive tonic. In times of need the plant is harvested from the Wild for its seeds which are an emergency source of food. The seed flour was used to prepare roti during extreme. It refers long sunny days for the growth draught conditions. Sometimes it is also grow in dried conditions and in poor soil. *Indigofera glandulosa Wendl* has a symbiotic relationship with certain soil bacteria thus bacteria from nodules on the root and fix atmospheric nitrogen (Pandit et. al.1990). *Indigofera glandulosa wendl.* seeds used as a source of food, in the period of scarcity when food grains were not available. Like other species of Fabaceae *Indigofera glandulosa Wendl.* is also cultivated by seeds. The seed has good rate of germination.

Taxonomic description:

APG Classification	
Kingdom	**Plantae**
Clade	**Angiosperm**
Clade	**Eudicot**
Clade	**Rosids**
Order	**Fabales**
Family	**Fabaceae**
Genus	***Indigofera***
Species	***glandulosa***

Bentham & Hookers Classification	
Kingdom	**Plantae**
Class	**Dicotyledonae**
Sub-class	**Polypetalae**
Series	**Calyciflorae**
Order	**Rosales**
Family	**Fabaceae**
Genus	***Indigofera***
Species	***Glandulosa Wendl***

Fabaceae or Leguminoceae is a largest land plant family. It has great agricultural importance. It contains more than 19,400 known species and 730 genera. Members of this family are widely in India. The largest genera in this family are *Astragulus* (about 700 species), *Acacia* (950 species), *Indigofera* (around 700 species), *Crotalaria* (around 700), and *Mimosa* (around 500 species). (Rahman et.al 2015).

Indigofera is a group of about 700 species of flowering plants belonging to the family facaceae. They occur throughout the tropical and subtropical region of the world, with a few species reaching the temperature zone of eastern Asia. The species are shrubs through some are herbaceous and a few can be become small trees up to 5 to 6m. (Vinoth et.al.,2011)

I. glandulosa Wendl. is branched, erect, perennial, and woody especially at the base. It grows about 10 to 75cm tall. It is collected from wild for used as nutritive tonic. In the period of scarcity when better food is not available *I. glandulosa Wendl.* seeds used as a food source. Habitat of *I. glandulosa wendl.* is periodically much desiccating heavy soil, agricultural land, grassy localities, and desiccated pools, roadside. For better growth and development sunny position and well drained but moist soil is suitable. It has symbiotic relationship with certain soil bacteria. Root nodules are help in the fixation of atmospheric nitrogen. (Tropical plants database ken fern.tropical.thefern.info.)

I. glandulosa wendl. is an annual herbs growing up to 20 to 90cm high. It is erect much branched, branches are long slender covered with hairs when young. Leaves are three foliate, petiole 1 to 1.2cm, leaflets 0.6 to 2.5cm by 0.5 to 1cm oblanceolate rounded or slightly retuse, apiculate green and with a few appressedly hairy and copiously nigro punctuate below. Flower are red in color and short axillary sessile heads. Calyx 2-3mm hairy outside. Teeth long setaceous. Corolla 2-3 times as long as calyx, pods linear oblong hair 5mm angle, the angles slightly winged and often toothed seeds 1-2 spherical smooth and polished sometimes mottled. (efloraofindia/species/a---l/f/fabaceae/*indigofera*/indigofera-glandulosa)

Indigofera glandulosa wendl. is an annual herb, growing up to 20 to 50cm tall. Stem is erect, much branch, covered with long hairs. Leaves are trifoliate, carried on 1 – 1.5cm long stalk. Leaflets are obovate, 1-2 cm long, hairy. Flower is developed at the stalk less heads in leaf axils. Flower is red in color 5-7mm across. Standard petal is circular, wings are deflexed. Pods are angled, 6mm velvety, period of flower is mostly September. (flowersofindia.net/catlog/slides/Barbada%20Indigo.html.)

It is sub shrubs, branchlets pubescents. Leaflets is 3.5 x 1.5cm oblanceolate, apex obtuse or emarginate, mucronate, base cuneate, membranous, pubescent, glandular beneath, laterals little smaller, petiole to 2cm, petiolule 1mm, stipules linear. Racemes axillary to 1cm long, flowers are pink, bracts linear, pubescent; standard petal 3 x1.5mm, oblong obovate; wing 2.5 x 1mm, keel 3 x 1mm, ciliate; staminal tube 2mm, filament to 1mm, unequal; anthers apiculate; ovary 2mm, subsessile, hirsute style 2mm. (Sasidharan and Pal india biodiversity portal 2014).

Medicinal Properties:

Indigo is a natural substance which can be used as dyestuff, it is extracted from *Indigofera* species and can be used for the treatment of various disease, such as epilepsy, bronchitis, liver disease and psychiatric illness. (Anand et al. 1979). *I. tinctoria, I. suffruticosum* are used for making dye indigo. some species of this group show anticancerous (Vieria et. al.2006), Anti-inflammatory activity. *I. articulate* is used for toothache and swelling. (Rajkapoor et.al.2005)

Indigofera glandulosa Wendl. is a medicinal plant. It has good antimicrobial activity against bacterial and fungal species *Pseudomonas putida, P. aeruginosa, Klebsiellapneumoniae, Aeromonas liquefaciens, Alcaligenes sp., Aspergillus niger, A. flavus, A. fumigatus, A. erythrocephalus and Fusarium sp.* Ethanol leaf extract if *Indigofera glandulosa Wendl.* show maximum zone of inhibition against all the bacterial species followed by chloroform and dimethyleformamide extract. The acetone leaf extract shows moderate inhibition zone against *Alcaligenes sp.*(9mm), *Aeromonas liquefaciens* (13mm) In antifungal assay the

aqueous extract shows maximum zone of inhibition was followed by dimethyleformamide and ethanolic extract. Acetone leaf extract have maximum antifungal activity against *fussarium sp*. The conbination extracts of different solventsuch as water:acetone:ethanol (1:1:1) showed maximum activity against tested bacteria and wateracetone combine mixture shows maximum zone of inhibition against some fungal species i.e. *A. flavus* (23mm), *A. fumigatus* (25mm). The dimethyleformamide extract of root have excellent activity against all test bacterial strain followed by ethanol, chloroform, & ecetone extract. In antifungal assay ethanol:chloroform:water combine extract of root show maximum inhibition zone against *P. Aeruginosa*(13mm), *Aeromonas liquefaciens*(14mm) and *Alcaligenes sp.* (15mm). Different combination of *Indigofera glandulosa Wendl.* show maximum antifungal activity in dimethyleformamide:chloroform extract. Among the test species *F. oxysporum* showed maximum activity. (Prabakaran 2011)

Nutritional Properties:

In India, Indonesia and north Australia *Indigofera glandulosa Wendl.* is widely distributed as a weed. *Indigofera glandulosa Wendl.* has an ability to grow under drought condition with an insufficient rainfall. Seed of this plant has great nutritious value. It has protein (25–31%), soluble carbohydrate (46.7%), water (8.2%), albumi-noids (31.9%), oil (2.2%), fibre (7.8%), total ash (2.18%), the essential nutrients like Ca (154 mg/100 g), P (291 mg/100 g), Fe (22.4 mg/100 g) and vitamins viz., thiamine, riboflavin and niacin. Essential amino acids such as arginine (24.7%), glycine (7.12%), threonine (4.92%), leucine (8.56%) along with the minor amounts of other amino acids are also reported (Deosthale and Nagarajan 1975; Freedman 2002)

Traditional uses

The green plant is used as forage for domestic animal like sheeps and goats. (Hanbelt 2001). Root nodules of *Indigofera glandulosa Wendl.* possess nitrogen fixing capacity which can be help in the improvement of soil fertility (Fikiru et.al.2007).

The neglected and underutilized plant species can play an important role to overcome the problems associated with malnutrition and food security. Due to lack of attention, potential value of *I. glandulosa Wendl.* is underestimated and may not be properly exploited. To improve germination capacity seeds were treated with con. H_2SO_4 for 10 min. This treatment shows difference in seed germination by soaking in distilled water and H_2SO_4 for 10 min. Seed soaked in distilled water for 10 min (control) fail to germinate at all. Hard seed coat inhibits the germination of seed. Hardness of seed coat can remove by H_2SO_4 treatment. Tribal's may use the seed flour for making breads, rotti and chapattis (Freedman 2002; Ghane et.al.2010)

Fruits:

Species of *Indigofera* shows some variation size, thickness of fruit wall, number of sclerenchymatous layer in endocarp, presence or absence of trichome, hypodermis and presence of separation tissue. Generally, pericarp is divide in to three type on the basis of anatomy i.e. Type I pericarp (thin pericarp and 3 to 5 sclerenchymatous layer in the endocarp), Type II pericarp (intermediatary pericarp thickness is 6 to 8 sclerenchymatous layer) and Type III pericarp (thick pericarp and more than 8 sclerenchymatous layer). In *Indigofera* dehiscence is caused by a separation layer present at the dorsal and ventral sutures except in some species such as *I. hochstetteri, I. karnatakana, I. glandulosa var. Sykesii & I. trita var. scabra*, etc. in which no separation of tissue is present; these species show delayed dehiscence or an indehiscent condition. In *Indigofera glandulosa Wendl.* trichome are pubescent, pericarp thickness is 160.31um, exocarp epidermis is single layer, thin wall; mesocarp is 4 to 6 layer collenchymatous, and parenchymatous narrow, elongated cell, most cell are idioblasts endocarp is 4to 6 layer sclerenchymatous. Pod length is 2 to 2.49mm and pod type is Type II. *I. glandulosa Wendl.* pods have glands on the surface. In mesocarp sometimes parenchymatous tissue also present in *I. glandulosa Wendl.* Pod dehiscence and dispersal are done by wind. (Chauhan and Arunpanday 2014).

Conclusion:

Total 16 research articles from various journals have been referred for this review article. The review was done on *Indigofera glandulosa Wendl.* (Barbada) plants considering its taxonomic description, medicinal properties and traditional uses. Author has faced lots of challenges to find literature studies on various aspects of this plant. On the basis of review of available articles, it can be concluded that Barbada is small herb belonging to the family, moreover it is one of the important crop in medicinal and nutritional properties. The seeds of Indigofera are rich in carbohydrates, proteins, vitamins, and amino acids. It is considered as nutritive food because the seeds possess qualities of nutritive tonic in Indian medicine. It is also used as a feed for cattle. Lack of attention and underestimation its nutritive power the weed would be lost, therefore attempts are being made to study all the properties of weed including phytochemical

nutritional and antimicrobial activity. Present research work also deals with its proper prospecting by bringing it under cultivation. This article also claims that the nutritional benefits of the weed would be taken to common people so that they will start consuming it and also will bring it under large scale cultivation. It would definitely become an affordable alternative source of food in their daily diet.

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