

Review: Indian Medicinal Plants and Wound Healing Properties

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Abstract- The body naturally recovers from tissue damage through the process of healing, but this process is very sluggish and there is a considerable risk of microbial infection. As a result, there is a desire for a component that quickens the healing process. Since the Vedic era, medicinal herbs have been utilized. They have been utilized to treat and prevent numerous illnesses for countless years. The therapeutic benefits of the plant are almost universal. Secondary metabolites of many kinds are present in medicinal plants and are crucial in the pathogenesis of numerous diseases. They are also employed in the production of pharmaceuticals. Numerous plants have been found to have additional benefits like antioxidant, wound-healing, anti-inflammatory, insecticidal, anti-parasitic, antibiotic, and anti-hemolytic characteristics. These plants are also commonly used by tribal people around the world. An overview of medicinal plants used for wound healing is provided in this article.

Keywords: Wound Healing, Phytotherapeutics, Phytoconstituents, Medicinal Plants, Properties

INTRODUCTION

The process of restoring damaged tissue's normal structure and functioning is known as wound healing. Shortening the time needed for healing or reducing unintended consequences are two ways to improve the healing process. One of the most important components of the necessary medications for soldiers is wound healers, which may aid in getting injured soldiers back on the battlefield as soon as feasible. By using them, wound healers also reduce the need for other medications like antibiotics and their potential negative effects(1). The medicinal plant is an integral part of human life to combat the sufferings from the dawn of civilization. Indigenous medicinal plants and plant-derived drugs are a potential source of alternative medicine and are extensively used to treat various health ailments. Use of the medicinal plants is

a core component at the primary healthcare level due to availability, acceptability, compatibility, and affordability. Dependency on these medicinal plants varies from country to country(2). Even today, hundreds of higher plants are cultivated worldwide to obtain useful substances in medicine and pharmacy. The therapeutic properties of plants gave rise to medicinal drugs made from certain plants with these benefits (3). In India, plants of therapeutic potential are widely used by all sections of people both as folk medicines in different indigenous systems of medicine like Siddha, Ayurveda, and Unani and also as processed product of pharmaceutical industry. India has about 4.5 million plant species and among them estimated only 250,000-500,000 plant species, have been investigated phytochemically for biological or pharmacological activity. The bioactive constituents or plants extracts may be uses for treatment of various diseases and these would be used as a new formulation for the novel drugs discovery in pharmaceutical industries(4). An overview of medicinal plants used for wound healing is provided in this article.

Albizia lebbbeck (Linn.) Benth.

Albizia lebbbeck (L.) Benth. (Family: Fabaceae) is commonly known as Siris, in Hindi; Lebbeck Tree in English and Bhandi, Sitapuspa, Sukapriya, Mrdupuspa in Sanskrit. It is mainly distributed in tropical and subtropical areas of India, Andaman Island, Myanmar, tropical Africa, Asia and northern Australia. Traditionally, it is used as an anti-asthmatic, anti-inflammatory, anti-fertility, anti-diarrhea, antiseptic, anti-dysenteric and anti-tubercular. It is also used in the treatment of ringworms and wounds by washing the affected areas, gonorrhea, leucorrhea, bronchitis, leprosy, paralysis and other genital diseases. The phytoconstituents reported in the plants are melacacidin, D-catechin, β -sitosterol, albiziahexoside, betulnic acid and echinocystic acid glycosides, which

are responsible for various potent physiological and pharmacological activities (5). Stem bark yields 7 to 11 % tannins; D-catechin D-leucocyanidin and Flowers yield triterpenoids, saponins, labbekanin D and 4, glycosides, lebbekannins D, F, G, and H. The leaves contain echinocystic acid and it yielded flavon, vicenin II and β -sitosterol. It is Muhallil-i Waram (anti-inflammatory), Mudammil-i Quruh (healing agent), Mudir-i Bawl (diuretic) Mudir-i Tams (emmenagogue), Tiryay (antidote)(6). The wound healing activity of methanolic extract of bark part of *Albizia lebeck* in the ointment form on mice was evaluated and the extract ointments showed considerable response in three types of wound models on mice (the excision, the incision and dead space wound model) comparable to those of a standard drug Betadine ointment in terms of wound contracting ability, wound closure time, tensile strength and dry granuloma weight. The reported result was *Albizia lebeck* bark extract exhibits significant wound healing potential (7).

Andrographis paniculate (Burm. F.) Wall. ex Nees
Andrographis paniculata (Burm. f.) Wall. ex Nees., belongs to the Acanthaceae family and is commonly known as "King of the bitters" or "Kalmegh". It is native to India and Sri Lanka and widely found in Southern and Southeastern Asia, including Bangladesh, China, Hong Kong, Indonesia, Malaysia, Myanmar, Philippines, and Thailand. Usually, the aerial parts, roots or leaves of *A. paniculata* are used separately. These plant parts are used traditionally as powder, infusion, or decoction form either alone or in combination with other medicinal plants for the treatment of leprosy, gonorrhoea, respiratory tract infections, scabies, boils, skin eruptions, chronic and seasonal fevers, griping, irregular bowel habits, loss of appetite, alopecia, general debility, diabetes, jaundice, dyspepsia, hemopathy, cough, edema, liver complaints, dysentery, malaria, enteritis, helminthiasis, herpes, peptic ulcer, skin infections (topical) (8). This plant has been reported to have a broad range of pharmacological effects including anticancer, antidiarrheal, antihepatitis, anti-HIV, antihyperglycemic, anti-inflammatory, antimicrobial, antimalarial, antioxidant, cardiovascular, cytotoxic, hepatoprotective, immunostimulatory, and sexual dysfunctions (2).

Antiacne herbal formulations are used for the treatment of *Acne vulgaris* with the added advantage of not producing adverse effects unlike synthetic drugs. Three herbal gel formulations were developed comprising 2.5%, 5.0% and 10% of herbal mixture containing methanolic extracts of *A. paniculata*, *G. glabra*, *C. papaya* and *C. pepo* using Carbopol 934 as gel base and the significant wound healing activity was observed in combined extracts and developed formulations as compared to standard and control group (9).

Bauhinia variegata Linn.

The mountain ebony, *Bauhinia variegata* L. belongs to the family Leguminosae. It is distributed throughout India, ascending to an altitude of 1300 in the Himalayas. It is widely planted in the tropics and warm regions of the world. The bark is astringent, tonic, anthelmintic, scrofula and skin diseases. The flowers and flower buds are used as a vegetables and laxative. The juice of flower is used to treat diarrhea, dysentery and other stomach disorders. The dried buds are used for the treatment of diarrhea and dysentery, worms, piles and tumors (10).

Extraction and entry point twisted models in pale skinned person wistar rats, were utilized to assess the injury recuperating movement of the ethanolic and fluid concentrates of foundation of *Bauhinia variegata* at measurements of 200 and 400 mg/kg bw. Both fluid and ethanolic concentrates of foundation of *Bauhinia variegata* at both measurements created noteworthy injury recuperating by extraction and cut injury models, which was equivalent to that of standard (framycetin) in extraction wound model (11).

Distinctive types of *Bauhinia* are referred to and utilized as Kanchnara in Indian arrangement of Medicine. Numerous mechanically helpful items, for example, tannins, fibre, gum and oil are gotten from *Bauhinia* species. Among these, *B. tomentosa* Linn, *B. racemosa* Lam, *B. retusa* Roxb, *B. purpurea* Linn, *B. variegata* Linn and *B. malabarica* Roxb. Discovered wide application in conventional frameworks of drug (11).

Betula utilis D. Don

Betula utilis D. Don (common name: Himalayan silver birch, Hindi name: Bhojpatra; Family: Betulaceae) is the broadleaved deciduous angiosperm and native to Himalayan region. The birch forest is referred as

primary vegetation due to being in original and natural state (12). *Betula utilis* D. Don (bhojpatra birch) forms tree line vegetation all along the Nepal Himalayas, and extensive stands of this species can be found on northern shady slopes and ravines (13).

Betula utilis leaf extract is used in bone fracture and its bark is used as condiment (14). *Betula utilis* seeds, leaves and bark are used for skin infection (topically)(14). *Betula utilis* seeds and leaves are mixed with *Cynodon dactylon* and used on fractured parts of the body, and the fractured part of the body is covered with the bark of *Betula utilis*. Seeds and leaves are mixed with *Cynodon dactylon* and a paste prepared and used on fractured parts of the body, which are then covered with the bark of *Betula utilis*. Bark extract is used in wounds(14).

The bark of *B. utilis* is widely used in the Ayurveda and Unani systems of medicine in the treatment of various ailments and diseases such as skin infections, diseases of the blood and ear, convulsions, wounds, bronchitis, leprosy, etc. (15). The leaves of the plant show efficacy in treating urinary tract infections and kidney and bladder stones. The paste of the bark was used to treat wounds, burns, and cuts. The juice of the bark was used to treat fever, cough and cold, internal bleeding, diarrhea, bronchitis, and jaundice. Leaf decoction is taken as diuretics. Bark paper is used to release fear and cure fever. *Betula utilis* serves as antiseptic (15).

Cassia Occidentalis Linn.

Cassia occidentalis L. (Kasamardah), Negro coffee, Family leguminose, is an erect, perennial plant and have traditional practice, as well as wide Phytochemicals and having diverse biological activities, known to possess antiallergic, antibacterial, antidote for poison, blood purifier, antifungal, antidiabetic, anti-inflammatory, antimutagenic, psoriasis, melanoblast cell line leprosy and hepatoprotective activity. Chemicals including achrosin, aloemodin, cassia occidentanol I, cassia occidentanol II, emodin, anthraquinones, anthrones, apigenin, aurantiobtusin, campesterol, cassiollin, chryso-obtusin, chrysophanic acid, chrysarobin, chrysophanol, chrysoeriol. The *Cassia occidentalis* has several biological activities such as blood purifier; expectorant, liver diseases, and traditionally used as anti-allergic, anti-inflammatory, anti-oxidant, the relaxant, anti-nociceptive activity and skin diseases

like psoriasis, anti-diabetic and hepato-protective. The hepatomyoencephalopathy in children and hypolipidemic, antioxidant and antiatherosclerogenic was also reported (16). The leaves useful in vitiated conditions of vata and kapha, leprosy, erysipelas, pruritus, wounds and ulcers, cough, bronchitis, asthma, pharyngodynia, fever and hydrophobia. The seeds are useful in leprosy, erysipelas, ulcers, strangury, cough, bronchitis and constipation (17). Chrysophanol extracted from the leaf have wound healing activity (18).

Commiphora mukul (Hook. Ex Stocks) Engl.

Commiphora mukul Engl., commonly known as Guggulu, is a most important medicinal plant and has been a key component in ancient Indian Ayurvedic, Unani and Siddha system of medicine. (Syn. *Commiphora wightii*; *Balsmodendron wightii*; *B. roxburghii*; *B. mukul*) is a stunted bush with spinescent branches belonging to family Burseraceae. Guggulu is an oleogum resin that exudes spontaneously as a result of injury from the bark of *Commiphora mukul*, is one of the most important drug used since vedic period. It contains several phytoconstituents like essential oils, flavonoids, ellagic acid, camphorene, cembrene, diterpene hydrocarbon, diterpene alcohol, Z - Guggulsterone, E- Guggulsterone, Guggulsterol-I, II, & III, cholesterol, etc. *Commiphora mukul* is antiseptic, ecboic, appetizing, aphrodisiac, emmenagogue, expectrorant and used in menorrhagia, anaemia, leucorrhoea, rheumatism, nervous diseases, bone- fractures, obesity, disorder of lipid metabolism and peptic ulcer, leprosy, muscle spasms, ophthalmia, skin disorders, ulcerative pharyngitis, hypertension, ischaemia, urinary disorders. Hypercholesterolemia, impotence, bronchitis, catarrh, sores, tumors, wounds, bone fractures, facial paralysis, diabetes, and as a tonic for the uterus etc. Oleo-gum resins of this plant used in incense, lacquers, varnishes, and ointments, as a fixative in perfumes, and in medicine. Gugulipid, an extract of *Commiphora mukul*, has recently been paid great attention for its cancer chemo-preventive and chemo-therapeutic potential (18). It responsible for reducing fat, indicated for healing Bone Fracture to inflammation, Arthritis, Atherosclerosis, Obesity, Hyperlipidemia, Rheumatism, Haemorrhids, Urinary disorder, skin disease high cholesterol, neuro-degenertion, Parkinson's diseases, mongolism and ageing process (19). It is a mixture of

phytoconstituents like volatile oil which contains terpenoidal constituents such as monoterpenoids, sesquiterpenoids, diterpenoids, and triterpenoids; steroids; flavonoids; guggultetrols; lignans; sugars; and amino acids (20). Gum guggul is the oleoresin of the plant *Commiphora mukul*, a plant native to India (21). Traditional uses of *C. wightii* include as an anti-inflammatory(21), antispasmodic, carminative, emmenagogue, hypoglycemic, alterative, antiseptic(22).

Daucus carota Linn. Var. sativa DC.

Carrot is the one of the major vegetable crops cultivated worldwide. The domesticated types are divided into two groups: the Eastern or Asian carrots (var. *atrorubens*), with mainly purple and yellow roots; and the Western carrots (var. *sativus*) with mainly orange roots (23). This plant possessed cytotoxic, antioxidant, antidiabetic, antimicrobial, smooth muscle relaxant, hypotensive effect and decrease intraocular pressure, gastro-protective, nephro-protective, hepato-protective, cardio-protective antidepressant memory enhancement, anti-inflammatory, reproductive, wound healing and hair induction and many other effects(23). The soft paraffin based cream containing 1%, 2% and 4% w/w of ethanolic extract of *Daucus carota* (EEDC) root was formulated and evaluated in wound healing activity on excision and incision wound models. Animals treated with topical EEDC cream formulation (1%, 2% and 4% w/w) showed significance decrease in wound area, epithelization period and scar width whereas, the rate of wound contraction was significantly increased as compared to control group animals in excision wound model. In incision wound model there was significant increase in tensile strength (23). Wound-healing property of ethanolic extract of *Daucus carota* L. root may be attributed to the various phytoconstituents like flavonoids and phenolic derivatives present in the root and the quicker process of wound healing could be a function of either its antioxidant or antimicrobial potential. This findings provide scientific evidence to the ethanomedicinal properties of *Daucus carota* in wounds healing activity (24).

Diospyros malabarica(Desr.)Kostel

Diospyros malabarica Gurke, commonly known as Kendu in Assamese, is a small middle sized evergreen tree belongs to family Ebenaceae (25). It is popular as

Gab or Tinduk. Different phytochemicals have been isolated from leaf and bark which include β -sitosterol, betulin, betulinic acid, oleanolic acid, lupeol and gallic acid. The plant is traditionally used for the treatment of dys-entery and menstrual problems. The plant is also used in snake bite and it possesses antifertility activity. Its fruit juice is useful in the treatment of wound and ulcer, stem bark is useful in intermittent fever. The bark also possesses hypo- glyceic (26). The bark and leaves are anti-inflammatory, febrifuge, depurative, constipating, acrid, astringent, cooling and are used in dyspepsia, leprosy, diarrhea, dysentery, hemorrhages, skin burning, diabetes, spermatorrhea, vaginal diseases, wounds, flatulence, prolepsis, scabies and as carminative, laxative and tonic. Fruits being bitter in taste are used as carminative, aphrodisiac and in digestive disorders (27). The percentage of wound contraction in Tinduka twak (*Diospyrose malabarica*) kwatha group is statistically significant increase on 8th and 16th day, highly significant increase on 12th, 20th, 24thday and better on 28th day. Good regeneration was observed in histological study in kwatha group. Tinduka twak kwatha was effective in burn wound healing (28).

Glycyrrhiza Glabra

Liquorice grows naturally in different parts of Baluchistan, Chitral and Hindu Kush Himalayan areas (29). The yellow color of licorice is due to the flavonoid content of the plant, which includes liquiritin, isoliquiritin (a chalcone), and other compounds (30). Author reported that F3 with 10% of herbal mixture had best wound healing, as the rate of epithelization and more contraction occurred at rapid phase and healed completely in less duration as compared to other extracts. This could be due to the fact that higher concentration of extracts are required for fast healing process (9). The effect of *Glycyrrhiza glabra* L. extract on the full-thickness wound healing in Guinea Pig model was investigated and hydroalcoholic extract of *G.glabra* creams (5% and 10% w/w) were significantly increased the epidermal formation, collagen deposition and neovascularization, and was decreased acute inflammation in comparison to the control group. Wound healing rate were increased in the *G. glabra* groups. *G.glabra* creams 10 % was more effective than 5% w/w. Author reported that 5% and 10% w/w *G. glabra* creams were effective in acute dermal

wound healing (31). The healing effect of licorice extract was investigated on open skin wounds in rabbits. Creams of 5%, 10% and 15% (w/w) extract in eucerin base were prepared and applied 2 times daily. Dexpanthenol ointment was used as standard control. Healing was determined by reduction in wound area. The results of this study proved that licorice cream of 10% was a potent healing agent even better than dexpanthenol cream (32).

Gossypium arboretum Linn.

The genus *Gossypium* is a leading species, comprises around 50 species in the tribe Gossypioideae and few new species continue to be discovered. It is native to India, having numerous varieties in this region (33). The healing activity of *Gossypium herbaceum* leaves methanolic extract has been proved by using excision, incision and dead space wound models in rats. In incision and excision models, a significant decrease in period of epithelization and wound contraction was observed in all the treatment groups when compared to control. In the incision wound model, a significant increase in the breaking strength was observed. Granulation tissue formation significantly increased in all treated animals compare to control. The wound healing activity of ethanol and ethyl ether fractions of leaves of *Gossypium herbaceum* was investigated by dexamethasone delayed wound healing model in rats. *Gossypium herbaceum* decreased glucose level against dexamethasone. In excision wound model wound contraction area was increased, the epithelization period and scar area were decreased with significantly increase in percentage of wound healing in *Gossypium herbaceum* treated groups. In incision mode, a combination of extract plus dexamethasone significantly increases the breaking strength. Hydroxyproline content significantly increased in the treated groups compare to dexamethasone group (33).

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