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Review

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Phytochemical constituents and pharmacological profile of *Albizzia lebbeck*

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Abstract

Albizzia lebbeck (Linn) is an avenue tree commonly observed in many parts of India and is reported to possess a variety of pharmacological actions. This article reviews the phytochemical constituents present in different parts of the plant. The major therapeutic uses are also reviewed.

Keywords: *Albizzia lebbeck*

1. Introduction

Albizzia lebbeck (Linn) belonging to the family Mimosaceae, is commonly known as Siris. It is a medium to large sized deciduous tree 12-21m in height with an umbrella shaped crown and gray to dark brown rough irregularly cracked bark. Leaves are abruptly bipinnate. It is distributed throughout India, tropical and subtropical Asia and Africa.

The plant is reported to have antiseptic, anti-tubercular and anti-diarrheal properties. The bark possesses astringent, bitter, acrid, sweet, mildly thermogenic, expectorant and anti-inflammatory activities. It is useful in vitiated conditions of pitta and kapha, cough and catarrah, asthma, enlarged cervical glands, opthalmopathy, skin eruption, leprosy, leucoderma, sprains, wounds, ulcers, and neuralgia. Ayurveda recommends all parts of the plant for treatment of snakebite. The flowers are used in chronic cough and bronchitis. According to the Unani system of medicine, the leaves are useful in night blindness. The seeds are claimed to be aphrodisiac and tonic to the brain; the oil is applied topically in leucoderma [1-3].

2. Chemistry

2.1 Seeds

Air-dried seed of *A. lebbeck* contain albigenin (I), a triterpene [4]. The seeds contain triterpene saponin, lebbekanin-A (II) having melting point 205-206°C, which on hydrolysis yields glucose, galactose, arabinose, xylose, fructose, and rhamnose in molar ratio of 5:1:1:1:1:2 and echinocystic acid as the genin [5]. It also contains β-sitosterol [6]. A methanolic extract of seeds yields three macrocyclic spermine alkaloids budmunchiamines L_1-L_3. [7].

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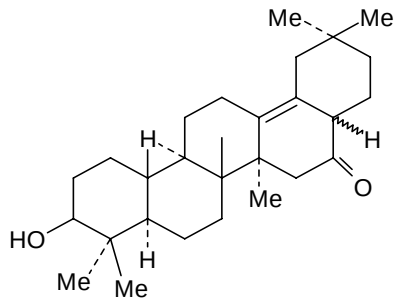
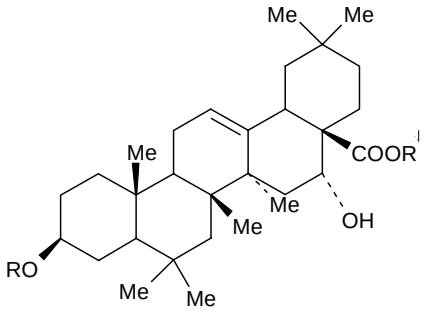
2.2. Bark

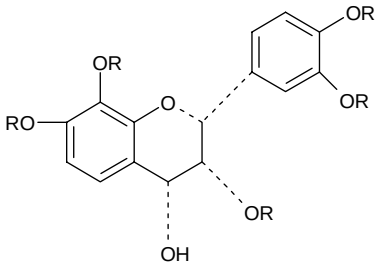
A novel phenolic glycoside, albizinin ($C_7H_{17}O_{32}$) and four known flavanols, (-) epicatechin, procyanidin B-2, procyanidin B-5, and procyanidin C-1, have been isolated from the acetone extract of the bark [14]. The bark contains echinocystic acid, and β-sitosterol [6]. Pal *et al*. have isolated three main saponins namely albizziasaponin A, B and C from the bark. Their structures were established through spectral analysis as acacic acid lactone 3-O-β-D-xylopyranosyl- (1õ2)-α-L-arabinopyrosyl(1õ6)-β-D-glucopyranoside, 3-O-β- D-glucopyranosyl-(1õ2)-O-{α-L-arabinopyranosyl-(1õ6)}-β-D-glucopyranoside and 3-O-β-D-xylopyranosyl (1õ2)-α-L-arabinopyranosyl (1õ6)-O-{β-D-glycopyranosyl-(1õ2)}-β-D-glycopyranoside [8].



I. Albigenin



II. Lebbekanin A



III. R = H, Melacacidin ;
IV. R = Me, (-)- 2, 3-cis-3, 4-cis, 3-O-methyl melacacidin

2.3 Leaves

The leaves contain three non-protein aminoacids, which are uncommon to any other plant. Young leaves and floral buds contain a higher concentration of these compounds as compared with their mature counterparts. Mature leaves accumulate a large amount of keto acids including phosphoenol-pyruvate, glyoxylate, oxaloacetate and α-oxoglutarate, whereas the open flowers have first three only [9].

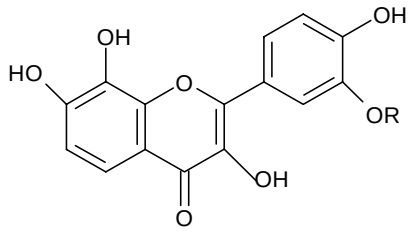
2.4 Flowers

Flowers of *A. lebbeck* contain 4 saponins lebbekanin-D (melting point 217-218°C), lebbekanin- F (melting point 204-205°C), lebbekanin-G (melting point 210-212°C) and lebbekanin- H (melting point- 220-222°C). On hydrolysis lebbekanin F, and G yield echinocystic acid and glucose, arabinose, xylose, fucose, and rhamnose in the molar ratio of 2:2:2:1:3 and 3:2:2:2:3 respectively. Lebbekanin D and H gave galactose, glucose, arabinose, xylose, and rhamnose in the molar ratio of 2:2:5:3:3 and 2:4:3:3:3 respectively. The sugars are attached at C_3-OH and C_{28}-COOH groups in the lebbekanin D and G [10-11].

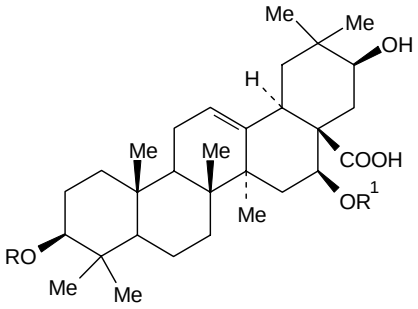
The flowers also contain lebbekanin A and C (glycoside of echinocystic acid) and lebekkanin B and E (glycosides of oleanolic acid and acacic acid) respectively [12].

2.5 Wood

The heart wood contains melacacidin (III) and (-)-2, 3-cis-3,4-cis- 3-O-methyl melacacidin as its methyl ether (IV), and melanoxetin (V) and 3'-O-methylmelanoxetin (VI) [13]. The wood also contains saponin, lebbekanin E (VII) having melting point 125-126°C and [α] D-39.21°. It is a glycoside of acacic acid and contains glucose, arabinose, xylose, and rhamnose in a molar ratio of 4:2:1:1 [14-15].



V. R = H, Melanoxetin ;
VI. R= Me, 3'-O-methylmelanoxetin



VII. Lebbekanin E

2.6 Oil:

The oil of *A. lebbeck* contains 3.5% of unsaponifiable fraction. The principal components of oil are sterols (38%), methyl sterols (3%), triterpene alcohol (18%), tocopherol (22%) and total hydrocarbons and carotenoids (19%). The main sterol of oil is β-sitosterol (78%). The other ingredients are cycloeucalenol, 24- ethylophenol, cycloartenol, β-amyrin, and α-tocopherol [16].

The hexane extract of pods contain a cyclic ester leneicos-7(2) enyl 24-hydroxytetracos- 10(2)-enoate, in addition to lupeol, oleanolic acid, docosanoic acid, and β-sitosterol [17].

3. Pharmacological profile

3.1 Antihistaminic and anti-asthmatic activity:

The effect of crude extract and pure saponin fraction of seeds of *A. lebbeck* were studied on the mast cells in the mesentery and peritoneal fluid of rats subjected to anaphylaxis. The crude extract and saponins protected the mast cells from degranulation due to antigenic shock [18].

In another study intramuscular injection of histamine into guinea pigs for 7 days increased blood catecholamine by approximately 40%. This effect was reduced when aqueous extract of bark was administered simultaneously [19]. Histamine-induced bronchospasm in guinea pigs was decreased by administration of an aqueous extract of *A. lebbeck* [20].

The bark is one of the major constituents of anti-asthma kada (the decoction). In anesthetized dogs, intravenous injection of the kada produced a dose dependent fall in blood pressure associated with bradycardia [21]. The clinical studies of kada (30ml b.i.d/t.i.d) produced a significant improvement in the peak expiratory flow rate and eosinophil count after 28days treatment. All patients showed improvement in the symptoms of breathlessness, cough and wheezing. This kada had no effect on the acute attack and also in reducing severity of symptoms. No side effects were observed in any patient [22].

A polyherbal formulation 'Pulmoflex', which contains an extract of A. lebbeck, was administered to 20 patients (age 12-45 yr.) suffering from allergic rhinitis for 2 weeks. The treatment improved total leucocyte count, differential eosinophil count, absolute eosinophil count, erythrocyte sedimentation rate, decreased sneezing frequency, and severity of rhinorrhea indicating its usefulness in the treatment of allergic respiratory disorders [26].

3.2 Anti-inflammatory activity:

Significant anti-inflammatory activity was assessed in male albino rats using carrageenan-induced paw edema method [23]. In one study 150 cases having different kinds of etiological factors for swelling were treated with composite drug 'Antisvel'. Significant decrease in inflammation was observed in 74% cases whereas no improvement was observed in remaining cases [24].

3.3 Opthalmic use:

A clinical study was done on 60 patients of various types of allergic conjunctivitis to assess the role of *A. lebbeck* in the form of eye drop and capsule for a period of 60 days of treatment and further 90 days for follow-up. Significant reduction in symptoms was observed [25].

3.4 Antifertility activity:

Saponins of *A. lebbeck* seeds were tested for their effect on copper induced ovulation in rabbits. The saponins prevented ovulation in 60% of treated animals and caused marked decrease in average number of ruptured follicles [27]. In another study, electrophoretic changes were observed on the protein profiles of seminiferous tubule fluid and epididymal fluid after the administration of alcoholic extract prepared from dry seeds [28].

3.5 Miscellaneous activities:

Antimicrobial screening of active compound(s) isolated from stem bark showed that the total glycosides, cardenolide glycoside and anthraquinone glycosides were active against the test cultures. The study of mode of action of active principles against aerobes showed that the glycosides caused leakage of cytoplasmic constituents. Electronmicroscopy of *Staph. aureus* cells treated with the minimum inhibitory concentration of anthraquinones revealed coarse granulation of the cytoplasmic matrix, vacuolation of the cells and in a few cases, disruption of the cell surface [29].

A saponin lebbekanin E exhibited spermicidal activity [14]. Thirty-five patients of tropical pulmonary eosiniphilia were treated with flowers for 6 weeks. Eighty-two percent cases showed excellent response, 12% showed good response, whereas 6% cases showed poor response. No side effects or toxicity was observed [30]. Clinical trials for treatment of bleeding piles have also been undertaken successfully [31].

Kasture et al., [32,33] have reported anticonvulsive activity of leaves of *Albizzia lebbeck* against seizures induced by maximal electroshock, pentylenetetrazol and lithium-pilocarpine in laboratory animals. This plant has been used in China as a folk medicine for treating psychological disorders, insomnia, and warts [34]. The saponins of *A. lebbeck* possess nootropic activity [35]. Thus, *Albizzia lebbeck* possesses multiple actions and bears potential for further research.

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