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Ethnobotanical knowledge of medicinal plants among tribal communities in Kota block of Bilaspur district, Chhattisgarh with special references to cut and wounds

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Abstract
The necrotic condition occurs in the skin and mucous membranes closes over time with a unique mechanism and the condition is called wound healing. The local tribal peoples have explored a variety of herbal medicines for effective cure of various diseases. The study area was divided into four Gram Panchayats; Tendubhatha, Rigwar, Pudu and Umariyadader. These gram panchayat includes ten villages. Questionnaire was conducted and necessary data has been collected from local traditional healers.

Some medicinal herbs and especially active compounds act by gene expression. It cannot certainly be stated efficiency medicinal plants in improving wound healing, but they have major potential for improving wound healing. The use of active compounds is a new strategy to improve wound healing. Medicinal plants and active compounds help to decrease inflammation. Future studies will be needed to determine more mechanisms.

Keywords: cut and wounds, ethnobotanical, medicinal plants, skin problem, tribes

Introduction

Wound is the disruption of the integrity of the skin. This necrotic condition occurs in the skin and mucous membranes closes over time with a unique mechanism and the condition is called wound healing. It consists of four overlapping physiological stages like: homeostasis, inflammation, proliferation, and re-maturation. Wound biting, firearms, flammable, cutting, and piercing substances occur will cause wound (Velnar, *et al.*, 2009) [68]. Wound healing is a complicated process and depends upon several factors that contribute jointly to wound closure, including blood coagulation, inflammation, fibroplasia, collagen deposition, and wound contraction (Srinivasan *et al.*, 2001) [63]. Now a days, different medicinal plants and their parts occurred from forest is used for the preparation medicine for wound healing (Department of Medicinal Plants, Thapathali, Kathmandu, 1982) [10]. Current traditional Indian medicines are mainly used for biliary disorders, anorexia, cough, diabetic wounds, hepatic disorders, rheumatism, and sinusitis when translated into terms of modern medicine (Jain and DeFilipps, 1991) [15].

The indigenous tribal communities residing inside the forest or fringe areas utilizing forest resources for their livelihood as well as for their primary health care (Harsha *et al.* 2003) [15]. The ethnic-medicobotany of the Uttrakannada district in Kerala, India. In his study he mentioned that tribals prepared variety of medicines from the medicinal plants found in the nearest forest. In another study, (Kandari *et al*. 2012) [21] mentioned the ethnobotanical knowledge of medicinal plants among tribal communities in Orissa.

In Chhattisgarh, tribals are living in different zones of the state. There are five tribal communities that are declared as particularly vulnerable tribal groups (PVTGs) by Govt. of India in Chhattisgarh. The local tribal peoples have explored a variety of herbal medicines for effective cure of various diseases. There are numerous of herbal medicines found in the forest of Chhattisgarh whose ingredients have not been experimented and documented by the pharmaceuticals, but by exclusive practice, these drugs have shown wonderful results. Tribals from their own traditional knowledge invented variety of treatments by using raw materials or parts of medicinal plants.

There is debate surrounding when a wound becomes classed as chronic (Sibbald *et al*., 2013) [57]. Many literatures suggested that wound present for more than 6 weeks is considered to be chronic in nature and without treatment it may be life threatening (Sibbald *et al*., 2013) [57].

When wound healing has stalled it is vital that the community nurse has the appropriate knowledge and skills to assess the whole patient and does not simply concentrate on the wound bed (Atkin, 2014). To ensure effective patient treatment the assessment should be based on determination of the causes of the wound, and identification of any co-morbidities/complications that may contribute to the wound or delay wound healing (World Union of Wound Healing Societies, 2008). The current study focus on the relation with medicinal plants and tribes in Kota area of Bilaspur district for cut and wound purpose.

Study area

The study area is situated at Kota block of Bilaspur district in Chhattisgarh. It is about 45 kms towards Bilaspur to Pendra road north from Bilaspur district headquarter. The study area was divided into four Gram Panchayats; Tendubhatha (Total area: 290.52 hectare, population: 822), Rigwar (Total area: 1404.3 hectare, population: 1117), Pudu (Total area: 1032 hectare, population: 1341) and Umariyadader (Total area: 427.03 hectare, population: 1023). These gram panchayats include ten villages.

Materials and Methods

The current study was based on field observation in 2017-18. The field visit and interview was conducted on regular interval in randomly selected areas of the Kota block in Bilaspur district, Chhattisgarh. In preliminary stage door to door survey on the basis of semi structured questionnaire was conducted and necessary data has been collected from local traditional healers i.e.; Baiga tribal. Baigas are residing in the forest villages.

Results and Discussions

Most of the Kota block area is surrounded by tropical deciduous forest. The variety of forest tree species and medicinal plants found in this area. The local baiga tribes are using some selected medicinal plants/trees for the treatments traditionally. As per their information, there are ten medicinal plants were taken for cut and wounds purpose. The details of the medicinal plants is given in Table 1.

Table 1: Details of the medicinal plants and their uses

S. N.	Botanical Name	Common Name	Family	Useful Plant Parts	Mode of Utilization	Propagation	Availability in the study area
1.	*Aloe vera* (L.) Burm.f.	Gwarpatha	Xanthorrhoeaceae	Leaf	Leaf pulp is applied externally for a week	Offset	Common
2.	*Curcuma longa* L.	Haldi	Zingiberaceae	Rhizome	Rhizome powder used externally twice a day a week	Rhizome	Common
3.	*Syzygium cumini (L.)*	Jamun	Myrtaceae	Bark	Fine powder utilized on wounds externally for ten days	Seed	Common
4.	*Madhuca longifolia* (J. Koenig ex L.) J. F.Macbr.	Mahua	Sapotaceae	Seed oil	Seed oil applied on wounds twice a day for 10-15 days	Seed	Common
5.	*Phyllanthus emblica* L.	Amla	Phyllanthaceae	Fruit	Powder of the fruit mixed with neem oil applied externally on the affected area twice a day for a week	Seed	Common
6.	*Pongamia pinnata* (L.) Pierre	Karanj	Leguminosae	Seed oil	Seed oil applied on wounds for 10-15 days thrice a day	Seed	Common
7.	*Schleichera oleosa* (Lour.) Merr.	Kusum	Sapindaceae	Seed oil	Seed oil applied on wounds two times a day for 10-15 days	Seed	Common
8.	*Terminalia bellirica* (Gaertn.) Roxb.	Bahera	Combretaceae	Bark and fruit	Bark and fruit are crushed well and paste on affected area twice a day for 10-12 days	Seed	Common
9.	*Terminalia chebula* Retz.	Harra	Combretaceae	Bark and fruit	Bark and fruit are crushed well and paste on affected area twice a day for 10-12 days	Seed	Common
10.	*Tridax procumbens* L.	Coat button	Asteraceae	Leaf	Leaf juice is utilized directly on the cut part of body	Seed	Abundant

Family wise Medicinal plants used for Cut and Wounds

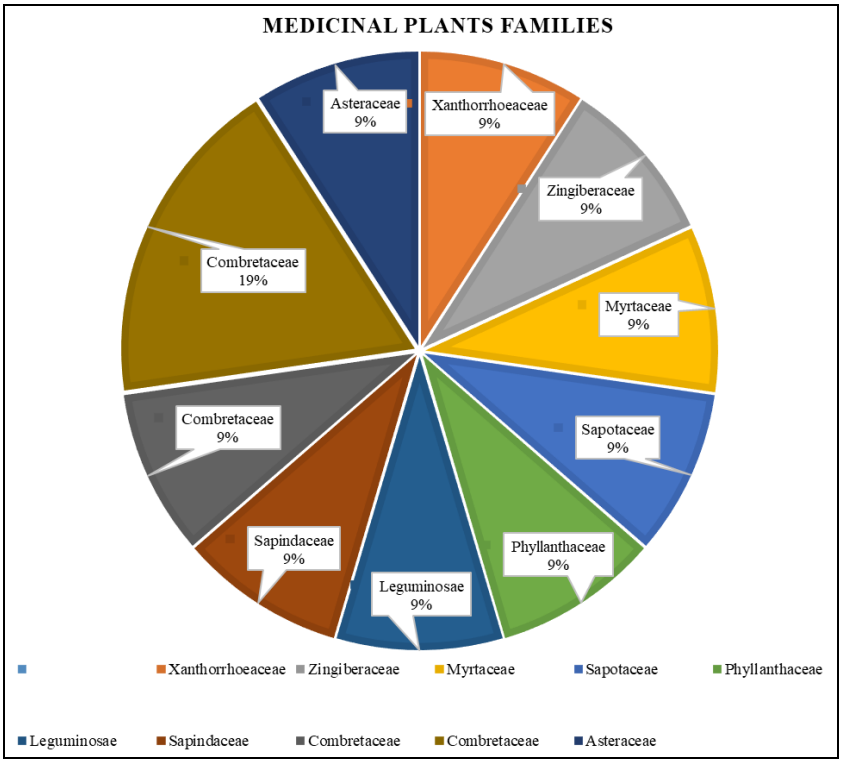

Fig 1: Distribution of medicinal plants family wise in the forest area

There are Ten medicinal plants were found useful for the purpose of Cut and Wounds and are belong to families like Combretaceae, Xanthorrhoeaceae, Zingiberaceae, Myrtaceae, Sapotaceae, Phyllanthaceae, Leguminosae, Sapindaceae, Combretaceae, and Asteraceae. A total of seven trees, three Herbaceous Medicinal plants were noticed. In terms of propagation eight Medicinal plants propagating using seeds and one by rhizome and one is offset were noticed. Availability of the Medicinal plants in Study area – Common nine and abundant one was recorded.
The socio-economic condition is found very poor but their knowledge about the utilization of medicinal plants for disease treatment is very sharp. This traditional knowledge is transferred to them generation wise. As per their knowledge and information a database of the medicinal plants were prepared which is used for the different wound healing purposes locally.

Medicinal Plants used for treating Cut and Wound healing

1. *Aloe Vera* (L.) Burm.f

Fig 2

Kingdom: Plantae
Division: Tracheophyta
Class: Magnoliopsida
Order: Asparagales
Family: Xanthorrhoeaceae
Genus: Aloe L
Species: *Aloe vera* (L.) Burm.f
Flower and fruit: the inflorescence is forked once or twice and is 60 to 90 cm high. The raceme is dense, cylindrical and narrows toward the top. The terminal raceme is up 40 cm high while the lower ones are somewhat shorter. The bracts are almost white, and the flowers are yellow, orange or red, and are 3 cm long.
Leaves, Stem, and Root: the lilylike succulent-leafed rosette shrub has a 25cm stem or none at all. The stem has about 25 leaves in an upright dense rosette. The lanceolate leaf is thick and flashy, 40 to 50 cm long and 6 to 7 cm wide at the base. The upper surface is concave, gray-green, often with a reddish tinge, which sometimes appears in patches in the young plants. The leaf margin has a pale pink edge and 2 mm long pale teeth.

Compounds: *Anthracene derivatives:* particularly anthrone-10-C-glycosyls, including aloin A, aloin B, 7-hydroxyaloins A and B, and 1, 8-dihydroxy ions, including Aloe-emodin, and 6' cinnamic acid esters of these compounds 2-alkylchromones: including Aloe resins B, C and D.

Aloe Vera is an excellent remedy for minor burns, cuts, and sunburns. Both juice and aqueous extract from the leaves show significant healing properties. It is also reported that it not only speeds up healing but also prevents the injured surface from getting infected (Chitra *et al.*, 1998) [5]. The leaf of A. Vera consists of mainly the outer thick green rind with white teeth at the margins, viscous jellies like mucilage layer in the inner side of the rind, and the fillet fluid which is the water storage area for the plant (Baruah *et al*. 2016) [2] Aloe Vera was studied for burn wounds by routine dressing by A. Vera extract every 3rd day in a chemically produced burn on healing subjects. The wound healing time and bacteriological control were significantly in the Aloe group (Udupa *et al*., 1994) [67].
The working mechanism of *Aloe Vera* for wound healing is reported to be enhancing collages turnover rate and increased level of lysyl oxidase (responsible for cross-linking of newly synthesized collages (Chitra *et al*., 1998) [5]. It binds to the cell surface receptors of fibroblast and hence activates collagen production. Plant growth regulator Gibberellin available in A Vera also enhances collagen and elastin formation for improvement of breaking strength by interfering with collagen cross-link for wound contraction which reduces wrinkle formation. When Acemannan comes in contact with the growth factors it readily accelerates the stimulation of the tissue granule in the damaged area and thereby heals the wound. Wound healing activity was also reported from a polysaccharide and glycoprotein isolated from the plant (Choi *et al*., 2001) [6]. Saponin named aloe genin present in A. vera was reported for its wound healing activity (Rajput *et al*., 2009). The plant directly acts on the wound healing process by increasing the rate of contraction of the wounded area (Subramanian *et al*., 2006) [51].

2. *Curcuma longa* Linn.

Fig 3

Kingdom: Plantae
Order: Zingiberales
Family: Zingiberaceae
Genus: Curcuma
Species: *Curcuma Longa* Linn.
It is also called Indian saffron, Curcuma. It consists of dried as well as fresh rhizomes of the plant known as Curcuma longa belonging to the family Zingiberaceae. It contains more than 4% of volatile oil. India accounts for as much as 90% of the total output of the world. The plants are grown for 7 to 9 months after which the rhizomes are harvested,

cooked, dried, and then processed for powder, oleo-resin, and curcumin. The extraction of powder is carried out by using solvents, water, or both. It contains about 5% of volatile oil, resin. Starch grains and curcuminoids which are the chief constitutes of curcumin, Volatile oil, content sesquiterpenes such as α and β pinene, α-phellandrene, camphor, zingiberene. It is used as a condiment or spices, and coloring agent, especially for ointments and creams. It is used for the detection of boric acid. Traditionally it has been proved as anti-inflammatory, anticancer, antiseptic (Mehra *et al*., 1984) [32].

The main activities of Curcuma rhizome are anti-inflammatory, hepatoprotective, anti-microbial, antifungal, antiviral, wound healing, anticancer, antitumor, anti-inflammatory, and antivenom agents (Gounder and Lingamallu 2012) [24]. Curcuma longa (Turmeric) is one of such medicinal plants, the most essential metabolite of turmeric is curcumin, and it's responsible for its anti-inflammatory properties (Jurenka, 2009) [20]. The leaves of the plant have been reported to have been used as a medication for wounds and inflammation as well as a treatment for ophthalmic disorders (Miron, 2014) [33].

Flower and Fruit: The inflorescence is cone like, 10 to 15 cm long, and is attached to a stem enclosed in a sheathing petiole. The flower has 2 pale green bracts, which are 5 to 6 cm long. The covering bracts are whitish, often red-tinged. The individual flowers are yellowish-white or yellow. The flowers have a tubular, a-lobed calyx, and funnel-shaped, 3-tipped corolla. The fruit is a globular capsule.

Leaves, Stem, and Root: Curcuma Longa is a perennial, erect, leafy plant with very large, lily like leaves up to 1.2 m long. The leaf blade is ovate-lanceilate, thin, entire-margined, and narrows to a long sheathlike petiole. The main rhizome is thickened to a tuber and has numerous roots. The roots in turn terminate in partially elliptical tubers. The secondary rhizomes are digit-shaped with no roots. All rhizomes are yellowish-brown with stipules and appear transversely ringed when they die.

Compounds: Volatile oil (3-5%): alpha- and beta-tumerone (aroma source), artumerone, alpha- and gamma-atlantone, curlone, zingiberene, curcumol, Curcuminoids (3-5%): including curcumin, demethoxy curcumin, bidemethoxy curcumin, 1,5-diaryl-penta-1,4-dien-3-one derivatives, Starch (30-40%)

3. *Syzygium cumini* Linn.

Fig 4

Kingdom: Plantae
Order: Myrtales
Family: Myrtaceae
Genus: Syzygium
Species: *Syzygium cumini* Linn.

Syzygium cumini L. is a polyembryonic species belongs to the family Myrtaceae. It is a tropical fruit tree of great economic importance. Fruit is commonly known as jamun, java plum, black plum, jambul and Indian blackberry. S. cumini is also used for the treatment of skin wounds (Oliveira *et al*., 2007) [39]. The seeds are fairly rich in protein and calcium. (Jadhav, Kamble, and Kadam 2009) [44].

Leaf extracts are used for the treatment of skin wounds (Oliveira *et al*., 2007) [39]. S. cumini reported to contain vitamin C, gallic acid, tannins, anthocyanins, includes cyanidin, petunidin, malvidin glucoside, a trace of pale yellow essential oil, fat, resin, albumin, chlorophyll, an alkaloid- jambosine, gallic acid, ellagic acid, corilagin, and related tannin, 3, 6-hexahydroxydiphenoylglucose and its isomer 4,6-hexahydroxydiphenoylglucose, 1-galloylglucose, 3-galloylglucose, quercetin (Md. Rashedul Alam 2019) [31].

When laser treatment was combined with S. cumini topical extract, results were significant as compared to laser and plant extract alone. This may be due to the additive antioxidant effects of the plant extract along with the wound healing effect of laser therapy. Regularly using this plant in the treatment of wound (Sorg *et al*. 2016) [60].

The medicinal parts are the dried bark, dried seed kernels, disintegrated kernels, dried bark, and macerated seeds.

Flower and Fruit: The flowers are in compound, triple panicles. They are sessile, whitish, fragrant, and usually on older branches behind the leaves. The calyx tube is 4 to 6 mm long and twisted. The petals are hood like. There are approximately 60 stamens, which are as long as the calyx tube. The drupe is 2 to 3 cm long, globular to ovate, 1-valved, 1-seeded and adible. The seeds are sub-cylindrical, about 6 mm long and rather less in diameter. One end of the seed is truncated and has a central depression. Externally, they are pinkish brown.

Characteristics: The taste of the seeds is faintly astringent and aromatic; the odor is slight.

Compounds

Seed: Fatty oil (3-5%): containing oleic acid, myristic acid, palmitic acid and linoleic acid, sterculiac acid and malvalic acid (cyclopropylidenic acids), among others, as well as vernolic acid (epoxy fatty acid), Tannins (6%): including corilagin, 3,3'-Di-O-methyl ellagic acid, galloyl glucose

Tannins: gallic and ellagic acid derivatives including 3,3'-Di-O-methyl ellagic acid

Steroids: sterols, including beta-sitosterol, beta-sitosterol glucoside

Triterpenes: betulinic acid, friedelin, friedelan-3-alpha-ole, epi-friedelanol, eugenin

Flavonoids: including myricetin, kempferol, quercetin, astragalin

4. *Madhuca longifolia* (J.Konig) J.F.Macbr.

Fig 5

Kingdom: Plantae
Order: Ericales
Family: Sapotaceae
Genus: Madhuca
Species: *Madhuca Longifolia* (J. Konig) J.F.Macbr.

M. longifolia trees are normally 15–16 m high, with clustered leaves at the end of branches. The barks are brownish to yellowish grey in colour. Elliptic flowers are small, cream coloured and are produced in clusters (Jha and Mazumder 2018) [18].

Flower: The mahua flower is edible and is a food item for tribals. They use it to make syrup for medicinal purposes.

Mahua flowers are rich in total sugars, out of which reducing sugar present in high amount. The flowers are also fermented to produce the alcoholic drink mahua, a country liquor. Tribals of Surguja and Bastar in Chhattisgarh consider the tree and the mahua drink as part of their cultural heritage. Mahua is an essential drink for tribal men and women during celebrations.

Previous phytochemical studies on *Madhuca longifolia* included characterization of sapogenins, carbohydrates, triterpenoids, steroids, saponins, flavonoids, and glycosides (Degen, 2012) [9]. In view of the attributed medicinal properties, new components including: madhucic acid (a pentacyclic triterpenoid), madhushazone (an untypical isoflavone), madhusalmone [(a bis(isoflavone)] (Yoshikawa *et al*. 2000) and four new oleanane-type triterpene glycosides (madlongisides A-D) (Siddiqui *et al*. 2004) [4]. Madhucosides A and B were isolated from *Madhuca longifolia* and showed significant inhibitory effects on both superoxide release from polymorphonuclear cells and hypochlorous acid generation from neutrophils (Pawar and Bhutani 2004) [40].

Madhuca longifolia fruit is valued for its seed which contain high quantity of lipids (ca. 50–61 %), commercially known as mahua or mowrah butter, and it has many edible, medicinal and non-food applications (Ramadan *et al*. 2006) [46]. This review reported on composition, nutritional value, functional properties as well as food and non-food applications of mahua lipids.

The whole mahua seeds contain 50–61 % oil, 16.9 % protein, 3.2 % fiber, 22 % carbohydrates, 3.4 % ash, 2.5 % saponins, and 0.5 % tannins. Oil represents the major component which is thrice the amount of protein. The deoiled seed cake contains 30 % protein, 1 % oil, 8.6 % fiber, 42.8 % carbohydrates, 6 % ash, 9.8 % saponins, and 1 % tannins (Singh and Singh 1991) [59]. Defatting of mahua seed increased the protein, saponin and tannin levels. The levels of saponins could be reduced by treatment with isopropanol. The deoiled mahua seed cake showed good oil absorption and emulsification properties. The in vitro digestibility of mahua seed cake after treatment with isopropanol was found to be 81 %. Detoxified mahua seed flour appears to be a good source of protein for food and feed products (Singh and Singh 1991; Ramadan and Moersel 2006) [59, 46].

Its taxonomy and nomenclature are as follows: Plant name: M. longifolia; Kingdom: Plantae; Phylum; Tracheophyta; Order: Ericales; Family: Sapotaceae; Genus: Madhuca; Species: longifolia. (Simon 2018) [58] Investigation of Sharma *et al*. deduced the notable wound healing property of Madhuca as compared to standard betadine. This activity may be due to the presence of constituents responsible for the promotion of wound healing.

The stanza about the general character of the *Madhuca longifolia* plant indicated that root bark can cure wounds. Therefore I selected the root bark of this plant for the research study. Chemically it contains Saponin, steroids, triterpenoids, tannins, flavonoids, alkaloids, edible fats cyanogen, and glycosides. (Ramadan, *et al*., 2006) [46]. A gradual healing process was taken place in the standard group, but a marked reduction in the size of wounds was observed in the test group. In the test group, the Size of the wound was gradually decreasing up to the third day, afterwards there was a sudden fall in size and it attained minimum level. All parts of *Madhuca longifolia* are medically important in the traditional system of medicine.

In this study, ether-benzene-95% crude ethanolic extract of leaves and bark of *M. longifolia* showed a marked reduction in wound healing time concerning control in an excision wound model. (Ousey 2018).

5. *Phyllanthus emblica* Linn.

Fig 6

Kingdom: Plantae
Order: Malpighiales
Family: Phyllanthaceae
Genus: Phyllanthus
Species: *Phyllanthus emblica* Linn.

Phyllanthus Emblica Linn. (Emblica officinalis), commonly known as Indian gooseberry or amla, belongs to the family Euphorbiaceae. The Indian gooseberry or Amla is an edible fruit and is sour, bitter, astringent, and quite fibrous. In traditional medicine, the fruits are used for the treatment of diarrhea, jaundice, and inflammation. They also show antidiabetic, hypolipidemic, antibacterial, antioxidant, antiulcerogenic, hepatoprotective, gastroprotective, and chemopreventive properties.

The fruits are rich in ascorbic acid i.e. Vitamin C. In addition, they contain phenols, including ellagic acid, gallic acid, quercetin, kaempferol, corilagin, geraniin, furosin, gallotanins, emblicanins, flavonoids, glycosides, and proanthocyanidins. The roots contain glycosides and tannins. The importance of amla is mainly attributed to its strong antioxidant action. The ascorbic acid content of the fruit mainly accounts for 45% to 70% of the antioxidant activity. Other compounds having antioxidant properties include emblicanins, gallic acid, methyl gallate, corilagin, furosin, and geraniin. The following table shows the type and chemical constituents of amla. (Lanka, 2018) [11].

An increase in collagen fibers, aldehyde content, and tensile strength was observed. There was an increasing concentration of anti-oxidants mainly ascorbic acid, superoxide dismutase, glutathione peroxidase, and catalase at the site of the wound indicating an anti-oxidant effect. Interestingly, the extract maintained its efficacy after being stored for one year (Sumitra *et al.*, 2009) [65].

6. *Pongamia pinnata*

Fig 7

Kingdom: Plantae
Order: Fabales
Family: Fabaceae
Genus: Millettia
Species: *Pongamia pinnata*

Pongamia pinnata (L.) Pierre (Fabaceae), popularly known as 'Karanja' (in Hindi), Pongam (in Tamil), and 'Indian beech' (in English), is native to India and widely distributed along with Southeast Asia to the West Pacific and North Australia. It is a medium-sized tree with a short crooked trunk and a broad crown of spreading or drooping branches.

The wound healing activity of ethanolic extract of stem bark of *Pongamia pinnata* (PP). The parameters studied were breaking strength in case of incision wounds, epithelization period, and wound area in case of excision wound. Healing is a physiological process and does not normally much help but still, wounds cause discomfort and are prone to infection and other complications. Ethno medically, this plant is used in folk remedies for treating Wounds, inflammations, piles, ulcers, and skin infection and it contains potent anti-inflammatory and ulcerogenic Studies have revealed the presence of different classes of major chemical components reported from P. pinnata are alkaloids dimethoxy-kanugin, gamatay, glabrin, glabrosaponin, kaempferol, kanjone, kanugin, karangin, neoglabrin, pinnate, pongamol, pongapin, quercitin, saponin, b-sitosterol, and tannin & syringyl groups (phytochemicals).(Kumar, *et al.*, 2003 and Sajid Z, *et al.*, 2012) [23, 52]. Whole leaves used as a digestive and laxative and to treat inflammation and wounds Leaf juice aids in the treatment of leprosy, gonorrhea, diarrhea, flatulence, coughs, and colds Leaf infusions and extracts alleviate rheumatism and itches, respectively (Pulipati *et al.*, 2018) [61, 62].

The leaves and latex are used in the healing of wounds, refractory ulcers, and septic gums and as a styptic in cuts and bruises. A proteolytic enzyme (curcumin) has been reported to have wound healing activity in mice (Villegas *et al.*, 1997) [69].

7. *Schleichera oleosa* (Lour.) Oken

Fig 8

Kingdom: plantae
Order: Sapindales
Family: Sapindaceae
Genus: Schleichera
Species: *Schleichera oleosa* (Lour.) Oken

Schleicher oleosa is Deciduous trees, to 20 m high, bole fluted; bark 10-12 mm thick, surface grey, smooth, brittle; blaze reddish-brown. Leaves paripinnate, alternate, exstipulate; rachis 5.5-11.5 cm, stout, glabrous, swollen at base; leaflets 4-6, opposite or subopposite; petiolule up to 3 mm, slender, glabrous; lamina 5-15 x 1.8-4.5 cm, elliptic-oblong, ovate or obovate, base oblique or rarely obtuse, apex acute or obtuse, margin entire, coriaceous, glabrous; lateral nerves 10-23, parallel, prominent, intercostal reticulate, faint. Flowers polygamodioecious. The seed powder is applied to cattle for ulcers and wounds to protect them from maggots. The literature also mentioned that this plant is used traditionally as antidiabetic. (Bhattacharya and Jatudrum, 1989) [3], (Mohapatra, and Sahoo, 2008) [35], (Mohanta, *et al, 2006*) [34], (Sandhya, *et al*, 2011) [53]. It also has many medicinal uses and is used in traditional medicine for several indications. The powdered seeds are applied to

wounds and ulcers of cattle to remove maggots. The bark is used as an astringent and against skin inflammations, ulcers, itching, acne, and other skin infections. In conclusion, the potential antidiabetic effect of S. oleosa was well established. The possible underlying mechanisms of this outcome may be related to that S. oleosa could inhibit α-amylase and α-glucosidase activity to decrease the absorption of carbohydrates from food. Moreover, the leaves of S. oleosa extract might contain active constituents for the management of diabetes and a promising supply for the invention of antidiabetic agents. Hence, further investigations are deserved to elucidate specific components and their mechanisms of S. oleosa for its anti-diabetic effect. The seeds powder is applied to wounds and ulcers of cattle to remove the maggots. The bark is having an astringent effect, and it's used to treat skin inflammations and infections, ulcers, itching, acne (Iwasa 1997) [14].

8. *Terminalia bellirica* (Gaertn.) Roxb.

Fig 9

Kingdom: Plantae
Order: Myrtales
Family: Combretaceae
Genus: Terminalia
Species: *Terminalia bellirica* (Gaertn.) Roxb.

Terminalia bellirica Roxb. Belonging to the family Combretaceae, commonly known as Belliric Myrobalan (Hindi-Bahera), is a deciduous tree found throughout the Indian forests and plains. Fruit is an astringent, antiseptic, rejuvenating, brain tonic, expectorant, and axative.

Terminalia bellerica is constituent of traditional purgative medicament of Triphala. Synthetically, the constituents'of β-sitosterol, gallic acid, ellagic acid, chebulagic acid, mannitol, glucose, fructose, and rhamnose in the product of Terminalia Billerica have been investigated. Phytoconstituent such as gallic acid had been reported (Manish *et al.* 2019) [29]. The attention on gallic acid is due to its medicinal efficacy as antioxidants. (Choudhary, 2008) [7].

The wound healing process involves several steps, including coagulation, formation of granulation tissue, collaboration, and acquisition of wound strength. During the formation of new tissue, endothelial cells proliferate and form new blood vessels. In tribal areas different crude drug preparations are used to treat various skin diseases including wounds. Healing of wound is an integrative and dynamic procedure of re-establishing cell structures and tissue layers. Diabetic wounds are difficult and tough to manage. Hyperglycemic wounds are moderate, delayed wounds that can continue for quite a long time despite sufficient and proper care.

9. *Terminalia Chebula* Retz.

Fig 10

Kingdom: Plantae
Order: Myrtales
Family: Combrataceae
Genus: Terminalia
Species: *Terminalia chebula* Retz.

The tree is tall about 50-80 feet in height. It has round crown and spreading branches. The bark is dark brown with some longitudinal cracks. Leaves are ovate and elliptical, with two large glands at the top of the petiole. The flowers are monoecious, dull white to yellow, with a strong unpleasant odour, borne in terminal spikes or short panicles. The flowers appear May-June, the fruits July-December. The fruit or drupe is about 1-2 inches in size. It has five lines or five ribs on the outer skin. Fruit is green when unripe and yellowish grey when ripe. Fruits were collected from January to April, fruit formation started from November to January.

Flower and fruit: the flowers are arranged in 5 to 7 cm axillary spikes, the flowers are small and fused, and arranged in fives. The sepals are almost glabrous and yellowish-white; the calyx tube has 5 tips. There are no petals, but there are 10 stamens and a single-chambered, inferior overy. The style is long and projects out of the bud. The fruit is a glabrous, ovoid drupe, yellow to orange-brown when ripe and 2 to 4 cm long.

Leaves, Stem, and Root: Tropical Almond is a tree that grows up to 25 m high. The leaves are alternate or opposite, 7 to 18 cm long, 4 to 6 cm wide, and coriaceous. The petiole is approximately 2.5 cm long, with 2 glands at the upper end. The lamina is ovate or elliptical, blunt and orbicular at the base. It is finaly crenate and woodley pubescent beneath. The branches are rust colored, woodlly or glabrous, and trunk has a brown, longitudinally fissured bark.

Compounds: Tannins (20 to 45%): gallotannins, including terchebulin, terflavin A, punicalagin, corilagin, chebulic acid, and chebulinic acid Monosaccharides/oligosaccharides (9%): including D-glucose. D-fructose, saccharose

Fruit acids: It including quinic acid (1.5%), shikimic acid (2%) Fatty oil (in the seeds, to 40%).

It consists of dried, ripe, and fully matured fruits of Terminalia Chebula belonging to the family Combretaceae. it is not cultivated and fruits are collected from wild-grown forest plants. It has yellowish-white flowers in the terminal spike. It contains hydrolyzable tannins which upon hydrolysis yield chebulic acid and d-galloyl glucose.it also contains chebulagic, chebulinic, ellagic, and gallic acids.

It also has many medicinal uses and is used in folkloric medicine for numerous indications. The powdered seeds are applied to wounds and ulcers of cattle to remove the maggots. The bark is used as an astringent and against skin inflammations, ulcers, itching, acne, and other skin infections. It is generally used as an analgesic, antibiotic, and against dysentery (Rout, *et al*., 2009) [50]. Recently, it was reported that the bark along with water is used to treat menorrhea. It is also called Haritaki, chebulic myrobalan.

It is used mainly as an astringent, laxatives, stomachic and tonic, anthelmintic. The fruit pulp is used to cure bleeding. It is an ingredient of ayurvedic preparation 'Triphala'. It is also used in wounds and external ulcers (Suguna *et al.*, 2002) [64].

10. *Tridax procumbens* Linn.

Fig 11

Kingdom: Plantae
Order: Asterales
Family: Asteraceae
Genus: Tridex
Species: *Tridax Procumbens* Linn.

Tridax procumbens is a species of flowering plant belonging to the family Asteraceae and is the most potent species among 30 species. It is best known as a widespread weed and pest plant. It is native to the tropical Americas but it has been introduced to tropical, subtropical, and mildly temperate regions worldwide. It is listed as a noxious weed in the United States and has a pest status. Some of the medicinally important species of the genus Tridax are T. Angustifolia (Ahmad Mir *et al*. 2017) [55] The present study aims to open new avenues for the improvement of medicinal uses of Tridax procumbens for the selected area for wound healing.

The effect of juice of fresh leaves of Tridax procumbens and the aqueous extract of leaves of the same plant were examined for the same Wound healing. The wounds were treated with an aqueous extract of the plant material with coconut oil and the juice of leaves of this plant. Wound healing involves a cascade of events characterized by the completion of biological processes in a certain order and a certain time frame. These events represent the restructuring of the damaged tissue in an attempt to restore as normal a condition as is possible. The natural response of a living organism is to repair the wounds in the shortest time possible and to re-establish the normal continuum of the structures (Nayak *et al., 2006*) [36].

Tridax procumbens L. (Compositae) is a common weed that grows in the rice fields of India. Traditionally the juice from the leaves of *Tridax procumbens* has been used for healing dermal wounds.

A dermal wound is a common pathologic condition and may be defined as any break in the integrity of the skin. It is associated with a high degree of morbidity due to blood loss, pain, edema, inflammation, and loss of functionality. Cutaneous wounds are characterized by migration and proliferation of fibroblasts, endothelial and epithelial cells, and deposition of connective tissue, angiogenesis, re-epithelization, and finally contraction of the wound (Shirish, and Pingale, 2012) [56].

Proper healing of wounds is essential for the restoration of disrupted anatomical continuity and disturbed functional state. Impaired healing of open wounds is one of the troublesome complications that have been recognized for many years. The leaf juice shows antiseptic, insecticidal, and parasiticidal properties, against conjunctivitis and to check hemorrhage from cuts, bruises, and wounds insect repellent. (Nazeruddin G. M. *et al*., 2011) [38].

Conclusion

We have surveyed and presented an overview of evidence that explains why many medicinal plants are used as traditional treatments for cutaneous wounds and clinical skin disorders. Medicinal plants have been the first line of treatment for trauma, infection, disease, and injury from prehistory. Over millennia, humans have learned to identify and transform the botanical resources from the immediate environment, and with the development of trade, as food and medicine. A great many of these "ancient" and traditional medical plants have been validated to confer therapeutic benefits, albeit not always in controlled clinical trials. One unexpected outcome from validation studies is just how many medical plants synthesize equivalent or closely related compounds. Consequently, it is not surprising that many biological properties are also shared by unrelated species. Also shared are many of the same biological targets and pathways; many of these are also key events in the mammalian wound healing cascade. The active ingredients, part of use, type of extract, assessment methods, bioactivities, clinical use formulation, and commercial product of the medicinal plants are summarized. While experimental evidence has been acquired for each documented plant from in vitro or *in vivo* analyses, not every mechanism of action has been verified.

In this chapter, the possible mechanisms were described. We only mentioned some medicinal plants. However, some medicinal herbs and especially active compounds act by gene expression. It cannot certainly be stated efficiency medicinal plants in improving wound healing, but they have major potential for improving wound healing. The use of active compounds is a new strategy to improve wound healing. Medicinal plants and active compounds help to

decrease inflammation. Future studies will be needed to determine more mechanisms.

References

1. Andrade Fdo S, Clark RM, Ferreira ML. Effects of low-level laser therapy on wound healing. Rev. Col. Bras Cir,2014:41(2):129-133.
2. Baruah A, Bordoloi M, Deka Baruah HP. Aloe vera : A multipurpose industrial crop. Industrial Crops and Products,2016:94:951-963.
3. Bhattacharya S Jatudrum (Kusum Briksha). In: Chiranjeeb Bonushadhi. 5th ed. Ananda Publishers Pvt. Ltd., Kolkata, 1989, 117-23.
4. Bina S Siddiqui, Shazia Khan M, Nadeem Kardar, Huma Aslam. Chemical Constituents from the Fruits of Madhuca latifolia,2004:87:1194-1201.
5. Chitra P, Sajithlal GB, Chandrakasan G. Influence of Aloe vera on collagen turnover in healing of dermal wounds in rats. Indian Journal of Experimental Biology,1998:36:896-901.
6. Choi SW, Son BW, Son YS, Park YI, Lee SK, Chung MH. The wound-healing effect of a glycoprotein fraction isolated from aloe vera. British Journal of Dermatology,2001:145(4):535-545.
7. Choudhary GP. Wound healing activity of the ethanol extract of Terminalia bellirica Roxxb. Fruits. Natural Product Radiance,2008:7(1):19-21.
8. Chularojmontri L, Suwatronnakorn M, Wattanapitayaku SK. Phyllanthus emblica L. Enhances human umbilical vein endothelial wound healing and sprouting. Evid Based Complement Alternat Med, 2013, 720-728.
9. Degen KE, Gourdie RG. Embryonic wound healing: A primer for engineering novel therapies for tissue repair. Birth Defects Research Part C: Embryo Today: Reviews,2012:96(3):258-270.
10. Department of Medicinal Plants. Medicinal Plants of Nepal. His Majesty's Government of Nepal, Ministry of Forests and Soil Conservation Department of Medicinal Plants, Thapathali, Kathmandu, Nepal, 1982, 28(3).
11. Dr Suseela Lanka. A review on pharmacological, medicinal and ethnobotanical important plant: phyllanthus emblica linn. (Emblica officinalis). World Journal of Pharmaceutical Research,2018:7(4):380-396.
12. Govt. of India. The Ayurvedic pharmacopoeia of India. New Delhi: Government of India Ministry of Health and Family Welfare Department of Indian System of Medicine & Homoeopathy, 2001.
13. Harsha VH, Hebber SS, Shripathi V, Hedge GR. Ethnomedicobotany of Uttrakannada district in Kerla, India. Plants in treatment of skin disease. Journal of Ethnopharmacology,2003:84:37-40.
14. Iwasa S. Schleichera oleosa (Lour.) Oken. I. faridah Hanum. L.J.G. van der Maesen (Eds.). Plant resources of South-east Asia No. 11. Auxilary Plants, Prosea Foundation, Bogor Indonesia, 1997, 227-229.
15. Jain, DeFilipps, 1991. Bergam A, Yanai J, Weis J. Acceleration of wound healing by topical application of honey: an animal model. American Journal of Surgery,1983:145:374-6.
16. Jain K. Ethnobotanical studies in the tribes region of Hoshangabad district with special reference to phytochemical analysis of some 1: 2 predominent plants. Thesis for Ph. D. (Botany), BarKatullah University, Bhopal (M. P.), 2002.
17. Jain SK, DeFilipps RA. Medicinal Plants of India. Reference Publications, Algonac, Michigan, 1991, 120.
18. Jha Dhruv, Papiya Mitra Mazumder. "Biological, Chemical and Pharmacological Aspects of Madhuca Longifolia",2018:11(1):9-14.
19. Jones ML. Wound healing Series 2.5. Wound debridement, part 1. British Journal of Healthcare Assistants,2018:12(2):78-80.
20. Julie S, Jurenka MT (ASCP). Anti-inflammatory Properties of Curcumin, a Major Constituent of Curcuma longa: A Review of Preclinical and Clinical Research. Alternative Medicine Review, 2009, 14(2).
21. Kandari LS, Gharai AK, Negi T, Phondani PC. Ethnobotanical Knowledge of Medicinal Plants among Tribal Communities in Orissa, India. The Journal of Forestry Research,2012:1(1):2-5.
22. Katiyar D, Singh V, Ali M. Recent advances in pharmacological potential of Syzygium cumini: A review. Adv. Appl. Sci. Res,2016:7(3):1-12.
23. Kumar S, Meera B, Kalidhar SB. A review of the chemistry and biological activity of Pongamia pinnata. J Med Aromat Plant Sci,2003:25:411-465.
24. Kutti Gounder D, Lingamallu J. Comparison of chemical composition and antioxidant potential of volatile oil from fresh, dried and cured turmeric (Curcuma longa) rhizomes. Industrial Crops and Products,2012:38:124-131.
25. Mahaptma SP, Sahoo HP. An ethano medico botanical study of Bolangi, Orissa, India: Native plant remedies against gynaecological diseases. Ethanobot Lealf,2008:12:846-54.
26. Mahmoud II, Marzouk MS, Moharram FA, El-Gindi MR, Hassan AM. Acylated flavonol glycosides from Eugenia jambolana leaves. Phytochemistry, 2001:58(8):1239-1244.
27. Maikhuri RK, Gangwar AK. Ethnobotanical notes of the Khasi and Graro tribes of Meghalaya, north east India. Economic Botany,1993:47:345-357.
28. Maikhuri RK, Nautiyal S, Rao KS, Saxena KG. Role of medicinal plants in the traditional health care system: A case study from Nanda Devi Biosphere Reserve. Himalaya Current Science,1998:75:152-157.
29. Manish Pal Singh, Avneet Gupta, Siddhraj Singh Sisodia. Wound healing activity of Terminalia bellerica Roxb. And gallic acid in experimentally induced diabetic animals. Journal of Complementary and Medicine, 2019, 133.
30. Maroyi A. Traditional use of medicinal plants in south central Zimbabwe: review and perspectives. Journal of Ethno-biology and Ethno-medicine,2013:9(3):12-18.
31. Md Rashedul Alam, Akib Bin Rahman, Md Moniruzzaman, Mohammad Fahim Kadir, Md Ahsanul Haque, Mohammad Razi-Ul-Hasan Alvi, Md Ratan. Evaluation of antidiabetic phytochemicals in Syzygium cumini (L.) Skeels (Family: Myrtaceae). Journal of Applied Pharmaceutical Science,2019:2(10):094-098.
32. Mehra KS, Mikuni I, Gupta U, Gode KD. Curcuma longa (Linn) drops in corneal wound healing Tokai. Journal of Experimental & Clinical Medicine,1984:9:27-31.

33. Miron RJ, Dard M, Weinreb M. Enamel matrix derivative, inflammation and soft tissue wound healing. Journal of Periodontal Research,2014:50(5):555-569.
34. Mohanta RK, Rout SD, Sahu HK. Ethnomedicinal plant resources of Similipal Biosphere Reserve, Orissa, India. Zoos‟ Print J,2006:21:2372-4.
35. Mohapatra S, Sahoo H. An ethno-medico-botanical study of Bolangir, Orissa, India: native plant remedies against gynaecological diseases. Ethnobot Leafl,2008:12:846-850.
36. Nayak S, Nalabothu P, Sandiford S, Bhogadi V, Adogwa A. Evaluation of wound healing activity of Allamanda cathartica. L. and Laurus nobilis. L. extracts on rats. BMC Complementary and Alternative Medicine, 2006, 6(1).
37. Nayak S, Nalabothu P, Sandiford V, Bhogadi a Adogwa. BMC Complement Altern Med,2006:5(6):12.
38. Nazeruddin GM, Shirish S, Pingale, Samir S Shaikh. Pharmacological review of Tridax procumbens L. Pelagia. Research Library Der Pharmacia Sinica,2011:2(4):172-175.
39. Oliveira GFD, Furtado NAJC, Silva Filho AAD, Martins CHG, Bastos JK, Cunha WR. Antimicrobial activity of Syzygium cumini (Myrtaceae) leaves extract. Braz J. Microbiol,2007:38(2):381-384.
40. Pawar RS, Bhutani KK. Madhucosides A and B, Protobassic Acid Glycosides from Madhucaindica with Inhibitory Activity on Free Radical Release from Phagocytes. Journal of Natural Products,2004:67(4):668-671.
41. Phondani PC, Maikhuri RK, Rawat LS, Farooquee NA, Kala CP. Ethnobotanical Uses of Plants among Bhotiya Tribal Communities of Niti Valley in Central Himalaya, India. Ethnobotany Reserch & Application,2010:8:233-244.
42. Plant Resources of South-East Asia No.11, Auxiliary Plants, Bogor Indonesia. Prosea Foundation, 1997, 227-229.
43. Priyadharshana M, Smitha V, Vadivel V. Ethnobotanical Survey of Medicinal Plants Used by the Traditional Healers in Mudivaithananthal Village of Thoothukudi District, Tamil Nadu, India. Journal of Pharmacy and Biological Sciences,2019:14(6):70-75.
44. Thorat RM, Jadhav VM, Kadam VJ, Kamble SS, Salaskar KP. Development of HPTLC method for estimation of Wedelolactone, Quercetin and Jatamansone in Polyherbal Formulation. International Journal of ChemTech Research CODEN (USA),2009:1(4):1079-1086.
45. Rajkumar N, Shivanna MB. Traditional herbal medical knowledge in Sagar taluk of Shimogga district, Karnataka, India. Indian Journal of Natural Products and Resources,2010:1:102-108.
46. Ramadan M. Sharanabasappa GP Seshgiri. Profile and levels of fatty acids and bioactive constituents in Madhua butter from fruits seedof buttercup tree. Madhuca longifolia (Koenig), 2006, 710-18.
47. Rao DS, Rao VS, Murthy P, Rao GMN, Rao YVRY. Some Ethnomedicinal Plants of Parnasala sacred grove area Eastern Ghats of Khammam District, Telangana, India. J Pharm. Sci. and Res,2015:7(4):210-218.
48. Ratnaraju Y, Yugandhar P, Savithramma N. Documentation of Ethnomedicinal Knowledge of hilly tract areas of East Godavari District of Andhra Pradesh, India. International Journal of Pharmacy and Pharmaceutical sciences,2014:6(4):6-24.
49. Rout SD, Panda T. Ethnobotanical survey of medicinal plants used for the treatment of diarrhoea and dysentery by the tribals of Similipal forest, Mayurbhanj, Odisha, India. App. Sci. Report,2017:19(1):9-18.
50. Rout SD, Panda T, Mishra N. Ethno-medical plants used to cure different diseases by tribal of Mayurbhanj district of North Orissa. Ethnomed,2009:3:27-36.
51. Subramanian S, Sathish Kumar D, Arulselvan P. Wound Healing Potential of Aloe vera Leaf Gel Studied in Experimental Rabbits. Asian Journal of Biochemistry,2006:1(2):178-185.
52. Sajid ZI, Anwar F, Shabir G, Rasul G, Khalid M, Alkharfy Gilani AH. Antioxidant, antimicrobial properties and phenolics of different Solvent extracts from bark, leaves and seeds of Pongamia pinnata (L.) Pierre. Molecules,2012:17:3917-3932.
53. Sandhya SP, Vinod SK, Banji KR, D Kumar K. Plants as Potent Anti-Diabetic and Wound Healing Agents- a Review. J Drugs Med,2011:3(1):11-9.
54. Saranraj P, Bhavani L, Suganthi K. Ethnobotanical survey of medicinal plants from Vellore district, Tamil nadu, India. International Journal of Advanced Research in Biological Sciences,2016:3(9):238-246.
55. Shahnawaz Ahmad Mir, Zubair Jan, Shafia Mir, Ayaz Mahmood Dar, Gouri Chitale. A Concise Review on Biological Activity of Tridax procumbens Linn. Organic Chemistry Current Research, 2017, 6(1).
56. Shirish S Pingale. Study of Wound Healing by Tridax procumbens. Journal of Pharmacy Research,2012:5(3):1696-1697.
57. Sibbald RG, Goodman L, Reneeka P. Wound Bed Preparation 2012. Journal of Cutaneous Medicine and Surgery,2013:17(4):12-22.
58. Simon JP, Evan Prince S. Aqueous leaves extract of Madhuca longifolia attenuate diclofenac-induced hepatotoxicity: Impact on oxidative stress, inflammation, and cytokines. Journal of Cellular Biochemistry,2018:119(7):6125-6135.
59. Singh A, Singh IS. Chemical evaluation of mahua (Madhuca indica) seed. Food Chemistry,1991:40(2):221-228.
60. Sorg H, Tilkorn DJ, Hager S, Hauser J, Mirastschijski U. Skin Wound Healing: An Update on the Current Knowledge and Concepts. European Surgical Research,2016:58(1-2):81-94.
61. Sowjanya Pulipati, Srinivasa Babu P, Neelima Lakshmi D, Navyasri N, Harshini Y, Vyshnavi J *et al*. A phyto pharmacological review on a versatile medicinal plant: Pongamia pinnata (L.) pierre. Journal of Pharmacognosy and Phytochemistry,2018:7(4):459-463.
62. Sowjanya Pulipati P, Srinivasa Babu D, Neelima Lakshmi N, Navyasri Y, Harshini J, Vyshnavi M Prasanth. A phyto pharmacological review on a versatile medicinal plant: Pongamia pinnata (L.) pierre. Journal of Pharmacognosy and Phytochemistry, 2018:7(4):459-463.
63. Srinivasan K, Muruganandan S, Lal J, Chandra S, Tandan SK, Prakash VR. Evaluation of anti-inflammatory activity of Pongamia pinnata leaves in rats. Journal Ethnopharmacol,2001:78:151-157.

64. Suguna L, Singh S, Sivakumar P, Sampath P, Chandrakasan G. Influence of Terminalia chebula on dermal wound healing in rats. Phytother Res,2002:16:227-231.
65. Sumitra M, Manikandan P, Gayathri VS, Mahendran P, Suguna L. Emblica officinalis exerts wound healing action through up-regulation of collagen and extracellular signal-regulated kinases (ERK1/2), 2009:17(1):99-107.
66. Timbola AK, Szpoganicz B, Branco A, Monache FD, Pizzolatti MG. A new flavonol from leaves of Eugenia jambolana. Fitoterapia,2002:73(2):174-176.
67. Udupa SL, Udupa AL, Kulkarni DR. Studies on anti-inflammatory and wound healing properties of Moringa oleifera and Aegle marmelos. Fitoterapia,1994:65:119-123.
68. Velnar T, Bailey T, Smrkolj V. The wound healing process: an overview of the cellular and molecular mechanisms. Journal of International Medical Research, 2009:37(5):1528-1542.
69. Villegas LF, Fernández ID, Maldonado H, Torres R, Zavaleta A, Vaisberg AJ *et al*. Evaluation of the wound-healing activity of selected traditional medicinal plants from Perú. J. Ethnopharmacol,1997:55(3):193-200.
70. WUWHS Abstracts. The International Journal of Lower Extremity Wounds,2008:7(4):241-247.
71. Zumla A, Lulat A. Honey—a remedy rediscovered. Journal of the Royal Society of Medicine,1989:82:384-5.