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Original Article

A Comprehensive Review on Pharmacological Activity and Secondary Metabolites of *Teramnus Labialis* L.

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ABSTRACT

The lesser-known leguminous plant *Teramnus labialis* has attracted a lot of interest because of its various therapeutic uses and bioactive ingredients. *T. labialis*, which has long been utilized in Ayurveda and traditional medicine, has a variety of pharmacological properties, such as antibacterial, hepatoprotective, antioxidant, and anti-inflammatory actions. Its extensive secondary metabolite profile, which includes terpenoids, alkaloids, flavonoids, and phenolic chemicals, is largely responsible for these medicinal benefits. The plant is a prospective option for natural anti-inflammatory therapy because of its noteworthy bioactivities, which include the ability to modulate inflammatory pathways. Despite its historical importance, there are very few thorough phytochemical and pharmacological analyses available. In order to shed light on *T. labialis*' s potential for pharmaceutical and nutraceutical development, this review attempts to compile the body of knowledge regarding its chemical composition, therapeutic uses, and anti-inflammatory qualities.

Keywords: Ayurveda, anti-oxidant activity, Pharmacological activity, secondary metabolites, *Teramnnus labialis*

INTRODUCTION

A plant in the *Fabaceae* family, mashaparni is used in ayurvedic medicine and is a staple in many Indians' diets. It is also a component of traditional Indian cuisine. The recognized botanical source of mashaparni is *Teramnus labialis* Spreng. In balyamahakashaya gana, Charaka acharya mentions that mashaparni is a common Balya medication (Pradeep *et al*., 2019). The blue wiss, scientifically known as *Teramnus labialis*, is a plant species belonging to the *Fabaceae* family. Plants synthesize active constituents which occur naturally in plant is known as phytochemicals (Vala and Bharat, 2022). Studies on other Teramnus species and plants in the *Fabaceae* family can shed light on possible secondary metabolites, even if *Teramnus labialis'* secondary metabolites appear to have gotten little attention. Flavonoids, alkaloids, tannins, saponins, and phenolic chemicals are common secondary metabolites found in plants of the Fabaceae family. The plant's antioxidant activity, therapeutic qualities, and defence mechanisms against diseases and herbivores are often enhanced by these secondary metabolites. Potential advantages of *Teramnus labialis* in the prevention or treatment of oxidative stress-related illnesses, including heart disease, neurological conditions, and various forms of cancer, may be investigated in future studies. Research may concentrate on its anti-oxidant qualities and how it affects oxidative damage in pertinent disease models Kirtikar and (Basu *et al*., 1935). *Teramnus labialis* Spreng (Leguminosae), known as "Mashoni" in Hindi, is a plant that is found throughout Ceylon and India. The fruit of this plant has antipyretic qualities. It aids in the treatment of paralysis, rheumatism, diseases of the neurological system, biliousness, and bronchitis (Chopra and Nayar, 1956). The current investigation is required since this plant has never before been the focus of any broad phytochemical studies. A collection of flowering plants of the legume Fabaceae family are grouped together under the genus name Teramnus. The tropics of the Americas, sub-Saharan Africa, the Arabian Peninsula, the Indian Subcontinent, Indochina, Hainan, Taiwan, and New Guinea are home to eight species of climbing plants and

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subshrubs. Typical habitats include grasslands, woodland regions, forest clearings, and seasonally dry tropical bushland and dense forest, which are often found in rocky**,** open locations. According to research, *T. labialis* methanol extract has potent anti-inflammatory properties. The traditional usage of *T. labialis* to treat rheumatism is supported by the identification and isolation of the recognized anti-inflammatory chemicals vitexin, bergenin, and daidzin from the methanolic extractives of the plant (Sridhar *et al*., 2006).

2.1. Chemical composition of *Teramnus* genus

Teramnus labialis (Fabaceae) was examined for its proximate composition, total (true) seed proteins, seed protein fractions, fatty acid composition, minerals, and antinutritional components Rajaram and Janardhanan, *et al*., (1989). Crude protein, crude fat, ash, and nitrogen-free extracts made up 22.86%, 6.10%, 4.62%, and 58.15% of the seed weight. The caloric value of 100 g of dry seed material was 378.94 kcal. The essential amino acids lysine, leucine, isoleucine, arginine, valine, and histidine were abundant. The unsaturated fatty acids accounted for more than 60% of the crude fat.

Teramnus labialis seed meal has comparable quantities of crude protein and lipids to other leguminous seeds such *Cicer arietinum, Entada pursaetha, Cajanus cajan, and Vigna umbellate*.

Table 1. Proximate composition of *Teramnus labialis* seed

Component	Percentage
Moisture	6.20
Total carbohydrates	67.52
Crude protein (Kjeldahl N x 6.25)	22.86
Crude fat	6.10
Crude fiber	8.27
Ash	4.62
Nitrogen Free Extract (NFE)	58.15
Kcal/100 g DM	378.94

The seeds' protein and lipid content contributed to their high dietary energy value. Albumins and globulins make up the majority of seed proteins.

Table 2. Protein fractions of *Teramnus labialis* seed

Protein fraction	g/100 g seed flour	g/100 g seed protein
Total protein (True protein)	16.43	100.00
Albumins	5.38	32.74
Globulins	8.06	49.06
Prolamines	1.21	7.37
Glutelins	1.78	10.83

High amounts of fatty acids (palmitic, linoleic, oleic, and stearic) were observed, but linolenic acid levels were low.

Table 3. Fatty acid composition of *Teramnus labialis* seed meal

Fatty acid	Percentage
Palmitic acid (C 16:0)	34.92
Stearic acid (C 18:0)	15.41
Oleic acid (C18:1)	19.17
Linoleic acid (C18:2)	25.91

Compared to other legumes, *Teramnus labialis* has greater concentrations of calcium, potassium, and sodium. Those who take diuretics to regulate their hypertension and have excessive potassium excretion through bodily fluids can benefit from the high potassium content in their meals (Siddhuraju *et al*., 2001). Entada rheedi and *Teramnus labialis* have higher iron contents than the ICMR's (1992) suggested dietary intake of 19 mg.

Table 4. Mineral composition of tribal pulses (mg 100g^{-1} seed flour) [a].

Botanical Name	Sodium	Potassium	Calcium	Magnesium	Phosphorus	Zinc	Manganese	Iron	Copper
Teramnus labialis	23.0 ±0.22	1866.2 ±1.06	230.2 ±0.18	520.3 ±0.86	162.1 ±0.12	3.2 ±0.03	0.5 ±0.01	44.0 ±0.12	2.2 ±0.08

All the values are means of triplicate determinations expressed on dry weight basis. ± denotes standard error.

2.2. Secondary metabolites of teramnus genus

From 2010 to 2011, *Teramnus* accessions were cultivated in a greenhouse and their fatty acid composition, oil percentage, and flavonoid content were assessed. There were notable differences in the number of seeds produced, the flavonol content, the oil percentage, and the makeup of the fatty acids. In both species, the number of seeds varied from 16 to 3,792. Compared to the other flavonols, *Teramnus* accessions produced higher quercetin (0.615–2.228 mg/g) in their seeds. Nonetheless, among all accessions, the amounts of kaempferol and isorhamnetin varied from 0 to 0.066 and 0 to 0.086 mg/g (dry seed weight basis), respectively. Of all Teramnus accessions, more oleic, linoleic, and linolenic acids were generated, with percentages ranging from 2.65 to 5.64% and 6.69 to 25.97, 31.82 to 41.44, and 17.7 to 32.66%, respectively. Additionally, the lowest saturated fatty acid contents (varying from 0.08 to 15.36%) were formed by seeds from all Teramnus accessions. For these characteristics, a number of noteworthy associations between the accessions were also found. Highly substantial positive associations were found between quercetin and oleic acid, oil%, and kaempfer. Additionally, quercetin and linoleic acid exhibited a strong negative connection. These associations are significant because they could be used to improve the flavonoid, oil percentage, and fatty acid compositions of *Teramnus labialis* and *T. uncinatus* accessions by beneficial breeding techniques (Morris *et al*., 2014). A number of species from the Leguminosae-Phaseoleae (genera related to Glycine) have been tested for their ability to produce glyceollins in response to bacterial inoculation. Produced by Glycine species, glyceollins are isoflavonoid (6a-hydroxypterocarpan) phytoalexins that have not been identified elsewhere in the Phaseoleae. With the exception of three species of Teramnus that produced glyceollin I but no other glyceollin isomer, none of the 27 species that were studied were found to produce glyceollins. However, *Terarnnus labialis* accessions did not yield any discernible levels of glyceollin 1 (Keen *et al*., 1989).

3.1 Pharmacological activities of teramnus genus

Phytostimulatory effect of indole-3-acetic acid by *Enterobacter cloacae* SN19 isolated from *Teramnus labialis* (L. f.) Spreng rhizosphere

Teramnus labialis (L. f.) Spreng, a wild tropical leguminous plant, generated a rhizosphere from which 30 morphologically different bacterial cultures were recovered. The bacterial isolate known as SN19, which was identified as Enterobacter cloacae, demonstrated the highest IAA synthesis (382.23 µg ml−1 in 0.1% L-tryptophan supplemented medium) among the isolates that were evaluated for various plant growth promoting (PGP) features (Bose *et al*., 2016)

3.2 Anti-inflammatory activity

Inflammation is a complex biological reaction of vascular tissues to adverse stimuli like pathogens, irritants, or damaged cells. According to Denko (1992), the organism's defensive response involves removing harmful stimuli and initiating tissue healing. Bioassay-guided fractionation of T. labialis methanolic extracts identified vitexin, bergenin, daidzin, and 3-O-methyl-D-chiro-inositol as active components due to their anti-inflammatory potential. Vitexin inhibited 5-lipoxygenase enzyme activity in a

dose-dependent manner (Sridhar *et al*., 2006). Bioassay-guided fractionation of *Teramnus labialis* methanolic extracts based on anti-inflammatory activity resulted in the extraction and characterization of vitexin, bergenin, daidzin, and 3-O-methyl-D-chiro-inositol as active components. The separated ingredients were also tested for antioxidant activity using the nitroblue tetrazolium (NBT) riboflavin photoreduction technique. The current study demonstrates that the methanol extract of T. labialis has potent antiinflammatory action. The isolation and characterization of vitexin, bergenin, and daidzin, recognized anti-inflammatory chemicals, from T. labialis methanolic extractives, supports the plant's traditional usage in rheumatoid arthritis treatment. It also demonstrated that vitexin may have anti-inflammatory properties by blocking the 5-lipoxygenase pathway. This is the first report to identify vitexin, bergenin, daidzin, and 3-O-methyl-D-chiro-inositol in T. labialis preparations (Rajaram and Janardhanan 1989). Phytochemical analysis of T. labialis seeds revealed a water-soluble gallactomannan (Alam and Gupta *et al*., 1986).

3.3 Lactogenic activity

A newborn's elixir of life is breast milk. It gives the infant immunity and nourishment. One of the most frequent causes of stopping breastfeeding is insufficient milk production. Plant sources with galactagogue activity are safer and more promising options for preventing the negative effects. "A galactagogue is a drug or combination of drugs that aid in the initiation, maintenance, and enhancement of lactation". The entire plant, including the roots, may have antioxidant, anti-inflammatory, antihyperglycemic, and hypolipidemic properties, according to earlier studies (Sahoo *et al*., 2016). Galactomannan and fraxidin are the two mains bioactive phytoconstituents. According to the findings of an experimental investigation, "the domperidone group and the methanolic extract of *Teramnus labialis* fruit dose at 200, 400, and 600 mg/kg produced 22%, 53%, 75%, and 58% increase of milk production respectively as compared to control." The pups' body weight doubled on the fifteenth day of nursing, and the methanolic extract of *Teramnus labialis* fruit group experienced a considerably higher rate of weight gain than the standard and control groups. Mother rats' body weight also exhibits a high value in comparison to the placebo control groups. The methanolic extract of *Teramnus labialis* fruit at 600 mg/kg group showed a more than two-fold increase in the levels of prolactin and cortisol, as well as a significant increase in the protein and glycogen content of the mammary gland and serum prolactin and cortisol compared to the control and standard groups (Alam and Gupta, 1986).

3.4 Antioxidant activity

Free radicals and ROS produced by oxidative stress are thought to be a major contributor to a number of physiological conditions, including cancer, diabetes mellitus, cirrhosis, aging, Parkinson's disease, arthritis, atherosclerosis, coronary heart disease, emphysema, gastric ulcers, and diabetes mellitus (Angelo *et al*., 1992). Studies on medicinal plants and vegetables conducted in vitro and epidemiologically have provided compelling evidence that plant components with antioxidant activity might shield biological systems from oxidative stress (Vasagam *et al*., 2011) Three distinct in vitro techniques were used to assess the in vitro antioxidant activity of *Teramnus labialis* (Linn.) whole plant extracts made with a methonolic solvent. Iron chelating activity, superoxide anion scavenging, and the DPPH (2, 2-diphenyl-1-picryl hydrazyl) technique.

3.4.1 DPPH Radical Scavenging assay

The highest DPPH scavenging activity of Teramnus labialis' methanolic extract was 67.50% at 1000 µg/ml, while that of rutin (standard) was 69.83% at the same concentration. The methanol extract of Teramnus labialis had an (IC50 = 210 µg/ml), while the reference rutin had an (IC50 = 480 µg/ml) (Vasagam *et al*., 2011).

3.4.2 Super Oxide Method

A highly reactive molecule, superoxide reacts with a variety of chemicals generated by metabolic activities. Superoxide radicals are broken down by superoxide dismutase enzymes, which are found in both aerobic and anaerobic organisms. The highest Superoxide anion scavenging activity of *Teramnus labialis'* methanolic extract was 85.71% at 1000 µg/ml, while quercetin (standard) showed 98.01% at the same concentration. Teramnus labialis methanolic extract had an (IC50 =70 µ/ml), while normal

quercetin had an (IC50 = 60µg/ml) (Vasagam *et al*., 2011).

3.4.3 Iron Chelating Method

Life depends on iron since it is necessary for respiration, oxygen transport, and the action of numerous enzymes. But iron is a very reactive metal that causes oxidative changes in proteins, lipids, and other parts of cells. At 1000 µg/ml, the methanolic extract of *Teramnus labialis* showed a maximal iron chelating activity of 94.23%, while the standard EDTA showed 97.90% at the same concentration. Teramnus labialis methanolic extract had an IC50 = 160 µg/ml, while normal EDTA had an IC50 = 65 µg/ml (Vasagam *et al*., 2011).

3.5 Hypolipidemic effect

The study's objective was to assess how efficiently *Teramnus labialis* whole plant methanolic extract reduced cholesterol levels in rats with experimentally induced hyperlipidemia. When *Teramnus labialis* methanolic extract (doses of 250 and 500 mg/kg) was administered concurrently, the raised levels of total cholesterol, ester & free cholesterol, phospholipids, triglycerides, LDL-cholestrol, and VLD-L caused by HFD were dramatically reduced. The HFD-fed groups (II) showed a significant decrease in HDL cholesterol, while the administration of *Teramnus labialis methanolic* extract (doses of 250 and 500 mg/kg) resulted in a considerable increase. The administration of *Teramnus labialis* methanolic extract (doses of 250 and 500 mg/kg) decreased the observed rise in body weight in the HFD-fed group (II). Thus, it was determined that *Teramnus labialis* whole plant methanolic extract had a clear cardioprotective effect against hyperlipidemia (Alagumani vasagam *et al*., 2011).

3.6 Anti-hyperglycemic activity

The aqueous alcohol extract of Teramnus labialis aerial parts for type 2 diabetes was fractionated using an in vivo bioassay, which produced an active fraction with a variety of coumarins. It was determined that fraxidin was the main coumarin found in the active fraction (Fort *et al*., 2000).

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