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Review Article

A Review on *Acacia tortilis*

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Abstract

Acacia tortilis is one of the important species of genus *Acacia* belonging to family Leguminaceae. Though there is no more study performed on this plant but it plays important role in the countries where it found. These countries includes North Africa, Arabian Peninsula and Asian countries including India, Pakistan The various part of *Acacia tortilis* plant say leaves, pods, gum exudates and bark is found to be beneficial for the purpose of commercially as well as medicinally . Commercially tannins derived from the bark part used as a dyestuff, pods and gum are used as a food, and leaves are useful for land fertility and cattle's grazing whereas medicinally it is useful for the treatment of various diseases like skin allergy, diabetes, diuretic and hypertension. Vast tract of the dry land in the world lie barren due to the scanty and uneven distribution of rainfall in this part of the world. Acacia and its various species including *Acacia tortilis* are drought resistant plant; these species are mainly found in arid and sub-arid area of Africa, Arabian and Asia. The survival of this plant in this part of the land is due to its ability to endure harsh condition and it is also help full to prevent soil erosion. In this review article the main focus is on the chemical composition and therapeutic potential as well as pharmacologically explored potential of *Acacia tortilis* and its importance in arid and sub-arid part of the world to fulfill the requirement of local population and animals.

1. INTRODUCTION

To date about 1200 *Acacia* species have been identified[1], these species are mainly found in the warmer, drier parts of the World, chiefly in Arabia, Australia and Africa. In India, there are about 22 indigenous species, distributed throughout the plains. Most of these species grow in arid and semi-arid regions, where the average temperature is 40 to 45°C in summer and less than 5 °C in winter[2]. Because they are the good sources of tannin, gum and timber[3], so it plays an important socio-economically role for the preparation of furniture, dyestuff and as a food additive. *Acacia tortilis* (*A. tortilis*) possesses valuable medicinal property and therapeutic potential so, it is also useful for treatment of various diseases like skin allergy, cough, inflammatory reaction and it is well used plant by the local population where it found commercially as well as medicinally. Their particular value in arid zones lies in their extreme resistance to heat, drought, salinity and alkalinity, drifting sand, grazing and repeated cutting[4]. Some of the Acacia species are of considerable value for re-forestation and reclamation of waste land[4].

2. HISTORY AND MORPHOLOGY OF *ACACIA TORTILIS*

The generic name '*Acacia*' derived from the Greek word '*akis*', meaning a point or a barb. The name '*tortilis*' means twisted and refers to the pod structure. It is also known as umbrella thorn due to it umbrella like structure and in India it is commonly known as Israeli babool[5].

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Table 1: Morphological description of *A.tortilis*[5]

Size	Small to medium-sized evergreen tree grows up to 21 m tall. The crown is dense, umbrella-like and flat-topped well-developed multiple boles support a flat-topped or rounded, spreading crown
Bark	Bark grey to black or dark brown, rough, fissured or smooth
Spine	Spines paired, 2 types-long, straight and white, or short, brownish and hooked; they range from 1.2 to 8 cm in length
Leaves and leaflet	Leaves are compound and the leaflets (6-22 pairs) are very small (1-4 mm long x 0.6-1 mm broad), glabrous to pubescent.
Fruit	A characteristic twisted browny pod

3. ECOLOGY

This species ranges from subtropical desert to dry through tropical desert to very dry forest life zones. The umbrella tree is reported to tolerate annual precipitation of 10-100 mm, an estimated annual temperature of 18-28 ºC and pH of 6.5-8.5. This species bear hot, arid climates with temperatures as high as 50 ºC [6].

4. ACACIA TORTILIS IN INDIA

A. tortilis ssp. *raddiana* is a comparatively new introduction to India, through the Central Arid Zone Research Institute in Jodhpur. At present it is planted extensively in northern tropical thorn forest zone in the arid areas of Andhra Pradesh, Gujarat, Haryana, Rajasthan and Tamil Nadu, and southern arid districts of Punjab[5].
Four sub-species of this plant can be distinguished:
A. tortilis (Forsk.) Hayne ssp. tortilis
A. tortilis (Forsk.) Hayne ssp. spirocarpa
A. tortilis (Forsk.) Hayne ssp. heteroacantha

A. tortilis (Forsk.) Hayne ssp. raddiana (Savi), which exists as two varieties: var. raddiana (young branch lets glabrous or sub glabrous and the pods glabrous) and var. pubescens A. Chev. (Young branch lets and rhachides of the leaves more or less pubescent, as are the pods)[7].

5. CHEMICAL COMPOSITION OF *ACACIA TORTILIS*

The chemical composition of *Acacia tortilis* is summarized in table-2.

Table 2: Chemical Composition of *Acacia tortilis*

Chemical component	Name of chemicals
Flavonoids	Apigenin-6,8-bis-C-β-d- glucopyranoside (vicenin)[8] Rutin (quercetin 3-*O*-rutinoside) [8]
Total Phenolic content	Gallic acid concentration (mg/g dry weight) of Acacia tortilis 42.11[9]
Gum	**Molar proportions (%) of constituent sugar residues** Uronic acid 8, Galactose 23, Arabinose 66, Rhamnose, Mannose 3[12]. **Polysaccharide** nitrogen 0.99%, protein content 6.18%, pH 6.46[10] **Nitrogen** High nitrogen content of gum is 1.9% **Amino acid** Uronic acid 8, Galactose 23, Arabinose 66, Rhamnose, Mannose 3[12].
Fatty acid from seed oils	*Acacia tortilis* contain 19% oleic, 72% linolenic, 60% linoleic acid[8]
Tannins	**Hydrolyzable tannins** The leaves, and to a lesser extent the bark, of many species contained between 1 and 8% hydrolyzable tannins[8] 1,3-di-O-galloyl-4,6-(−)hexahydroxydiphenoyl-β glucopyranose has been reported from the leaves of *A. tortilis raddiana*.

6. THERAPEUTIC POTENTIAL OF *ACACIA TORTILIS*

The traditional uses of *Acacia tortilis* are listed in table-3.

Table 3: Traditional Uses of *Acacia tortilis*

Plant part	Uses	Description
Seed	Food	In Kenya, the Turkana make porridge from the pods after extracting the seed. The Maasai eat the immature seeds[13].
Leaves and Fruits	Fodder	The leaves are fed green as well as dry by cattle. A 10-year-old *A. tortilis* yields about 4-6 kg dry leaf and 10- 12 kg pods per year. Fruits are preferred for stall-fed animals and should be ground to make them more nutritious.
Flowers	Forage	90% of the flowers abort and drop to the ground, providing additional important forage[14].
Wood	Fuel and Timber	*A.tortilis* starts producing fuel wood at the age of 8-18 years, at the rate of 50 kg/tree. Its fast growth and good coppicing behavior, coupled with the high calorific value for its wood (4400 kcal/kg), make it suitable for firewood and charcoal[14]. Used for planking, boxes, poles,moisture proof plywood, gun and rifle parts, furniture, house construction and farm implements. It is believed that Noah of the Old Testament made his ark from the wood of *A. tortilis*[1].
Bark	Dyestuff	The bark is reported to be a rich source of tannin so it is used as a dye[1]
Gum	Food additive	Gum obtained from *Acacia tortilis* and other species of acacia has been used as a food additive and for medicinal purpose[15]
Whole part	Soil fertility	Soil organic matter, total N, P and Ca^{2+} which are significantly higher under tree canopies [16]. Increasing Acacia age resulted in significant improvement in soil chemical, microbiological and biochemical properties, which have been manifested in pH, soil Corg, Cmic, and qCO2, enzyme activities. Resulting positive influence of the chronological development of the woody legume *A. tortilis* subsp. raddiana in terms of soil quality, which are vital for long-term productivity and sustainability of the arid low fertile soils[17].

7. NUTRITIVE POTENTIAL VALUE AND POTENTIAL DEGRADABILITY OF *A.TORTILIS*

In *A.tortilis* Crude protein (CP) content ranged from 134 to 213 g/kg Dry matter (DM). It is concluded that based on the moderate to high CP values and the degradation characteristics, these species have potential as livestock fodder. The content of neutral detergent fibre (NDF) and acid detergent fibre (ADF) ranged from 154 to 308 and from 114 to 251 g/kg DM, poor in phosphorus, moderate in calcium, magnesium and sulphur and rich in most microelements. Iron and selenium ranged from 132 to 459 and 13 to >100 mg/g.

The ranking order of the acacia species on the basis of their potential degradability has been establish in a following manner:

A.nubica > *A. tortilis* > *A. mellifera* > *A. brevispica*> *A. seyal*> *A. nilotica*[18].

Table 4: Recently Explored Pharmacological Therapeutic Potential of *Acacia tortilis:*

Plant part	Disease	Pharmacological activity
Polysaccharide isolated from Gum exudates	Diabetes mellitus	α-D-Glucosidase inhibitory activity of polysaccharide isolated from *Acacia tortilis* gum exudates has been found[10]. This study was conducted in our department of Shri Guru Ram Rai Institute of Pharmaceutical Sciences and Technology.
Stem bark	Fungal disease	Stem bark of *A.tortilis* has been showed strong activity against Candida albicans with MIC 125µg/ml and MFC 250µg/ml. It also shows moderate activity against *Aspergillus niger* with MIC and MBC= 1000µg/ml (water extract) [19].So it may use as an effective antifungal agent
Bark tannins	Diarrhoea	In cattle Tannins form protective layers on the skin and mucous membranes so it proves useful in cattle suffering from diarrhoea. In *A.tortilis* Due to presence of tannins it is beneficial in diarrhoea in cattle[20].
Stem bark	Infectious disease	In *A.tortilis* Stem bark is pounded and soaked in water, the extract gurgled to treat mouth infections and dental problems, so it is also useful in infectious diseases[21].
Wood	Dry cough	In Dry coughs plant is applied on burning charcoal and smoke is inhaled nasally.
Root	Cough and Diphtheria	In Coughs root is applied on burning charcoal and smoke is inhaled nasally. In case of Diphtheria Soaking crushed roots in water and the water is taken orally, while in Wounds Heated leaves or roots are applied topically or leaves or root paste is applied topically[22].
Root bark	malaria	*Acacia tortilis* root bark possesses antimalarial activity but would not be considered for follow up as an antimalarial candidate[23].
Aqueous extract	Hyper cholesterol and inflammation	Administration of *Acacia* aqueous extract lead to decrease in serum total cholesterol, and LDL level while an increase in serum HDL- cholesterol was observed as compared to their control rats. Decrease in body weight has been also observed[24]. In *A.tortilis*, property of Inhibition of prostaglandin biosynthesis and PAF-induced exocytosis has been found so it is also found effective in inflammatory reactions and febrifuge[25].
Methanol extract of *Acacia tortilis*	Leishmania and parasitic disease	Methanol extract of *Acacia tortilis* had moderate activity against Plasmodium falciparum, so it is effective in treatment of Leishmania and act as anti-parasitic[26].

Table 5: Interaction of *Acacia tortilis*

Interaction of plant	Object	Description
Pods and Seeds of *Acacia tortilis*	Bruchidius andrewesi Pic (recorded as a serious pesticide)	Infestation of pods is directly related to infestation of seed and both pod and seed infestations are also directly correlated with loss in seed biomass. The heavy infestation is damaging not only to *A. tortilis* but also to other leguminous trees of the desert[21].
Spines of *Acacia tortilis*	Herbivores	It is commonly observed that the risk of damage by herbivores is highest on plants growing in nutrient-rich soils. Spines act as an effective form of anti-herbivore protection, and then these plants might be expected to increase their production of physical defenses (long spines) under such circumstances[27].
***Acacia tortilis* ssp. *raddiana* tree**	Cereals yield	The improvement in soil fertility and microclimate provided by *A. tortilis* ssp. *raddiana* is known to facilitate the establishment of new species, but little is known about the interaction between the tree species and the cereals cultivated. Soil under Acacia trees had more organic matter (OM), more N content and more extractable P content. Higher cations content (Ca, Mg, Na, and K) but it has no effects on cereals yield[28].
Growth of *A. tortilis*	*Arbuscular mycorrhizal* fungi	It is suggested that indigenous *Arbuscular mycorrhizal* fungi, which are adapted to the limiting conditions in the plots, are the preferable source of inoculums for improving the growth of *A. tortilis* in plantations in pre-Saharan ecosystems[29].
A.tortilis* subs. *Spirocarpa	In Vitro Germination and Micro-Propagation	*A. tortilis* subs. *Spirocarpa*; a multipurpose tree of economic and environment importance in Sudan is possible to develop a simple and feasible *in vitro* propagation protocol for production of fodder for animals as well as for production of firewood and charcoal [30].

8. CONCLUSION

Interestingly, despite of wide activity of the Acacia tortilis, the work is limited. In the form of a solution or mucilage, it is frequently used in medicinal preparations for cough, cold, hoarseness, pharyngitis, gastric irritation and inflammation, diarrhea, dysentery, pulmonary tuberculosis, soothing to burns and scalds of the mouth and alimentary canal, hemorrhage, relief from pain in burn etc.

Thus, the growing evidence base for *Acacia tortilis* suggest that it is very important plant of genus acacia species and it may prove as a boon for arid and sub arid zone, it consist of numerous medicinal as well as commercial value. The best part of this plant is, it has no toxic effect, so it may prove important alternative therapy for treatment of various diseases.

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