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WOUND HEALING PLANTS OF ACHARYA JAGADISH CHANDRA BOSE INDIAN BOTANIC GARDEN, HOWRAH, INDIA AND THEIR CONSERVATION

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ABSTRACT

The present study has been aimed to document the wound healing plants that grow in Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIBG), and also to compile the information required for further investigation on their potential role in the wound management. Wound healing is a biological process that starts with trauma and ends in scar formation. The present study revealed the occurrence of a total of 75 plants species having wound healing properties in the Garden. Furthermore, the study confirms that not only the plant parts *i.e.* root, stem, leaves, flowers and rhizomes are used in wound healing but the plant products of these species such as oil, resin, latex have also played a vital role in wound healing. The present communication deals with a list of 74 angiospermic species and 01 Gymnosperm along with their family name, distribution and parts used in wound healing.

Key words : Wound healing activity, Botanic Garden, Plants, Conservation.

Introduction

In an era of climate change and declining biodiversity, botanical gardens are playing a crucial role in conserving a part of earth's biodiversity. Botanical garden, originally, a collection of living plants designed chiefly to illustrate relationships within plant groups. In India, there is a chain of botanic gardens established in almost every region of the country, of which the Acharya Jagadish Chandra Bose Indian Botanic Garden, Howrah is one of the most celebrated botanic gardens not only in this continent but in the whole world. Established in 1787 by Col. Robert Kyd under the East India Company's patronage, the "Company Bagan" (present day Indian Botanic Garden) covers an area of about 273 acres situated on the west bank of the river Ganga (Hooghly) (22.5587° N, 88.2911° E). Its unique landscaping was initiated by Sir George King. At present, the garden is divided into 25 divisions, encompassing many sections of different plant groups, each specified for growing different types of plants. There are 24 artificial lakes in the Garden, which are

interconnected with underground pipes and connected with the river Ganga through sluice gates for the regular inlet and outlet of water. The garden is the living repository of more than 12,000 trees, shrubs and climbers representing over 1400 species together with large numbers of wild and planted herbs. The Garden is a unique place of learning and rich array of curiosity and occupies matchless attractions such as the 'Great Banyan Tree', a living wonder in the plant kingdom; the Large Palm House containing rich collection of palms including *Lodoicea maldivica* (J.F.Gmel.) Pers. (the Double Coconut Palm); Branching Palm [*Hyphaene thebaica* (L.) Mart.] introduced from Egypt; the century Palm (*Coryphautan* Lam.); the Giant Water Lily (*Victoria amazonica* (Poepp.) J.C. Sower by and *V. cruziana* A.D. Orb.) brought from the Amazon river; the queen of flowering trees (*Amherstia nobilis* Wall.) a native of Mayanmar; the mountain rose or Venezuelan rose (*Brownea* sp.); the Baobab tree or Kalpavriksh (*Adansonia digitata* L.) native of Africa; the Rosogolla tree (*Chrysohyllum cainito* L.); the Cannon ball tree

(*Couroupita guianensis* Aubl.); the African Sausage tree [*Kigelia africana* (Lam.) Benth.] and the mad tree [*Pterigota alata* (Roxb.) R. Br. var. *irregularis*] and the 'Candle Stick Tree' (*Parmentiera cereifera* Seem.) are some of them to mention (Hameed *et al.*, 2016).

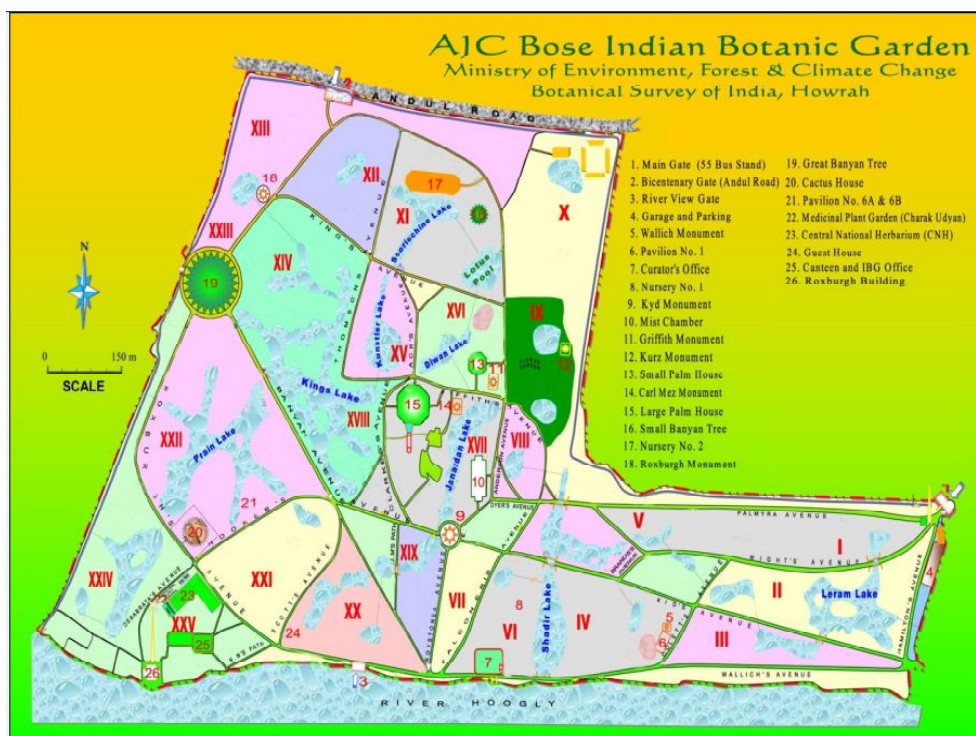
This garden has played a very important role in introducing, multiplying and distributing many commercially important plants from various parts of the world. Introduction of some of the notable species directly influenced the welfare of people and economic development of the country. Tea [*Camellia sinensis* var. *assamica* (J.W. Mast.) Kitam.], Cinchona (*Cinchona pubescens* Vahl), Rubber [*Hevea brasiliensis* (Willd. ex A. Juss.) Mull. Arg.] and Mahagony [*Swietenia mahagoni* (L.) Jacq.] were first introduced in the Garden and subsequently transferred to other parts of the country. Many economic and spice plants such as Cardamom, Cinchona, Cinnamon, Coffee, Cotton, Indigo, Nutmeg, Pepper, Clove, Sugarcane, Potato, Sago, Teak and other species used as forage, fodder, oil, fruit, fibre, timber and ornamental plants were first introduced into this historic Garden. Multiplication of most of the introduced species carried out in the Garden itself and later they were distributed to different parts of the country for commercial cultivation. This Garden has a unique collection of different plant groups planted in different plant sections for the sake of research and management such as Bamboos in Bambusetum, Pines in Pinetum, Palms in Palmarum, Rose in Rosarium and Medicinal Plants in

Medicinal Plant Section (Charaka Udyan). Studies have shown that in AJCBIBG despite having plenty of medicinal plants, no documentation of wound healing plants has not been conducted yet. As now-a-days, wounds represent a major global health challenge, which put much economic, financial, and social stress on health institutions, care-givers, patients and their families (Benbow, 2011). Wounds are defined as physical, chemical, or thermal injuries or insult that result in an opening or breaking in the integrity of the skin or the disruption of anatomical and functional integrity of living tissues (Meenakshi *et al.*, 2006). The use of medicinal plants in the management of acute and chronic wounds is common in most traditional medicine practices in the world as the herbal remedies is found to be both affordable and effective, mainly when used in conjunction with wound healing, bacterial activity and reducing oxidative stress in animals.

Considering this, throughout this documentation, an effort has been made to provide a glimpse into freshly discovered medicinal plants that have wound recovery mechanisms and may be effective in the treatment and the invention of new wound-healing pharmaceuticals.

Materials and Methods

The present work is an extensive division wise survey of medicinal plants having wound healing properties of AJCBIBG, Howrah (Map 1). Since, its inception no one has made any attempt to survey these plants having wound healing properties. The information includes medicinal



Map 1 : Study area.

Table 1 : Details of wound healing plants of AJCBIBG, Howrah.

S. no.	Name of the plant	Family	Habit	Common name	Parts used	Phenology	IUCN status	Distribution
1.	<i>Abrus precatorius</i> L.	Fabaceae	Tree	Gunj (H), Rosary pea (E)	SD, RT	Fl. & Fr.: Sept-Dec		Almost throughout India
2.	<i>Senegalia polyacantha</i> (Willd.) Seigler & Ebinger (= <i>Acacia catechu</i> Willd.)	Fabaceae	Tree	White thorn (E)	ST	Fl. & Fr.: Jun-Sept		Andhra Pradesh, Assam (planted), Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Tamil Nadu, West Bengal.
3.	<i>Vachellia farnesiana</i> (L.) Wight & Arn. [= <i>Acacia fermeiana</i> (L.) Willd.]	Fabaceae	Tree	Gandh Babul (H), Needle Bush (E)	ST, OL	Fl.: Mar-Jun & Fr.: Jul-Dec	Least Concern	Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, West Bengal.
4.	<i>Acorus calamus</i> L.	Acoraceae	Herb	Ghorbach (H), Sweet Flag (E)	RH	Fl. & Fr.: Jun- Jul	Least Concern	Almost throughout India
5.	<i>Justicia adhatoda</i> L. (= <i>Adhatoda vasica</i> Nees)	Acanthaceae	Shrub	Arusa (H), Malabar nut (E)	L, FL, RT, OL	Fl. & Fr.: Dec-May	Least Concern	Almost throughout India
6.	<i>Aegle marmelos</i> (L.) Corrêa	Rutaceae	Tree	Bel (H), Stone Apple (E)	L, ST	Fl.: Mar-Apr & Fr.: Apr-Sept	Near Threatened	Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, Tamil Nadu, West Bengal.
7.	<i>Albizia lebbek</i> (L.) Benth	Fabaceae	Tree	Saras (H), Woman's Toung (E)	WH, ST, SD	Fl. & Fr.: Apr- Jun	Least Concern	Almost throughout India
8.	<i>Anacardium occidentale</i> L	Anacardiaceae	Herb	Kaju (H), Cashew (E)	RT, ST, FU	Fl. & Fr.: Nov-Apr	Least Concern	Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu.
9.	<i>Annona squamosa</i> L.	Annonaceae	Tree	Sharifa (H), Custard Apple (E)	RT, L, FU, SD	Fl.: Mar-May & Fr.: Aug -Jan	Least Concern	Andhra Pradesh, Assam, Bihar, Delhi, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. (Cultivated and almost naturalised)

Table 1 continued...

Table 1 continued...

10.	<i>Terminalia anogeissiana</i> Gere & Boatwr. (= <i>Anogeissus latifolia</i> Wall)	Combretaceae	Shrub	Dhaura (H), Axle wood tree (E)	ST	Fl.: Feb, Fr.: Sept	Common in the dry deciduous forests of India upto 1500 m on the Himalayas (Western and Central) and Madhya Pradesh
11.	<i>Neolamarckia cadamba</i> (Roxb.) Bosser [= <i>Anthocephalus cadamba</i> (Roxb.) Miq.]	Rubiaceae	Tree	Kadamb (H), Kadam (E)	ST, L	Fl. & Fr.: Jun-Sept	Grows on the sub-Himalayas tract from Nepal to Eastwards. Eastern Andhra, Western ghats and southern India.
12.	<i>Artemisia vulgaris</i> L.	Asteraceae	Shrub	Damnak (H)	WH	Fl. & Fr.: Jul- Sept	Occurs throughout mountain district of India, 1700-4000 m and on Western Himalayas from 1700 to 2700 m. in Sikkim, Khasi hills, Mt. Abu. Western Ghats, Konkan to southwards.
13.	<i>Asparagus racemosus</i> Willd.	Asparagaceae	Climber	Shatamuli, (H), Climbing Asparagus (E)	RT	Fl. & Fr.: Dec-Jan	Almost throughout India
14.	<i>Baliospermum solanifolium</i> (Burm.) Suresh (= <i>Baliospermum montanum</i> Muell. Arg.)	Euphorbiaceae	Shrub	Danti (H), Wild Castor (E)	L, SD,	Fl.: Jan-Feb & Fr.: Mar-Apr	Grows on the outer range of Himalayas from Kashmir to Bhutan upto 1000 m. Assam, Khasi hills, N.E. Bengal, Bihar from Central and Western India to Travancore.
15.	<i>Bauhinia purpurea</i> L.	Fabaceae	Tree	Kanjar (H), Purple Orchid Tree (E)	SD, FL, FU, OL, LX	Fl. & Fr.: Sept- Nov	It grows in the sub-Himalayan tract upto 1300 m. Assam, Khasi hills, Chittagong (Bangladesh), West Peninsula, often cultivated in India.
16.	<i>Biancaea sappan</i> (L.) Tod. (= <i>Caesalpinia sappan</i> L.)	Fabaceae	Shrub	Bakam (H), Sappan Wood (E)	SD, OL, ST	Fl. & Fr.: Jul-Sept	Southern India, Bengal, often cultivated as hedge plant, native to India and Malaysia.
17.	<i>Calophyllum inophyllum</i> L.	Calophyllaceae	Tree	Sultan Champa (H), Ball Tree (E)	RT, OL	Fl. & Fr.: occurs twice in a year, Apr-June & Oct-Dec	It grows in coastal regions of southern India and Andaman Islands.
18.	<i>Calotropis gigantea</i> (L.) W.T. Aiton	Apocynaceae	Shrub	Safed Aak (H), Crown Flower (E)	LX	Fl. & Fr.: Nov-Apr	Almost throughout India.

Table 1 continued...

Table 1 continued...

19.	<i>Calotropis procera</i> (Aiton) W.T.Aiton	Apocynaceae	Shrub	Mudar (H), Rubber Bush (E)	RT, ST, LX	Fl. & Fr.: throughout the year.	Least Concern	Warm and dry regions of India.					
20.	<i>Senna auriculata</i> (L.) Roxb. (= <i>Cassia auriculata</i> L.)	Fabaceae	Shrub	Tarwar (H), Tanner's Cassia (E)	ST, FL, SD	Fl. & Fr.: Almost throughout the year.		It occurs in wild dry regions of Madhya Pradesh, W. Peninsula and Rajasthan.					
21.	<i>Celastrus paniculatus</i> Willd.	Celastraceae	Climber	Malkangani (H), Black Oil Plant (E)	SD, OL	Fl.: Apr-Jun & Fr.: Jun-Sept		Throughout greater part of India upto 2000 m chiefly Madhya Pradesh, Maharashtra and Tamil Nadu.					
22.	<i>Chenopodium album</i> L.	Chenopodiaceae	Herb	Bathua (H), Fat hen (E)	L, OL	Fl. & Fr.: Feb - Mar		It grows wild and often cultivated throughout India upto an altitude of 1000 m. It is also cultivated as a pot herb in Western Himalayas in India.					
23.	<i>Chloroxylon swietenia</i> DC.	Rutaceae	Tree	Bhirra (H), Ceylon Satinwood (E)	L, OL	Fl.: Mar-Apr & Fr.: occurs 2-3 months later.	Vulnerable	Dry and semidry deciduous forests of Indian Peninsular region extending to North upto Jharkhand and Chattisgarh					
24.	<i>Cinnamomum tamala</i> (Buch.-Ham.) T.Nees & C.H.Eberm.	Lauraceae	Tree	Tej patta (H), Indian Bay Leaf (E)	ST, OL	Fl.: May & Fr.: Jun-Jul	Least Concern	Subtropical Himalayas, Khasi and Jaintia hills, often planted in the Terai belt of Northern India.					
25.	<i>Citrus maxima</i> (Burm.) Merr. (= <i>Citrus decumana</i> L.)	Rutaceae	Shrub	Baranambu (H)	L, SD, OL	Fl.: Apr-May & Fr.: Sept-Dec	Least Concern	Native to Thailand and Malaysia, grown in Tamil Nadu, Uttar Pradesh, Karnataka, West Bengal, Punjab, Maharashtra, often cultivated for its fruits.					
26.	<i>Coscinium fenestratum</i> (Gaertn.) Colebr.	Menispermaceae	Climber	Kuldi (H)	ST, RT, RS	Fl. & Fr.: Aug-Oct	Data Deficient	Southern India particularly in Western Ghats					
27.	<i>Embelia ribes</i> Burm. f.	Primulaceae	Climber	Vidanga (H), Embelia (E)	FU, OL, RS	Fl.: Mar-Apr & Fr.: Jun-Oct		Throughout India upto 5000 m.					
28.	<i>Elephantopus scaber</i> Linn	Asteraceae	Herb	Samudri (H), Elephant foot (E)	WH, RT, L	Fl. & Fr.: Oct-Jan		Throughout the hotter parts of India.					
29.	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Tree	Karpura (H)	OL, L, RT	Fl. & Fr.: Dec-May	Least Concern	Throughout India and commercially in southern India to feed rayon industry. Native to Australia.					
30.	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Herb	Bara Dudhi (H), Asthma weed (E)	RT, LX, OL	Fl. & Fr.: throughout the year		Throughout the hotter parts of India.					

Table 1 continued...

Table 1 continued...

31.	<i>Euphorbia neritifolia</i> L.	Euphorbiaceae	Herb	Danda thaur (H), Indian spurge tree (E)	LX, RT	Fl. & Fr.: Mar-Apr	Least Concern	It grows in Orissa and Deccan peninsula and often cultivated.					
32.	<i>Evolvulus alsinoides</i> L.	Convolvulaceae	Climber	Visnukrantha (H), Dwarf Morning Glory (E)	FU	Fl. & Fr.: Feb-Jun		Commonly found throughout India upto 2000 m on the Himalayas.					
33.	<i>Ficus benghalensis</i> L.	Moraceae	Tree	Bar (H), Banyan tree (E)	ST, L	Fl. & Fr.: Nov-Jan		Almost throughout India					
34.	<i>Ficus hispida</i> L.f.	Moraceae	Tree	Gobla (H), Hairy Fig (E)	ST, FU, SD	Fl. & Fr.: almost throughout the year	Least Concern	Throughout India.					
35.	<i>Ficus religiosa</i> Linn	Moraceae	Tree	Aswattha (H), Peepal (E)	ST, SH, L	Fl. & Fr.: almost throughout the year	Least Concern	Throughout India					
36.	<i>Ficus retusa</i> L.	Moraceae	Tree	Kuni (H)	RT, L, ST	Fl. & Fr.: almost throughout the year		Andaman, Jharkhand, Chattisgarh and West Bengal					
37.	<i>Grewia tenax</i> (Forssk.) Fiori	Malvaceae	Tree	Gondni (H), White crossberry (E)	WH	Fl. & Fr.: Aug-Nov	Least Concern	Occurs in Rajasthan, Gujarat, Maharashtra, Deccan, Karnataka, Tamil Nadu and Punjab.					
38.	<i>Hemidesmus indicus</i> (L.) R.Br.	Apocynaceae	Climber	Anantamul (H), Indian Sarsaparilla (E)	RT, OL	Fl. & Fr.: Oct-Jan		It occurs in upper Gangetic plains, eastward to Bengal, Sundarbans and from Madhya Pradesh to southern India.					
39.	<i>Ichnocarpus frutescens</i> (L.) W.T. Aiton	Apocynaceae	Shrub	Kali dudhi (H), Black creeper (E)	RT	Fl. & Fr.: Aug-Dec		Almost throughout India.					
40.	<i>Jasminum auriculatum</i> Vahl	Oleaceae	Climber	Juhi (H)	FL	Fl. & Fr.: Mar-Apr		Deccan, Karnataka and Western peninsular India; often cultivated for its fragrant flowers.					
41.	<i>Jasminum sambac</i> (L.) Aiton	Oleaceae	Climber	Madan Mogra (H), Arabian jasmine (E)	ST, L, SD, OL	Fl. & Fr.: Mar-Oct		It is cultivated throughout India.					
42.	<i>Jatropha curcas</i> L.	Euphorbiaceae	Shrub	Jamal ghota (H), Physic nut (E)	L, SD, OL, RS	Fl. & Fr.: Sept-Apr	Least Concern	It grows almost throughout India and Andamans islands.					
43.	<i>Madhuca indica</i> J.F. Gmel [= <i>Madhuca longifolia</i> var. <i>latifolia</i> (Roxb.) A.Chev.]	Sapotaceae	Tree	Mahua (H), Indian butter tree (E)	WH, OL	Fl. & Fr.: Feb-Apr		UP, Bihar, Orissa, M.P, Gujrat, Goa, South Maharashtra, Deccan, Andhra in India often cultivated, native to India.					

Table 1 continued...

Table 1 continued...

44.	<i>Melastoma malabathricum</i> L.	Melastomataceae	Shrub	Phutki (H), Malabar Melastome (E)	RT	Fl.: Feb-Aug. & Fr.: Jul-Dec		It grows in humid part of India upto 1800 m and in the Andaman Islands.
45.	<i>Melia azedarach</i> L.	Meliaceae	Tree	Bakain (H)	ST, OL	Fl. & Fr.: Apr- May	Least Concern	It is cultivated and naturalized throughout India, also found wild in the sub-Himalayan tract at about 1800 m elevation.
46.	<i>Mesua ferrea</i> L.	Calophyllaceae	Tree	Nagesar(H), Cobra Saffron(E)	SM, L, FL, OL	Fl.: Apr-Jun & Fr.: Jul-Sep		Eastern Himalayas, West Bengal, Assam, North Karnataka, Goa, Western Ghats, Kerela upto 1500 m and Andamans in India, often cultivated.
47.	<i>Mimosa pudica</i> L.	Mimosaceae	Herb	Lajwanti (H), Touch Me Not(E)	WH	Fl. & Fr.: Nov-Mar	Least Concern	It is naturalized almost throughout India. A native of tropical America.
48.	<i>Mimusops elengi</i> L.	Sapotaceae	Tree	Maulsari (H), Spanish Cherry (E)	ST, L, OL	Fl.: Apr & Fr.: Jun-Dec	Least Concern	Southern India and Andamans often cultivated in Indian region.
49.	<i>Morinda citrifolia</i> L.	Rubiaceae	Tree	Bartundi (H), Indian Mulberry (E)	L	Fl. & Fr.: throughout the year		It is indigenous to Darjeeling Terai and outer hills, found in Andamans along Konkan coast. Cultivated largely in India.
50.	<i>Moringa oleifera</i> Lam.	Moringaceae	Tree	Senjana (H), Drumstick tree (E)	RT, OL	Fl. & Fr.: Jul-Oct	Least Concern	Indigenous in the sub-Himalayan tract from the Chenab to Oudh; also cultivated throughout India.
51.	<i>Bergera koenigii</i> L. [= <i>Murraya koenigii</i> (L.) Spreng.]	Rutaceae	Shrub	Karipatta (H), Curry leaf (E)	RT, L, OL	Fl.: Apr-May & Fr.: Jul-Aug	Least Concern	Konkan, Western Ghat of Bombay to Travancore, Deccan, S.Maratha country, in most districts of the Madras state, chiefly in N. Circars, along the foot of the Himalayas from Kumaon to Sikkim upto 5000 ft. and West Bengal.
52.	<i>Musa paradisiaca</i> L.	Musaceae	Shrub	Kela (H), Banana (E)	ST			Cultivated in wider parts of India in humid tropics/subtropics.
53.	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	Climber	Kamal (H), Lotus (E)	ST, FL, RT	Fl. & Fr.: Apr-Sept	Data Deficient	Throughout the warmer parts of India upto 1800 m.
54.	<i>Nerium oleander</i> L. (= <i>Nerium indicum</i> Mill.)	Apocynaceae	Shrub	Kaner (H), Oleander (E)	RT	Fl. & Fr.: Apr-Aug		Grown as an ornamental species, native to Mediterranean region.
55.	<i>Piper nigrum</i> L.	Piperaceae	Climber	Kali Mirch (H), Black pepper (E)	FU	Fl. & Fr.: Jun- Dec		Cultivated in hot and damp parts of India.

Table 1 continued...

Table 1 continued...

56.	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Climber	Chitrak (H), Plumbago (E)	RT	Fl.: Sept- Nov & Fr.: Jan- Feb	It grows throughout India often cultivated in gardens, wild in W. Peninsula and West Bengal.
57.	<i>Psidium guajava</i> L.	Myrtaceae	Tree	Amrud (H), Guava (E)	L, OL	Fl. & Fr.: Jun- Sept	It is widely cultivated and naturalized throughout India.
58.	<i>Pterocarpus santalinus</i> L.f.	Fabaceae	Tree	Raktachandan(H), Red Sandalwood(E)	ST	Fl. & Fr.: Sept-Jan	Andhra Pradesh and Tamil Nadu
59.	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	Tree	Bijasal (H), Indian Kino tree (E)	L	Fl. & Fr.: Sept- Oct	Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh.
60.	<i>Saraca indica</i> L.	Fabaceae	Tree	Malaysian Ashok (E)	ST	Fl. & Fr.: Feb- Apr	Grows in semi-warm, humid climatic regions of India.
61.	<i>Semecarpus anacardium</i> L.f	Anacardiaceae	Tree	Bhilawan (H), Marking nut (E)	RT	Fl. & Fr.: Feb-Apr	Grows in Assam, Khasi hills, Madhya Pradesh, Gujarat, Goa, Maharashtra, Karnataka, deciduous forests of Tamil Nadu, and on the sub-Himalayan tractS upto 1000 m in India.
62.	<i>Anthoshorea roxburghii</i> (G.Don) P.S.Ashton & J.Heck. (= <i>Shorea robusta</i> C.F.Gaertn.)	Dipterocarpaceae	Tree	Sal (H)	ST, SD, RS	Fl. & Fr.: Jan- Mar	Andhra Pradesh, Assam, Bihar, Himachal Pradesh, Madhya Pradesh, Odisha, Tripura, West Bengal.
63.	<i>Sida acuta</i> Burm. f.	Malvaceae	Shrub	Baraura (H), Morning mallow (E)	RT	Fl. & Fr.: Sept-May	Throughout India
64.	<i>Sida cordifolia</i> L.	Malvaceae	Herb	Kharinta (H), Heart leaf Sida (E)	RT	Fl. & Fr.: throughout the year	Throughout India upto 1050 m.
65.	<i>Soyimida febrifuga</i> (Roxb.) A.Juss.	Meliaceae	Tree	Raktarohan (H), Indian Redwood (E)	ST	Fl. & Fr.: Feb- Jun	It occurs only in dry forests of western peninsular India, extending northwards to Rajasthan, Uttar Pradesh, Bihar (Chhotanagpur).
66.	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Tree	Jamun(H), Java plum(E)	ST, FU	Fl.: Apr-May & Fr.: Jun to Jul	Throughout India
67.	<i>Tagetes erecta</i> L.	Asteraceae	Herb	Genda(H), Marigold (E)	FL, L, OL	Fl. & Fr.: Sept -Nov	It is native of Mexico grown in garden as an ornamental.

Table 1 continued...

Table 1 continued...

68.	<i>Tarenna asiatica</i> (L.). Kuntze ex K.Schum	Rubiaceae	Shrub	Bingi Papadi (H), Asiatic Tarenna (E)	L	Fl. & Fr.: Feb-Sept	Grows in western Peninsular India, from Goa to southwards.
69.	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	Herb	Sarapunkha(H), Common Tephrosia (E)	WH	Fl. & Fr.: Sept - Oct	Throughout India.
70.	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Combret- aceae	Tree	Arjun(H)	ST	Fl.: May-Jun & Fr.: Jan-Mar	Throughout the greater part of India.
71.	<i>Terminalia chebula</i> Retz.	Combret- aceae	Tree	Harra (H), Chebulic Myrobalan (E)	FU	Fl. & Fr.: Feb- Aug	Grows abundantly throughout N.India extending Southwards to Deccan upto 1000 km, Kerela upto 2000 m, and Western Ghats in India.
72.	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	Malvaceae	Tree	Paraspipal (H), Indian tulip tree (E)	FU, L, RT	Fl. & Fr.: throughout the year	It is found in the coastal forest of India, largely grown as roadside tree in the tropical region and in Andaman island.
73.	<i>Platycladus orientalis</i> (L.) Franco(= <i>Thuja orientalis</i> L.)	Cupress- aceae	Tree	Vidya(H)	ST	Fl. & Fr.:Mar-Apr	Arunachal Pradesh: Eastern and Western Himalayas, Assam, Uttarakhand.
74.	<i>Vateria indica</i> L.	Dipteroca- rpaceae	Tree	Safed daamar (H), Indian Copal (E)	LX, RS	Fl. & Fr.: Feb-Apr	It occurs chiefly in the evergreen .forests from N. Karnataka, to Kerela between 1000 & 1500 m and W. Ghats in India, often planted.
75.	<i>Vitex negundo</i> L.	Lamiaceae	Shrub	Nirgundi (H), Chaste Tree (E)	L, RT	Fl. & Fr.:almost throughout the year	Throughout warmer parts of India upto 1500 m.

L = Leaves; SD = Seed; ST = Stem; FU = Fruit; WH = Whole plant; RH = Rhizome; RT = Root; FL = Flower; LX = Latex; OL = Oil; SH = Shoot; SM = Stamen; RS = Resin.

plants with their common names both in English and Hindi and parts used. The plants were identified in consultation with modern floras and monographs. The plants are arranged alphabetically along with their family. The list is compiled based on Textual data, References and Cross-references and websites. The plants used in the management of wounds as described in different literature are listed in Table 1 with other relevant information such as common name (English and Hindi), botanical name, family name, parts used, habit, phenology and IUCN status. The wound healing properties of the reported species have been confirmed by following standard literatures (Kirtikar and Basu, 1935; Chopra *et al.*, 1956; Agarwal and Ghosh, 1985; Satyavati *et al.*, 1987; Warriar *et al.*, 1994-96 and Chandra, 1998).

Results and Discussion

The present geographical distribution of wound healing plants throughout India is 283 of which 26.50% (75) is observed in AJCBIBG. The 75 plant species having ethnomedicinal uses and properties especially wound

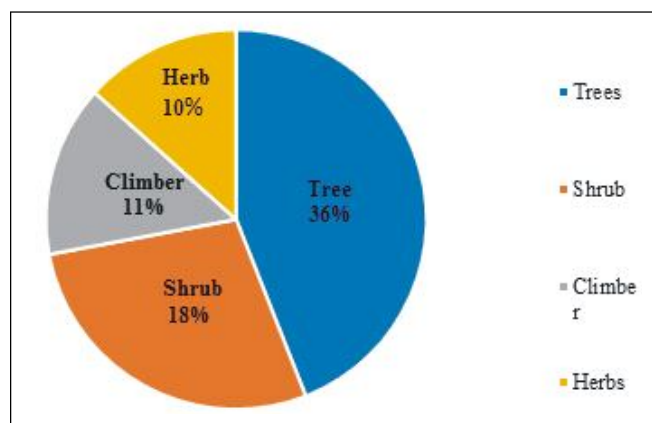


Fig. 1 : Habit-wise Diversity of wound healing plants of A.J.C.B.I.B.G

healing, belong to 64 genera under 36 families of angiosperms and 01 genus under one family of gymnosperm. Trees (36 species) are the most used plant form (Fig. 1) followed by shrubs (18 species) and climbers (11 species) and herbs (10 species).

Of these (75 species of plants), 89.18% are dicotyledons and 10.81% are monocotyledons. Fabaceae are the dominant family with eleven species (Fig. 2) followed by Apocynaceae (05 species), Rutaceae, Euphorbiaceae, Moraceae and Malvaceae (04 species), Combretaceae, Rubiaceae, Asteraceae, Myrtaceae (03 species), Anacardiaceae, Calophyllaceae, Oleaceae, Saptoaceae, Meliaceae, Dipterocarpaceae (02 species); whereas 17 families (Acanthaceae, Annonaceae, Liliaceae, Celastraceae, Chenopodiaceae, Cupressaceae, Lauraceae, Menispermaceae, Primulaceae, Convolvulaceae, Melastomataceae, Moringaceae, Nelumbonaceae, Piperaceae, Plumbaginaceae, Papilionaceae, Lamiaceae) are having single species. Different parts of these medicinal plants are used as medicine by the local traditional healers. Traditional healers are employing these plants to cure diseases related to skin, cold, fever, cough, headache, diarrhoea, fertility problems, toothache, stomach ache, diabetes, rheumatism, asthma, dysentery, smallpox, bone fractures, earache, hair loss and poison (snake, scorpion and insect) bites especially wounds (Chopda and Mahajan, 2009).

Mostly stem is used for wound healing followed by root (Fig. 3). Rest of the parts are used are in following order leaves > seed > fruit > whole plant > flower > rhizome > shoot > stamen.

In addition to plant parts, plant products such as under oil > Latex > resin (Fig. 4) are also obtained quite abundantly and used in wound healing purpose also.

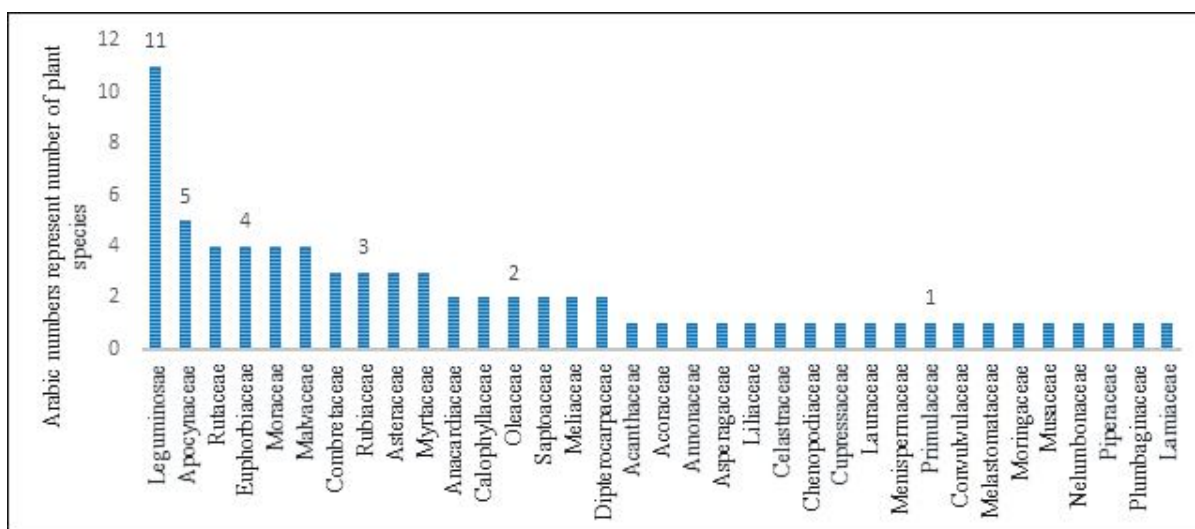


Fig. 2 : Family-wise Diversity of wound healing plants in AJCBIBG.

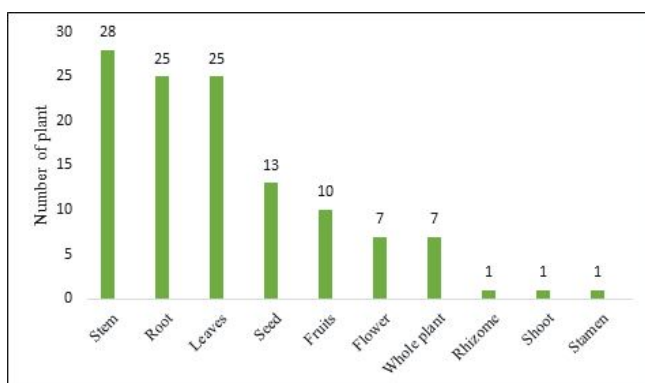


Fig. 3 : Plant parts used for wound healing.

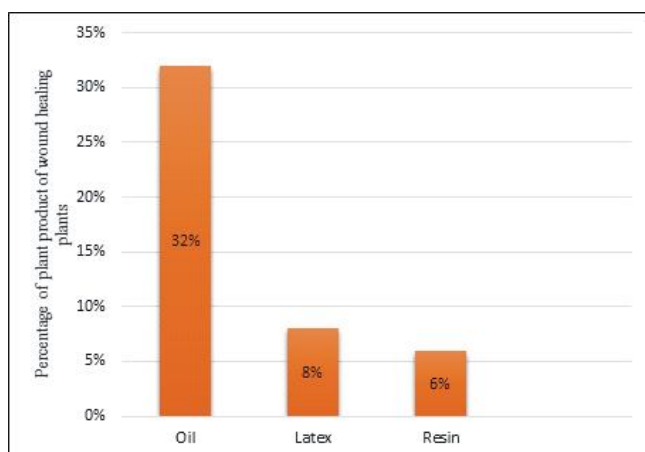


Fig. 4 : Plant products with wound healing properties (in %).

Conclusion

The survey revealed that, the AJC Bose Indian Botanic Garden harbours a good number of medicinal plants to mitigate a wide spectrum of human ailments. Since plants promote their pair mechanism in a very natural way, they are considered as more potent healers. Wound healing is a biological process that starts with trauma and ends with scar formation. The present study clearly demonstrates that nature has a huge possession of plants that show significant wound healing activities. These natural agencies are rich target for the development of alternatives to synthetic drugs. The information is recorded with scientific name, local name, family, parts used, phenology and IUCN status of every species. Herbal medicines in wound management involve disinfection, debridement and providing a moist environment to encourage the establishment of the suitable environment for natural healing process (Barek *et al.*, 2019). There is a likelihood of losing this wealth of knowledge in the near future due to lack of interest among the younger generation. It thus become necessary to acquire and preserve this traditional system of medicine by proper documentation and identification of specimens (Chopda and Mahajan, 2009). The demand of herbal drugs

is increasing day by day in developed as well as developing countries because they are safer and well tolerated as compared with those allopathic drugs. Further investigation on the plants can increase the isolation of the newer molecules, which will be helpful for the treatment of wounds. These plants should be subjected to human studies to determine their effectiveness.

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