



Medicinal plants with potential anti-arthritic activity

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ABSTRACT

Ethno Pharmacological Relevance: Traditional medicinal plants are practiced worldwide for treatment of arthritis especially in developing countries where resources are meager. This review presents the plants profiles inhabiting throughout the world regarding their traditional usage by various tribes/ethnic groups for treatment of arthritis. **Materials and Methods:** Bibliographic investigation was carried out by analyzing classical text books and peer reviewed papers, consulting worldwide accepted scientific databases from the last six decades. Plants/their parts/extracts/polyherbal formulations, toxicity studies for arthritis have been included in the review article. The profiles presented also include information about the scientific name, family, dose, methodology along with mechanism of action and toxicity profile. Research status of 20 potential plant species has been discussed. Further, geographical distribution of research, plants distribution according to families has been given in graphical form. **Results:** 485 plant species belonging to 100 families, traditionally used in arthritis are used. Among 100 plant families, malvaceae constitute 16, leguminosae 7, fabaceae 13, euphorbiaceae 7, compositae 20, araceae 7, solanaceae 12, liliaceae 9, apocynaceae, lauraceae, and rubiaceae 10, and remaining in lesser proportion. It was observed in our study that majority of researches are carried mainly in developing countries like India, China, Korea and Nigeria. **Conclusion:** This review clearly indicates that list of medicinal plants presented in this review might be useful to researchers as well as practitioners. This review can be useful for preliminary screening of potential anti-arthritis plants. Further toxicity profile given in the review can be useful for the researchers for finding the safe dose.

KEY WORDS: Arthritis, plant, polyherbal, traditional uses

INTRODUCTION

Immune system of our body plays a crucial role, as an overactive immune system may lead to certain fatal disease because of various hypersensitive or allergic reactions which may cause numerous derangements; loss of normal capacity to differentiate self from non-self resulting in immune reactions against our own's cells and tissues called autoimmune diseases. Certain common autoimmune diseases like myasthenia gravis, serum sickness, pernicious anemia, reactive arthritis etc., are the severe issues for medical and pharmaceutical community because of unknown etiology [1]. According to WHO, 0.3-1% of the world population is affected from rheumatoid arthritis (RA) and among them females are three times more prone to the disease as compared to males [2]. RA is a chronic, inflammatory, and systemic autoimmune disease [3]. The primary symptoms of RA include pain, swelling, and destruction of cartilage and bone as a result of which permanent disability occur. Although the exact etiology is unknown but several hypotheses said that it

is triggered by the combination of genetic predisposition and exposure to environmental factors like viruses [4]. The exact pathophysiology is still unknown but release of certain free radicals such as nitrous oxide and superoxide radicals generated as by-products of cellular metabolism. The release of such free radicals may induce the production of interleukins (IL) and tumor necrosis factor (TNF- α) from T-cells which ultimately influence the production of growth factors, cytokines and adhesive molecules on immune cells as such factors may cause tissue destruction and inflammation [5]. Pathological changes in RA are hyperplasia of synovial membrane, infiltration of inflammatory cells and neovascularization, which results into cartilage erosion and articular destruction [3].

The goal of treatment for rheumatoid arthritic patients is to eliminate symptoms, slow disease progression, and optimize quality-of-life [6]. Therefore, before starting the treatment of RA certain goals must be kept in mind such as relief of analgesia, reduction of inflammation, protection of

articular structure, maintenance of function, and control of systemic involvement [5]. Presently for the treatment of RA, strategies have changed from traditionally used non-steroidal anti-inflammatory drugs (NSAIDs) or disease modifying antirheumatic drugs (DMARDs) to novel biological agents, like TNF monoclonal antibody. Clinically, the treatment of RA includes five strategies. The foremost approach is the use of NSAIDs followed by mild doses of glucocorticoids to minimize the signs of inflammation as well as progression of disease. In chronic patients, the use of DMARDs such as methotrexate, sulfasalazine, gold salts or D-penicillamine can be included in the treatment. In certain cases, TNF- α neutralizing agents like infliximab, etanercept etc; IL-1 neutralizing agents like anakinra; and the drugs which interfere with T-cell activation such as abatacept can also be included in treatment of chronic cases. Finally, immunosuppressive and cytotoxic drugs such as cyclosporine, azathioprine, and cyclophosphamide are used for the treatment of chronic patients [5,7,8]. The above-mentioned therapeutic agents reduce the inflammation and joint destruction but their long-term risks are still unknown. However, long-term risks of drugs includes gastrointestinal ulcers, cardiovascular complications, hematologic toxicity, nephrotoxicity, pulmonary toxicity, myelosuppression, hepatic fibrosis, stomatitis, cirrhosis, diarrhea, immune reactions, and local injection-site reactions. Moreover, higher costs and side effects which include high risks of infections and melangancies requires continuous monitoring [1].

Herbal Therapy for the Treatment of Arthritis

Herbal medicines are used for the treatment of various ailments from ancient times and it is not an exaggeration to say that the use of the herbal drugs is as old as mankind [9]. Herbal medicines are synthesized from the therapeutic experience of generation of practicing physicians of ancient system of medicine for more than hundreds of years [10]. Nowadays, researcher shows a great interest in those medicinal agents that are derived from plants because the currently available drugs are either have certain side effects or are highly expensive [11]. Nature has blessed us with enormous wealth of herbal plants which are widely distributed all over the world as a source of therapeutic agents for the prevention and cure of various diseases [12]. According to WHO, world's 80% population uses herbal medicines for their primary health care needs. Herbal medicines will act as parcels of human society to combat disease from the dawn of civilization [13]. The medicinally important parts of these herbal plants are chemical constituents that produce a desired physiological action on the body [14].

Since ancient time India uses herbal medicines in the officially alternative systems of health such as Ayurveda, Unani, Sidha, Homeopathy, and Naturopathy [15]. In India, there are more than 2500 plants species which are currently used as herbal medicaments. For than 3000 years, the herbal medicines are used either directly as folk medication or indirectly in the preparation of recent pharmaceuticals [16]. Thus, from the knowledge of traditional plants, one might be able to discover new effective and cheaper drugs [17]. In this review article,

we have tried to cover all the ayurvedic strategies that are followed for the treatment of RA without any possible side effects. The future treatment of RA should provide more effective relief [5].

MATERIALS AND METHODS

In this review, bibliographic investigation was carried out during July 2011-December 2013, by referring various text books and certain review papers and research papers, consulting globally accepted databases from last some decades. The data were gathered from various databases i.e. Science Direct, PubMed, and Google and the information is compiled by reviewing more than 250 research and review articles. The data which are relevant would be considered. The botanical correct names and families were mentioned after verification from published literature and databases.

The method of scrutinizing the data for this review article includes those plants: (i) Which are native to India and other countries such as America, Africa or Europe, (ii) used in traditional systems and in various polyherbal preparations, (iii) with reported anti-arthritis activity, (iv) appropriate dosage, (v) mechanism of action, (vi) safety profile, and (vii) models used. Plants/their parts/extracts used traditionally in acute rheumatic attacks, chronic analgesia, and chronic rheumatism have been considered as anti-arthritis agents. Further, detailed information on research status of 20 plant species has been explained.

Polyherbal Formulations for Arthritis

Analgesics and NSAIDs are helpful in reducing pain and inflammation in either acute or chronic RA patients [18]. Although the treatment of RA is available but due to potential adverse effects or irreversible organ damage the new approaches are developed for maintaining the balance between these potential risks and acknowledged benefits [19]. Currently for the treatment of RA safer and more potent medicaments are developed from oriental sources. Large number of herbal extracts and products such as polyherbal formulations are prepared to reduce such side effects and increase the benefits [18].

Rheum off Gold is a polyherbal formulation that is commonly recommended by Ayurvedic medical practitioners for the treatment of arthritis. The anti-arthritis activity was confirmed on complete Freund's adjuvant (CFA) induced arthritis model in wistar rats and it was observed that significant reduction in arthritis index, paw thickness and inflammatory markers such as C-reactive protein, serum rheumatoid factor and erythrocyte sedimentation rate (ESR) when compared with dexamethasone. Thus, the formulation possesses a potential anti-arthritis activity [20].

A Unani polyherbal formulation was evaluated for its anti-arthritis activity in rats. The anti-arthritis efficacy of Manjoon Suranjan was evaluated using formaldehyde and CFA induced arthritis models. The data obtained suggested the anti-arthritis activity of the formulation [21].

Evaluation of Sudard as a potent anti-arthritic polyherbal formulation was studied using formaldehyde and adjuvant induced arthritis models in wistar rats. The formulation at the doses of 150 mg/kg and 300 mg/kg p.o. proves to have an anti-inflammatory and anti-arthritic activity [22].

Anti-arthritic potential of Tongbiling (TBL-II) which was prepared by some modification in Chinese herbal formulation TBL. The anti-arthritic efficacy of formulation was studied using the collagen induced arthritis model in wistar rats and it was revealed that at the doses of 100 and 300 mg/kg p.o. the levels of IL-1 β and TNF- α was significantly reduced. Thus it was concluded that the formulation have an anti-arthritic potential [23].

Chinese herbal formula HLXL was used in the treatment from last hundred years for the treatment of inflammation and arthritis. Moreover, after certain modifications in HLXL herbal formulation it was evaluated for its anti-arthritic property using CFA model in rats. It was concluded that the polyherbal formulation shows an anti-arthritic activity through significant inhibition of paw edema and levels of TNF- α and IL- β [24].

The therapeutic effect of Ganghwaljetongyeum on RA in rabbit knee synovial membrane was evaluated. It was observed that there would be significant inhibition of proliferation of HG-82 cells which shows that the polyherbal formulation have an anti-arthritic activity. Moreover, there was significant reduction in TNF- α , IL-10 and NO species [18]. Various polyherbal formulations are described in Table 1.

RESULTS

About more than 350 articles were reviewed. More than 20 articles were studied for searching the traditional use of plants in arthritis [Table 2]. Around 108 articles were referred for citing the proved anti-inflammatory and anti-arthritic activities of plants along with mechanism of action, acute toxicity profile, and doses [Table 3].

The detailed information on research status of following 20 plant species was gathered from multiple references.

Alstonia scholaris Linn. (AS)(Family-Apocynaceae)

AS is commonly known as saptaparni or devil's tree, widely distributed in dried forests of India as Western Himalayas, Western Ghats, and in the Southern region. AS is a medium to large tree about 40 m high with a somewhat tessellated corky grey to grey-white bark [25]. Traditionally, bark of AS is used in the treatment of rheumatism, malarial fevers, abdominal disorders, leprosy, asthma, bronchitis, pruritis, and chronic ulcers [12]. Milky juice is mixed with oil and was applied in rheumatic pains. The chief alkaloids present in AS are echitamine, tubotaiwine, akaummicine, echitamidine, picrinine, and strictamine. AS flowers also contains amino acids, carbohydrates, phenol, tannins, cardiac glycosides, saponins, flavanoids, steroids, fixed oil, and fats [26]. The plant shows immune-stimulatory, hepato-

protective [27], anti-cancer [28], anti-plasmodial [29], and anti-hypertensive [30] activities. Extract of AS possess an anti-diabetic, anti-hyperlipidemic [31], anti-bacterial [32], anti-inflammatory, analgesic [33], antioxidant [27], immunostimulant [34], anti-cancer [35], anti-asthmatic [36], hepatoprotective [37], and anti-anxiety activity [12,25,38]. The ethanolic extract of AS leaves at doses of 100 and 200 mg/kg confirmed anti-arthritic activity in male wistar rats. The anti-arthritic activity was mainly by reducing the total leukocyte migration as well as lymphocytes and monocytes/macrophages migration. It can be concluded that AS shows an anti-arthritic activity on male wistar rats [39].

Aristolochia bractea Lam. (AB)(Family-Aristolochiaceae)

AB commonly known as worm killer or kidamari is a shrub found in Deccan Gujarat, western and southern India, Bihar, Sindh, and Bengal [16]. Traditional use of AB was found in gonorrhoea, syphilis, inflammation, ulcer, amenorrhoea, skin disease, dermatitis, leprosy, jaundice, and helminthiasis [16]. The major chemical constituents of the AB are alkaloids, triterpenoids, steroids, flavonoids, saponins, carbohydrates, proteins, and cardiac glycosides [40,41]. The studies of extract have shown anti-pyretic [42], anti-allergic [43], anti-inflammatory, anti-arthritic [1], anti-ulcer [44], anti-fungal [45], anti-microbial [46], antioxidant [47], wound healing [48], anti-implantation, and abortifacient activities [49]. The petroleum ether, methanol, and chloroform extract of whole plant of AB possess comparable anti-arthritic activity at doses of 100, 200, and 400 mg/kg body weight. AB revealed anti-arthritic activity by maintaining the synovial membrane and vascular permeability thus inhibiting cytokines and leukotriene infiltration. In conclusion, AB possesses an anti-arthritic effect on wistar albino rats of either sex [1].

Boerhaavia diffusa Linn. (BD)(Family-Nyctagineae)

BD is found all over India especially during rain. Two varieties of BD are explored, one with white flowers called "shwethpurna" and other flowers called "raktapurna." The medicinally important part is root (MateriaMedica, 1982). BD is traditionally significant due to their laxative, diuretic, expectorant, diaphoretic, and emetic properties [50]. A paste made up of roots together with *Colchicum*, *Solanum nigrum*, Tamarind stone, Stag's horn and dried ginger, all in equal parts, are used in rheumatic and gouty painful joints. Root is used as powder in drachm doses or decoction or infusion for the treatment of inflammatory disorders like arthritis. Chakradatta used it in the treatment of chronic alcoholism and various other ailments i.e. phthisis, insomnia, and rheumatism [51]. The air-dried plant was found to contain large quantities of potassium nitrate and also contains an alkaloid, panamavine, present in very small quantity of 0.01%. Recent investigations reported that BD possess an antistress, adaptogenic [52], antioxidant [53], immunosuppressive [54], anti-carcinogenic [55], hepatoprotective [56,57], diuretic [58], anti-diabetic [59], anti-viral [60], and anti-inflammatory

Table 1: Polyherbal formulations

Product name	Ingredients	Botanical name	Quantity	Manufactured by
Rumalaya forte - Tablet	Shallaki	<i>Boswellia serrata</i>	240 mg	Himalaya Global Holdings Ltd.
	Camphor	<i>Commiphora wightii</i>	200 mg	
	Rasna	<i>Alpinia galangal</i>	70 mg	
	Yashtimadhu	<i>Glycyrrhiza glabra</i>	70 mg	
	Gokshura	<i>Tribulus terrestris</i>	60 mg	
	Guduchi	<i>Tinospora cordifolia</i>	60 mg	
	Nirgundi	<i>Vitex negundi</i>	60 mg	
	Sunthi	<i>Zinger officinalis</i>	60 mg	
Rumalaya - Liniment	Bakuchi	<i>Psoralea caryofolia</i>	35 mg	Himalaya Global Holdings Ltd.
	Maricha	<i>Piper nigrum</i>	35 mg	
	Karpura	<i>Cinnamomum camphor</i>	90 mg	
	Pudina	<i>Mentha arvensis</i>	40 mg	
	Ajamoda	<i>Carum capticum</i>	35 mg	
	Tila	<i>Sasamum indicum</i>	365 mg	
	Gandhapura	<i>Gaultheria fragrantissima</i>	350 mg	
Artha cure - Oil	Sarala	<i>Pinus longifolia</i>	50 mg	Be Sure Health Care (P) Ltd.
	Clovos	<i>Syzygium aromaticum</i>	50 mg	
	Mithazahar	<i>Aconitum ferox</i>	25 mg	
	Kupilu	<i>Strychnos nux vomica</i>	25 mg	
	Garlic	<i>Allium sativum</i>	50 mg	
	Akasbel	<i>Cuscuta reflexa</i>	50 mg	
	Jatiphalam	<i>Myristica fragrans</i>	50 mg	
Arthcure - Capsule	Khorpad	<i>Aloe vera</i>	50 mg	Be Sure Health Care (P) Ltd.
	Hiranya-tuttha	<i>Colchicum leuteum</i>	50 mg	
	Nisoth	<i>Operculina terpepethum</i>	50 mg	
	Shonpat	<i>Crotalaria juncea</i>	50 mg	
	Pippali	<i>Piper longum</i>	50 mg	
	Jatiphalam.	<i>Myristica fragrans</i>	50 mg	
	Clovos	<i>Syzygium aromaticum</i>	50 mg	
	Sonth	<i>Zingiber officinale</i>	50 mg	
	Asphalt	<i>Black bitumen</i>	25 mg	
	Mahayogaraaja guggulu	<i>Commiphora mukul</i>	25 mg	
	Mithzahar	<i>Aconitum ferox</i>	25 mg	
	Kupila	<i>Strychnos nux vomica</i>	25 mg	
	Ashvagandha	<i>Withania somnifera</i>	50 mg	
	Shatavari	<i>Asparagus racemosus</i>	50 mg	
	Garlic	<i>Allium sativum</i>	50 mg	
Rheumartho gold - Capsule	Akasbel	<i>Cuscuta reflexa</i>	50 mg	Baidyanath
	Suranjan kadwi	<i>Colchicum luteum</i>	60 mg	
	Asgandh	<i>Withania somnifera</i>	60 mg	
	Shodhit kuchla	<i>Strychnos nux vomica</i>	50 mg	
	Salai guggul	<i>Boswellia serrata</i>	215 mg	
	Maharasnadi qwath	<i>Ghanna sativa</i>	64 mg	
	Abrak bhama	<i>Biotite calx</i>	5 mg	
	Harsingar	<i>Nyctanthes arbor-tristis</i>	30 mg	
	Swarnamakshik bhasma	<i>Calx of copper pyrites</i>	5 mg	
	Yograj guggulu	<i>Commiphora mukul</i>	30 mg	
	Swarn bhasma	<i>Ipomoea digitata</i>	0.6 mg	
	Loha bhasma	<i>Calx of corat</i>	5 mg	
	Ortho joint oil	Vishagarbha taila	<i>Ricinus communis</i>	
Mahamasha taila		<i>Vign unguiculata</i>	2.5 ml	
Dalchini taila		<i>Cinnamomum zeylanicum</i>	0.5 ml	
Gandhapuro		<i>Gaultheria fragrantissima</i>	2.0 ml	
Camphor		<i>Cinnamomum camphor</i>	100 mg	
Sat pudina		<i>Mentha arvensis</i>	2.5 mg	
Narayan taila		<i>Withania somnifera</i>	2.5 ml	
Rheuma off gold	Mahayogaraaja guggulu	<i>Commiphora mukul</i>	72 mg	Virgo UAP Pharma (P) Ltd. [20]
	Maharasnadi kwath	<i>Suvarna bhasma</i>	112 mg	
	Suvarna bhasma	<i>Strychnos nux vomica</i>	1.6 mg	
	Suddha kuchala	<i>Boswellia serrata</i>	9.6 mg	
	Shallaki		4.8 mg	
Majoon suranjan	Kalaparni	<i>Ipomea turpethum</i>	445 mg	Qarshi herbal products [21]
	Pathya	<i>Terminalia cheluba</i>	223 mg	
	Hiranya-tuttha	<i>Colchicum luteum</i>	223 mg	
	Kakadani	<i>Capparis spinosa</i>	44.5 mg	
	Kustumbari	<i>Coriandrum sativum</i>	44.5 mg	

Contd...

Table 1: Polyherbal formulations

Product name	Ingredients	Botanical name	Quantity	Manufactured by
	Fish baries	<i>Rosa damascus</i>	44.5 mg	
	Lancaster rose	<i>Plumbago zelanicum</i>	44.5 mg	
	Chitra	<i>Zingiber officinalis</i>	44.5 mg	
	Sonth	<i>Aloe barbadensis</i>	44.5 mg	
	Khorpad	<i>Apium graveolens</i>	33 mg	
	Ajmoda	<i>Convulvulus scammony</i>	33 mg	
	Sakmunia	<i>Sepia latimanus</i>	33 mg	
	Cuttle fish bone	<i>Foeniculum vulgare</i>	33 mg	
	Fennel	<i>Lawsonia inermis</i>	33 mg	
	Mendhi	<i>Piper nigrum</i>	33 mg	
	Black pepper	<i>Sodium chloride</i>	33 mg	
	Table salt	<i>Zataria multiflora</i>	33 mg	
	Satar	<i>Ricinus communis</i>	33 mg	
	Eranda		0.668 mg	
	Saccharum base			
	Preservatives			
Huo Luo Xiao Ling Dan (HLXL)	Ruxiang	<i>Boswellia carterii</i>	15 g	[24]
	Qianghuo	<i>Notopterygium incisum</i>	12 g	
	Danggui	<i>Angelica sinensis</i>	12 g	
	Chishao	<i>Paeonia lactiflora</i>	12 g	
	Gancao	<i>Glycyrrhiza uralensis</i>	12 g	
	Yanhusuo	<i>Corydalis yanhusuo</i>	12 g	
	Danshen	<i>Salvia miltiorrhiza</i>	12 g	
	Chuanxiong	<i>Ligusticum chuanxiong</i>	12 g	
	Qinjiao	<i>Gentiana macrophylla</i>	12 g	
	Guizhi	<i>Cinnamomum cassia</i>	15 g	
	Duhuo	<i>Angelica pubescens</i>	12 g	
Ganghwaljetongyeum (GHJTY)	Angelicae koreanae	<i>Angelica koreanum</i>	06 mg	[18]
	Atractylodis rhizoma	<i>Atractylodes chinensis</i>	06 mg	
	Manchurian spikenard	<i>Aralia continentalis</i>	04 mg	
	Paeonia radix rubra	<i>Paeonia obovata</i>	04 mg	
	<i>Stephaniae tetrandrae</i>	<i>Sinomenium acutum</i>	04 mg	
	Clematidis radix	<i>Clematis mandshurica</i>	04 mg	
	Giant angelica	<i>Angelica gigas</i>	04 mg	
	Hoelen	<i>Poria cocos</i>	04 mg	
	<i>Alismatis rhizoma</i>	<i>Alisma orientale</i>	04 mg	
	Akebiae caulis	<i>Akebia quinata</i>	04 mg	
	Tangerine	<i>Citrus unshiu</i>	04 mg	
	Chaenomeles fructus	<i>Chaenomeles sinensis</i>	04 mg	
	Phellodendri cortex	<i>Phellodendron amurense</i>	03 mg	
	Glycyrrhizae radix	<i>Glycyrrhiza uralensis</i>	02 mg	
	Juncus medulla	<i>Juncus effuses</i>	04 mg	
	Gleditsiae spina	<i>Gleditsia sinensis</i>	04 mg	
	Lonicerae caulis	<i>Lonicera japonica</i>	04 mg	
	Taraxaci herba	<i>Taraxacum platycarpum</i>	04 mg	
Sudard	Guggulu	<i>Commiphora mukul</i>	100 mg	Anglo French Drugs and Industries Ltd, Bangalore, India [22]
	Rasna	<i>Pluchea lanceolata</i>	50 mg	
	Gandha prasarini	<i>Paederia foetida</i>	50 mg	
	Nirgundi	<i>Vitex negundo</i>	50 mg	
	Ginger	<i>Zingiber officinalis</i>	50 mg	
	Eranda mula	<i>Ricinus communis</i>	50 mg	
	Chandra sura	<i>Lepidium sativum</i>	30 mg	
	Suranjan	<i>Colchicum luteum</i>	30 mg	
	Dwipantra wacha	<i>Smilax glabra</i>	30 mg	
	Kupilu	<i>Strychnous nuxvomica</i>	10 mg	
	Shilajatu	<i>Mineral pitch</i>	50 mg	
TBL-II	<i>Cinnamomi cassiae</i>	<i>Cinnamomi cassiae</i>	15 g	Zhong-Yue Herbal Pharmaceutical Union Company in China [23]
	<i>Paeoniae alba radix</i>	<i>Paeoniae alba</i>	30 g	
	<i>Radix aconiti lateralis</i>	<i>Aconiti lateralis</i>	09 g	
	<i>Achyranthes bidentata</i>	<i>Achyranthes bidentata</i>	09 g	
	<i>Celastrus orbiculatus</i>	<i>Celastrus orbiculatus</i>	18 g	
	<i>Millettia reticulata</i>	<i>Millettia reticulata</i> Benth	06 g	

TBL: Tongbiling

activities [61,62]. The petroleum ether extract of roots at dose 1000 mg/kg has been evaluated as anti-arthritis using

CFA model and showed 81.5% response as compared to indomethacin [63].

Table 2: Traditionally used anti-arthritic plants

Botanical name	Family	Common name	Part used	Dosage form	References
<i>Abrus precatorius</i> Linn.	Papilionaceae	Indian liquorice, chirmiti, gunchi	L	Oil	[278]
<i>Acacia catechu</i> Willd.	Fabaceae	Mimosa catechu	R	Extract	[279]
<i>Acalypha indica</i> Linn.	Euphorbiaceae	Kuppu, Arittmanjarie	L	Juice	[19]
<i>Acanthus illicifolius</i> Linn.	Acanthaceae	Sea holly, Moranna harikusa	L	Extract	[278]
<i>Achillea millefolium</i> Linn.	Compositae	Rojmari, bloodwort, arrow-root	H	Extract	[280]
<i>Achyranthus aspera</i> Linn.	Amaranthaceae	Chirchitta, aghada, prickly chaff-flower	R	Infusion	[281]
<i>Acampe wightiana</i> Lindl.	Orchidaceae	Marabale	Wh	Extract	[278]
<i>Aconitum ferox</i> Wall.	Ranunculaceae	Mithazahar, visha	R	Liniment, paste	[51]
<i>Aconitum napellus</i> Linn.	Ranunculaceae	Monk' hood	R, L	Liniment	[51]
<i>Aconitum palmatum</i> Don.	Ranunculaceae	Bikhma	R	Paste	[51]
<i>Acorus calamus</i> Linn.	Aroideae	Bach, vacha	R	Powder	[51]
<i>Actaea racemosa</i> Linn.	Ranunculaceae	Black cohosh	R, Rh	Extract	[51]
<i>Actaea spicata</i> Linn.	Ranunculaceae	Banberry, grapewort	R	Powder	[278]
<i>Adansonia digitata</i> Linn.	Malvaceae	Gorakh amlī	L	Poultices	[19]
<i>Adenthera pavonina</i> Linn.	Leguminosae	Kuchandana	L, B	Decoction	[51]
<i>Adhatoda vasika</i> Nees.	Acanthaceae	Adosa, adarushah	L	Poultices	[51]
<i>Aegle marmolosa</i> Corr.	Rutaceae	Stone apple, bael	F	Juice	[14]
<i>Aesculus indica</i> Colebr.	Sapindaceae	Bankhor, pankar	F	Oil	[278]
<i>Agave americana</i> Linn.	Amaryllidaceae	American aloe, kantal, bilatipat	L	Paste	[278]
<i>Aghati grandiflora</i> Desv.	Leguminosae	Hathia, agastya	R	Paste	[51]
<i>Agropyron repens</i> Beauv.	Graminae	Couch G, quilch	Rh	Extract	[278]
<i>Ailanthus excels</i> Roxb.	Simaroubaceae	Indian tree of heaven	L	Oil, extract	[279]
<i>Alangium lamarkii</i> Thwaites.	Cornaceae	Akola, shoedhanam	R, B	Oil	[51]
<i>Allium cepa</i> Linn.	Liliaceae	Onion, palandu	Bu	Paste	[19]
<i>Allium sativum</i> Linn.	Liliaceae	Garlic, lasun	S	Oil	[51]
<i>Alocasia indica</i> Schott.	Aroideae	Zamkanda, alooka	T	Hot T	[51]
<i>Alpinia galangal</i> Willd.	Scitamineae	Sugandhavacha	Rh	Paste	[51]
<i>Alstonia scholaris</i> R.Br.	Apocynaceae	Datyuni, saptaparna	Mj	Juice	[39]
<i>Althaea rosea</i> Cav.	Malvaceae	Hollyhock, round dock	Fl	Oil	[278]
<i>Ammannia baccifera</i> Linn.	Lythraceae	Dadmari, agni-garva	L	Blisters	[2]
<i>Amorphophallus campanulatus</i> Roxb.	Aracea	Zamikand, kandula kandvardhana	S	Oil	[278]
<i>Anacyclus pyrethrum</i> DC.	Compositae	Akarkaro	R	Infusion	[51]
<i>Andropogon citratus</i> DC.	Gramineae	Bhushtrina, true lemon grass	L	Oil, liniment	[51]
<i>Andropogon iwarancusa</i> Roxb.	Gramineae	Lamjak	R	Paste	[51]
<i>Andropogon martini</i> DC.	Gramineae	Grass of nemaur	G	Oil	[51]
<i>Andropogon nardus</i> Linn.	Gramineae	lemon grass	St	Oil	[282]
<i>Anemone obtusiloba</i> Don.	Ranunculaceae	Padar, rattanjog	R	Oil	[51]
<i>Anisomeles malabarica</i> Linn.	Labiatae	Alamoola	L	Oil, decoction	[19]
<i>Aphanamixis polystachya</i> Blatter.	Meliaceae	Harinhara, janavallabha	S	Oil, liniment	[278]
<i>Apium graveolens</i> Linn.	Umbelliferae	Ajmoda, celery	R	Decoction	[280]
<i>Aquilaria agallocha</i> Roxb.	Thymelaeaceae	Aloe-wood, garu	W	Decoction	[51]
<i>Arctium lappa</i> Linn.	Compositae	Garden celery	L	Infusion	[280]
<i>Argyrea speciosa</i> Sweet.	Convolvulaceae	Elephant creeper	R	Powder	[19]
<i>Aristolochia bracteata</i> Linn.	Aristolochiaceae	Birthworts, pipevines	Wh	Extract	[1]
<i>Aristolochia serpentaria</i> Linn.	Aristolochiaceae	Virginian snake root	R	Infusion	[282]
<i>Artanema sesamoides</i> Benth.	Scrophularineae	Kokilaksha	R	Decoction	[51]
<i>Artemisa absinthium</i> Linn.	Compositae	Indhana, worm-wood	H	Juice	[51]
<i>Asparagus filicinus</i> Ham.	Liliaceae	Allipalli, sansarpal	R	Extract	[278]
<i>Asparagus officinalis</i> Linn.	Liliaceae	Marchuba	R	Powder	[51]
<i>Asparagus racemosus</i> Willd.	Liliaceae	Shatavari	R	Oil	[51]
<i>Asystasia coromandeliana</i> Nees.	Acanthaceae	Lavana-valli	Wh	Juice	[51]
<i>Asystasia gangetica</i> T. Anders.	Acanthaceae	Avokombily, puruk	Wh	Juice	[278]
<i>Atalantia monophylla</i> DC.	Rutaceae	Wild-lime, atavi-jambira	Be	Oil	[51]
<i>Atropa belladonna</i> Linn.	Solanaceae	Black cherry, sagangur	R, L	Extract	[278]
<i>Atylosia barbata</i> Baker.	Leguminosae	Mashaparni	R	Extraction	[51]
<i>Azadirachta indica</i> A. Juss.	Meliaceae	Bakayan, Indian lilac, balnimb	L	Decoction	[278]
<i>Azima tetracantha</i> Lam.	Salvadoraceae	Kundali	L, R	Decoction	[19]
<i>Bacopa monnieri</i> Penell.	Plantaginaceae	Brahmi	Wh	Extract	[283]
<i>Balsamodendron mukul</i> Hook.	Burseraceae	Guggula, salaitree	Gm	Paste	[51]
<i>Balsamodendron playfairii</i> Hook.	Burseraceae	Meena-herma	Gm	Paste	[51]
<i>Barleria courtallica</i> Nees.	Acanthaceae	Wahiti, artagala	R	Decoction	[278]
<i>Barleria cristata</i> Linn.	Acanthaceae	Jhinti, tadrelu	R	Decoction	[51]
<i>Baliospermum montanum</i> Muell.	Euphorbiaceae	Dantimul, hakum, anukheti	S	Oil	[278]
<i>Bassia butyracea</i> Roxb.	Sapotaceae	Phulwara butter	K	Fat	[51]
<i>Bassia latifolia</i> Roxb.	Sapotaceae	Madhuka, jangli moha	B	Decoction	[51]
<i>Bassia longifolia</i> Linn.	Sapotaceae	Madhuka, mohua	S	Oil	[51]

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Table 2: Contd...

Botanical name	Family	Common name	Part used	Dosage form	References
<i>Bassia malabarica</i> Bedd.	Sapotaceae	Illuppi	F, S	Oil	[51]
<i>Barosma crenulata</i> Hook.	Rutaceae	Bucchu, buku	L	Powder	[282]
<i>Bauhinia racemosa</i> Lam.	Fabaceae	Bidi leaf tree, kachnal	B	Extract	[14]
<i>Bauhinia tomentosa</i> Linn.	Fabaceae	Yellow bell orchid	L	Infusion	[13]
<i>Berberis asiatica</i> Roxb.	Berberidaceae	Kilmora	St	Decoction	[51]
<i>Berberis petiolaris</i> Wall.	Berberidaceae	Chachar, ambar	R	Decoction	[278]
<i>Berberis vulgaris</i> Linn.	Berberidaceae	True barberry	St	Decoction	[51]
<i>Bidens pilosa</i> Linn.	Compositae	Black jack, phutium	Sh	Young shoots	[278]
<i>Blumea balsamifera</i> DC.	Compositae	Nagal camphor, kakaronda	L	Fumigation	[278]
<i>Blumea ripens</i> DC.	Asteraceae	Red stink wood	S	Oil	[279]
<i>Bula alba</i> Linn.	Cupuliferae	White birch bark	L	Extraction	[51]
<i>Boerhaavia diffusa</i> Linn.	Nyctagineae	Punarnava, thikri	R	Paste	[63]
<i>Boucerosia aucheriana</i> Dcne.	Asclepiadaceae	Charungli, chungi pamanke	St, Wh	Juice	[278]
<i>Borassus flabellifer</i> Linn.	Arecaceae	Toody palm, sugar palm	F	Juice	[14]
<i>Boswellia glabra</i> Roxb.	Burseraceae	Kapithaparni, lobhan	Gm	Gum	[51]
<i>Boswellia serrata</i> Triana.	Burseraceae	Salai gugul	Gm, Rs	Gum	[76]
<i>Brassica campestris</i> Linn.	Cruciferae	Wild turnip, bangasarson	S	Oil	[278]
<i>Brassica integrifolia</i> West.	Cruciferae	Rai, Indian mustard, rajika	S	Oil	[278]
<i>Brassica juncea</i> Coss	Cruciferae	Rai, rajika	S	Oil	[51]
<i>Brassica nepus</i> Linn.	Cruciferae	Van dai, onuma	Wh	Extract	[278]
<i>Brassica nigra</i> Linn. & Koch.	Cruciferae	Kalori, sarshapah	S	Oil	[51]
<i>Brassica oleracea</i> Linn.	Cruciferae	Cabbage, karamkalla	L	Extract	[278]
<i>Bridelia retusa</i> Spreng.	Euphorbiaceae	Gaya, kajja, assana	B	Oil	[278]
<i>Bryonia epigoea</i> Rottl.	Cucurbitaceae	Rakas-gaddah, mahamula	R	Powder	[51]
<i>Buxus sempervirens</i> Linn.	Euphorbiaceae	Papari	L	Extraction	[51]
<i>Caccinia glauca</i> Savi.	Boragineae	Goazaban	L	Extraction	[51]
<i>Cadaba indica</i> Lamk	Capparidaceae	Indian cadaba	L	Decoction	[19]
<i>Caesalpinia bonduc</i> Roxb.	Caesalpinaceae	Katkaranj, latakaranja	S	Oil	[51]
<i>Callicarpa macrophylla</i> Vahl.	Verbenaceae	Sumali	R	Decoction	[51]
<i>Calophyllum apelatum</i> Wild.	Guttiferae	Cherupinnai, sarapuna	S	Oil	[278]
<i>Calophyllum inophyllum</i> Linn.	Guttiferae	Surpan, punnaga	K	Oil	[19]
<i>Calotropis gigantea</i> R.Br.	Asclepiadaceae	Gigantic, arka	R	Powder (mucilage)	[51]
<i>Calotropis procera</i> R.Br.	Asclepiadaceae	Madar	R-B	Extract	[282]
<i>Cammphora officinarum</i> Bauh.	Lauraceae	Camphor, kapur	C	Liniments	[51]
<i>Canarium odoratum</i> Baill.	Annonaceae	Kadapanyan, maladi	Fl	Oil	[278]
<i>Canarium bengalense</i> Roxb.	Burseraceae	Bisjang, dhuna, goguldhop	L, B	Extract	[278]
<i>Canarium commune</i> Linn.	Burseraceae	Java almond, jangali badam	T	Ointment	[278]
<i>Canarium strictum</i> Roxb.	Burseraceae	Black damer	Rs	Ointment	[51]
<i>Cannabis sativa</i> Linn.	Urticaceae	Ganja, charas	S	Oil	[98]
<i>Canella alba</i> Murry.	Canellaceae	Jamaica	B	Oil	[282]
<i>Capparis aphylla</i> Roth.	Capparidaceae	Caper plant, karira	R-B	Powder, infusion	[51]
<i>Capparis decidua</i> Edgew	Capparidaceae	Chayruka	L	Extract	[278]
<i>Capparis heyneana</i> Wall.	Capparidaceae	Chayruka	L	Decoction	[51]
<i>Capparis spinosa</i> Linn.	Capparidaceae	Kabra, kakadani	L	Decoction	[51]
<i>Capsicum annum</i> Linn.	Solanaceae	Lal mirchi, spanish pepper	F	Tincture	[51]
<i>Cardiospermum halicacabum</i> Linn.	Sapindaceae	Balloon vine, winter cherry	R, L	Decoction	[284]
<i>Carissa carandas</i> Linn.	Apocynaceae	Karamardaka	S	Extract	[279]
<i>Carissa spinarum</i> Linn.	Apocynaceae	Karaunda, garna	R	Extract	[278]
<i>Carthamus tinctorius</i> Linn.	Compositae	Wild saffron, kamalottara	Fl	Hot infusion	[51]
<i>Cassia fistula</i> Linn.	Caesalpiniceae	Sonhali, nripadruma	B, L	Paste	[19]
<i>Cassia sophera</i> Linn.	Caesalpiniceae	Bas-ki-kasunda	L	Infusion	[51]
<i>Cassia tora</i> Linn.	Fabaceae	Charota, taga	L	Infusion	[279]
<i>Cadreja toona</i> Roxb.	Meliaceae	Toona, khusing	B	Infusion	[51]
<i>Cedrus deodara</i> Lou Don.	Coniferae	Deodar, kilan, geyar	W	Oil	[278]
<i>Cedrus libani</i> Barrel	Coniferae	Deodar, devadaru	Gm	Gum	[51]
<i>Celastrus paniculata</i> Willd.	Calastraceae	Malakanguni, vanhiruchi	S	Decoction	[19]
<i>Celosia argentia</i> Linn.	Amaranthaceae	Paanai keerai	L	Decoction	[13]
<i>Centella asiatica</i> Urban.	Mackinlayaceae	Gotu kola	St	Extract	[285]
<i>Cephaelis ipecacuanha</i> A.Rich.	Rubiaceae	Poaya	R	Extract	[282]
<i>Chenopodium album</i> Linn.	Chenopodiaceae	Goosefoot, fathen	Wh	Extract	[279]
<i>Chloroxylon swietenia</i> DC	Meliaceae	Bheria, girya, yellow wood	L	Oil	[278]
<i>Cicuta virosa</i> Linn.	Apiaceae	Cowbane, water hemlock	Wh	Poultice	[282]
<i>Cimicifuga racemosa</i> Ellicot.	Ranunculaceae	Black snake root, bugbane	R	Extract	[282]
<i>Cinchona calisaya</i> Hook.	Rubiaceae	Peruvian bark	B	Infusion	[51]
<i>Cinnamomum camphora</i> Nees.	Lauraceae	Camphor laurel	W	Oil	[282]
<i>Cinnamomum cassia</i> Blume.	Lauraceae	Dalchini, gudadvak	L	Oil	[51]

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Table 2: Contd...

Botanical name	Family	Common name	Part used	Dosage form	References
<i>Cinnamomum tamala</i> Fr.Nees.	Lauraceae	Cassia lignea, tejpat	L	Extract	[278]
<i>Cinnamomum macrocarpum</i> Hook.	Lauraceae	Dalchini, tejpatra	R, B, L	Oil	[109]
<i>Cinnamomum parthenoxylon</i> DC.	Lauraceae	Kaaway, kayogadis	F	Oil	[278]
<i>Cissus quadrangularis</i> Linn.	Vitaceae	Devil's backbone	Wh	Extract	[279]
<i>Cistus creticus</i> Linn.	Cistaceae	Ladano	L	Oil	[282]
<i>Citrullus colocynthis</i> Schrad.	Cucurbitaceae	Indrayan, colocynth	R	Powder	[19]
<i>Citrus aurantium</i> Linn.	Rutaceae	Narengi, sweet orange	Fl	Liniment	[51]
<i>Citrus bergamia</i> Ris.	Rutaceae	Jambha, nimbu	F	Juice	[51]
<i>Citrus limonum</i> Sp.Risso.	Rutaceae	Jambira, limpaka	F	Juice	[51]
<i>Cleome brachycarpa</i> Linn.	Capparidaceae	Panwar, kasturi	Wh	Extract	[278]
<i>Cleome gynandra</i> Linn.	Capparaceae	African cabbage, spiderwisp	Wh	Extract	[286]
<i>Cleome rutidosperma</i> DC.	Cleomaceae	Fringed spider flower	Wh	Decoction	[14]
<i>Clerodendron colebrookianum</i> Walp.	Lamiaceae	Glowery bower	Rh	Extract	[279]
<i>Clerodendron inerme</i> Gaertn.	Verbenaceae	Garden quinine, binjoam	R	Liniment	[51]
<i>Clerodendron phlomides</i> L.F.	Verbenaceae	Agnimantha, jaya	L	Paste	[14]
<i>Clerodendron serratum</i> Spreng.	Verbenaceae	Barangi, baleya, angaravalli	R	Decoction	[278]
<i>Clerodendron siphonanthus</i> R.Br.	Verbenaceae	Bharangi, arnah, chingari	W	Rs	[278]
<i>Clitoria ternatea</i> Linn.	Verbenaceae	Butterfly-pea	Wh	Extract	[279]
<i>Cocculus cordifolius</i> Miers.	Menispermaceae	Heart-leaved, gulancha	St, L, R	Infusion	[51]
<i>Cocculus hirsutus</i> Diels.	Menispermaceae	Broom creeper, chireta	R	Infusion	[278]
<i>Cocculus villosus</i> DC.	Menispermaceae	Jalianni, faridbel	R	Decoction	[19]
<i>Cochlearia armoracia</i> Linn.	Cruciferae	Horse-radish	R	Condiment	[282]
<i>Colchicum autumnale</i> Linn.	Melanthaceae	Wild saffron	S	Extract	[282]
<i>Colchicum luteum</i> Baker.	Liliaceae	Golden collyrium, hiranya-tuttha	R	Extract	[51]
<i>Coldenia procumbens</i> Linn.	Boraginaceae	Tripungkee	L	Extract	[51]
<i>Coptis teeta</i> Wall.	Ranunculaceae	Gold thread, mishamitita	R	Paste	[51]
<i>Corallocarpus epigeous</i> Rottl & Willd.	Cucurbitaceae	Akasgaddah, karwinai, lufa	R	Decoction	[19]
<i>Coriandrum sativum</i> Linn.	Umbelliferae	Coriander, kustumbari	F, L	Oil	[120]
<i>Costus speciosus</i> Sm.	Scitamineae	Kemuka, kushtha, padmapatra	R	Extract	[287]
<i>Cotula anthemoides</i> Linn.	Compositae	Babuna	R	Infusion	[51]
<i>Crataeva nurvala</i> Linn.	Capparidaceae	Bhatavarna, biiana	L	Juice	[278]
<i>Crataeva religosa</i> Hook & Forst.	Capparidaceae	Three leaved creeper, pashuganda	L	Juice	[51]
<i>Crinum asiaticum</i> Linn.	Amaryllidaceae	Poison bulb, chindar	Bu	Roasted Bu	[51]
<i>Crinum latifolium</i> Linn.	Amaryllidaceae	Chakrangi, dadhyani	Bu	Roasted Bu	[278]
<i>Crocus sativus</i> Linn.	Irideae	Saffron, bhavarakta	Sg	Tincture, infusion	[51]
<i>Crotalaria prostrata</i> Rottler.	Fabaceae	Prostate rattlepod	Wh	Extract	[279]
<i>Croton oblongifolius</i> Rox.	Euphorbiaceae	Chucka, bhutamkusam	B	Infusion	[51]
<i>Croton tiglium</i> Linn.	Euphorbiaceae	Jamalgota, naepala	S	Liniment	[51]
<i>Curcuma longa</i> Linn.	Scitamineae	Turmeric, haldi, varnavat	Rh	Powder	[130]
<i>Cymbopogon citrates</i> Stapf.	Graminae	Melissa grass, gandhatrina	G	Oil	[278]
<i>Cymbopogon jwarancusa</i> Schult.	Graminae	Ghatyari, amrinala, izkhir	G	Oil	[278]
<i>Cymbopogon schoenanthus</i> Spreng.	Graminae	Geranium grass, bhutika	G	Oil	[278]
<i>Cynodon dactylon</i> Pers.	Graminae	Bahama grass, amari, bhargavi	Wh, Rh	Extract	[278]
<i>Daemia extensa</i> R.Br.	Asclepiadeae	Utranajutuka, phala-kantak	L	Juice	[19]
<i>Dalbergia lanceolaria</i> Linn.	Fabaceae	Bithua, takoli	B	Oil	[278]
<i>Daphne mezereum</i> Linn.	Thymelaceae	Mezereon	B	Extract	[282]
<i>Datisca cannabina</i> Linn.	Datisceae	Akalbar, bhargjala drnkhari	R	Decoction	[278]
<i>Datura alba</i> Nees.	Solanaceae	Thornapple, tattur	L	Juice	[51]
<i>Datura metel</i> Linn.	Solanaceae	Downy datura, dushtura	L	Paste	[278]
<i>Datura stramonium</i> Linn.	Solanaceae	Apple of peru, tattur, devika	L	Infusion	[278]
<i>Delonix elata</i> Gamble Fl.	Fabaceae	Vayni, tiger bean	Wh	Extract	[288]
<i>Delphinium cenudatum</i> Wall.	Ranunculaceae	Vishalakarni, jadwar	R	Decoction	[51]
<i>Delphinium consolida</i> Linn.	Ranunculaceae	Larkspur	S	Oil	[282]
<i>Delphinium staphisagri</i> Linn.	Ranunculaceae	Spach	S	Oil	[282]
<i>Derris uliginosa</i> Benth.	Papilionaceae	Panlata, worm killer	B	Decoction	[51]
<i>Dichrostachys cinera</i> W.&A.	Fabaceae	Kheri, vertuli, bahuvaraka	R	Extract	[278]
<i>Diospyros candollena</i> Wight.	Ebanaceae	Nila-variksha	B	Decoction	[51]
<i>Diospyros paniculata</i> Dalz.	Ebanaceae	Tinduka, karinthuvvari	B	Powder	[51]
<i>Dipterocarpus alatus</i> Roxb.	Dipterocarpaceae	Gurjan, battisal, kanyin	B	Extract	[278]
<i>Dipterocarpus indicus</i> Bedd.	Dipterocarpaceae	Ennei	Rs	Rs	[51]
<i>Dodonaea viscosa</i> Linn.	Sapindaceae	Aliar, sanatta, Dhasera	L	Poultice	[51]
<i>Dolichos falcatus</i> Klein.	Papilionaceae	Kattamara	S	Decoction	[51]
<i>Dysoxylum malabaricum</i> Bedd.	Meliaceae	Agaru, kana-mulla	W	Decoction	[51]
<i>Eclipta prostrata</i> Linn.	Asteraceae	Bhringaraj	R, L	Juice, decoction	[14]
<i>Elaeocarpus oblongus</i> Gaertn	Tiliaceae	Malankara	F	Oil	[51]
<i>Elaeocarpus serratus</i> Linn.	Tiliaceae	Julpai, olang-karai	L	Extract	[51]

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Botanical name	Family	Common name	Part used	Dosage form	References
<i>Elaeis guineensis</i> Jacq.	Palmae	African oil palm	Sr	Oil	[278]
<i>Elaeocarpus tuberculatus</i> Roxb.	Tiliaceae	Rudraksha, rutthraksham	B	Decoction	[51]
<i>Elephantopus scaber</i> Linn.	Asteraceae	Elephant foot, tutup bumi	L	Oil	[279]
<i>Emblica officinalis</i> Gaertn.	Euphorbiaceae	Amla	F	Juice	[14]
<i>Ephedra Gerardiana</i> Wall.	Gnetaceae	Amsania, budshur	St, R	Decoction	[278]
<i>Ephedra vulgaris</i> Rich.	Ephedraceae	Khanda, ma-hung	Be	Decoction	[289]
<i>Erythrina stricta</i> Roxb.	Papilionaceae	Mura, murukku	B	Powder	[51]
<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Blue gum tree	B, L	Oil	[282]
<i>Eugenia operculata</i> Roxb.	Myrtaceae	Rai-Jaman, piaman	F	Oil	[51]
<i>Eupatorium perfoliatum</i> Linn.	Asteraceae	Boneset, crosswort	L	Extract	[282]
<i>Euphorbia antiquorum</i> Linn.	Euphorbiaceae	Triangular spurge, Tidhara, vajratundi	Br	Gum, milky juice	[290]
<i>Euphorbia helioscopia</i> Linn.	Euphorbiaceae	Hirruseeah, gandabhuti	Br	Juice	[51]
<i>Euphorbia nerifolia</i> Linn.	Euphorbiaceae	Snoohi, common milk hedge	Br	Juice	[51]
<i>Euphorbia nivulia</i> Ham.	Euphorbiaceae	Katathohar, vajri	L	Juice	[278]
<i>Euphorbia tirucalli</i> Linn.	Euphorbiaceae	Milk bush, sehund	Wh	Milky juice	[278]
<i>Euryale ferox</i> Salisb & Roxb.	Nymphaeaceae	Makhana, foxnut, machana	L	Extract	[278]
<i>Erythrina stricta</i> Roxb.	Fabaceae	Indian coral tree	B	Decoction	[279]
<i>Excoecaria acerifolia</i> Didrichs.	Euphorbiaceae	Basing	Wh	Juice	[51]
<i>Fagopyrum esculentum</i> Moench.	Polygonaceae	Buckweat	R	Extract	[279]
<i>Farsetia aegyptiaca</i> Turr.	Cruciferae	Mulei, faridbuti	F, L	Extract	[51]
<i>Farsetia hamiltonii</i> Royle.	Cruciferae	Farid-but	F, L	Extract	[51]
<i>Farseaia jacquemontii</i> Hk.F. & T.	Cruciferae	Mulei	F, L	Extract	[51]
<i>Feaula asafoetida</i> Linn.	Umbelliferae	Hing, bhutnasan	R	Oil	[51]
<i>Ferula galbaniflua</i> Bioss.	Umbelliferae	Gandhabiroza, galbanum	R	Oil	[51]
<i>Ferula narthex</i> Boiss.	Umbelliferae	Hingra, bhutari, devil's dung	L	Infusion	[278]
<i>Ficus bengalensis</i> Linn.	Urticaceae	Banyan tree, sriksha	S, F	Juice	[291]
<i>Ficus religiosa</i> Linn.	Urticaceae	Pippala, peepul tree	B	Decoction, oil	[51]
<i>Ficus retusa</i> Linn.	Urticaceae	Nandruk, pilala, kamrup	L, B	Poultice	[278]
<i>Flacourtia sepiara</i> Roxb.	Cyperzaceae	Kondai, kingaro	L, R	Infusion	[51]
<i>Fraxinus excelsior</i> Linn.	Oleaceae	European ash	L	Exudates	[282]
<i>Garcinia pictorialis</i> Roxb.	Guttiferae	Mysore gamboges tree, tamal	Rs	Powder	[51]
<i>Gaultheria fragrantissima</i> Wall.	Eriaceae	Indian wintergreen gandapuro	L	Oil	[51]
<i>Gelsemium nitidum</i> Michaux.	Loganiaceae	Wild yellow jessamine	R	Extract	[282]
<i>Gendarussa vulgaris</i> Nees.	Acanthaceae	Nili-nargandi, kala-bashimb	L	Infusion	[51]
<i>Gentian lutea</i> Linn.	Gentianaceae	Yellow gentian	R	Powder	[282]
<i>Geodorum densiflorum</i> Lam.	Orchidaceae	Shepherd's crook orchid	Rh	Extract	[279]
<i>Geranium maculatum</i> Linn.	Geraniaceae	Alum-root	Rh	Oil, liniment	[282]
<i>Gmelina asiatica</i> Linn.	Verbenaceae	Badhara, vikarini	R	Extract	[19]
<i>Gossypium arboretum</i> Linn.	Malvaceae	Tree cotton	S	Oil	[279]
<i>Gossypium badense</i> Linn.	Malvaceae	Sea island cotton	S	Cotton	[282]
<i>Gossypium hanceum</i> Linn.	Malvaceae	Levant cotton	L	Oil	[279]
<i>Gossypium indicum</i> Linn.	Malvaceae	Indian cotton plant, anagnika	S	Oil, liniment	[51]
<i>Grangia maderaspatana</i> Poir.	Compositae	Mukhatari, afsantin	R	Decoction	[278]
<i>Grewia asiatica</i> Linn.	Tiliaceae	Palsa, dharmana	B	Infusion	[51]
<i>Grewia tenax</i> Fiori.	Tiliaceae	Gowali, kakarundah	L, F	Oil	[278]
<i>Guaiaacum officinale</i> Linn.	Zygophyllaceae	Lignum vita	St	Rs	[282]
<i>Guizojia abyssynica</i> Cass.	Compositae	Nigers, kala-til	S, F	Oil	[51]
<i>Gynandropsis gyandra</i> Marill.	Capparidaceae	Churota, hulhul, ajagandha	L	Extract	[278]
<i>Gynocardia odorata</i> R.Br.	Flacourtiaceae	Chaulmugra, biringmogra	S	Oil	[51]
<i>Hedeoma pulegioides</i> Persoon.	Labiatae	Ameican pennyroyal	L	Infusion	[282]
<i>Heliotropium indicum</i> Linn.	Boraginaceae	Hattasura, siriri bhurundi	R, L	Plasters	[278]
<i>Hemidesmus indicus</i> R.Br.	Asclepiadaceae	Sugandhi, indian sarsaparilla	R-B	Infusion	[292]
<i>Herpestis monniera</i> H.B.K.	Scrophularineae	Brahmi, thyme-leaved	L	Juice	[51]
<i>Hibiscus tillaceus</i> Linn.	Malvaceae	Cork wood, pola	R	Embrocation	[51]
<i>Hiptage benghalensis</i> Linn.	Malpighiaceae	Hutumukta, kampti	L	Juice	[278]
<i>Hiptage madablota</i> Gaertn.	Malpighiaceae	Madhab, madavilata	L	Extract	[51]
<i>Holarrhena antidysenterica</i> Wall.	Apocynaceae	Kurchi, kutaja, kewar	B	Lep	[51]
<i>Hedera helix</i> Linn.	Araliaceae	Barren ivy, mandia bind wood	Be	Infusion	[278]
<i>Holoptelea integrifolia</i> Planch.	Urticaceae	Papri, vavala	B	Juice	[51]
<i>Humulus lupulus</i> Linn.	Cannabineae	Hop	Wh	Infusion	[282]
<i>Hydnocarpus wightiana</i> Blume.	Flacourtiaceae	Jangli almond, tuvaraka, chaulmoogra	S	Oil	[51]
<i>Hydrocotyle asiatica</i> Linn.	Umbelliferae	Brahmi, Indian penny-wort	Wh	Juice extract	[51]
<i>Hygrophila spinosa</i> T.Anders	Acanthaceae	Kolistha, gokhula-kanta	R	Decoction	[51]
<i>Hyssopus officinalis</i> Linn.	Labiatae	Zupha	L	Infusion, syrup	[51]
<i>Illicium verum</i> Hook.	Magnoliaceae	Star anise, anasphal	F	Oil	[51]
<i>Indigofera oblongifolia</i> Forsk.	Papilionaceae	Jhilla, mridupatraka	R	Decoction	[278]

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Table 2: Contd...

Botanical name	Family	Common name	Part used	Dosage form	References
<i>Indigofera paucifolia</i> Delile.	Papilionaceae	Kuttukkar-chamathi	St	Decoction	[51]
<i>Indigofera trifoliata</i> Linn.	Papilionaceae	Vekhario, malmandi	S	Confection	[51]
<i>Inula helenium</i> Hook.	Compositae	Rasan	L	Oil	[51]
<i>Ipomoea eriocarpa</i> Br.	Convolvulaceae	Nakhari, pulichevidu	Wh	Oil	[51]
<i>Ipomoea hispida</i> Roem & Schult.	Convolvulaceae	Bhanwar, harankhuri	Wh	Oil	[278]
<i>Ipomoea pescaprae</i> Purga.	Convolvulaceae	Goat's foot creeper, chagalanghri	R, L	Decoction	[51]
<i>Ipomoea reniformis</i> Chois.	Convolvulaceae	Mushakani, mooshakarni	Wh	Decoction	[51]
<i>Ipomoea turpethum</i> Br.	Convolvulaceae	Indian jalap, kalaparni	R-B	Powder	[51]
<i>Jasminum grandiflorum</i> Linn.	Oleaceae	Spanish jasmine, chambeli	R	Oil	[278]
<i>Jatropha curcas</i> Linn.	Euphorbiaceae	Jangli-erandi, angula-leaved physic nut	S	Oil	[293]
<i>Jatropha glandulifera</i> Roxb.	Euphorbiaceae	Nikumba, lal-bhranda	S	Oil	[51]
<i>Juglans regia</i> Linn.	Juglandaceae	Akhor, darga, walnut tree	B	Decoction	[280]
<i>Juniperus communis</i> Linn.	Coniferae	Juniper berry, hapusha	Be	Powder	[51]
<i>Justica ecbolium</i> Linn.	Acanthaceae	Odoojati	Wh	Extract	[51]
<i>Justica gendaruusa</i> Burm.	Acanthaceae	Nilinargandi, kapika, bhutakeshi	L	Decoction	[294]
<i>Justica procumbens</i> Linn.	Acanthaceae	Carmentine couchee	H	Infusion	[51]
<i>Koelipinia linearis</i> Pallas.	Asteraceae	Koelipinia	Wh	Extract	[279]
<i>Lantana aculeata</i> Linn.	Verbenaceae	Wild Sage, ghaneri	Wh	Decoction	[278]
<i>Launaea pinnatifida</i> Cass.	Compositae	Pathri, almirao	L	Juice	[51]
<i>Lavandula stoechas</i> Linn.	Labiatae	Arabian lavender, dharu	Fl	Formentation	[51]
<i>Lawsonia alba</i> Linn.	Lythraceae	Heena, mendhi, mehndi	L	Paste	[295]
<i>Leea indicum</i> Merr.	Vitaceae	Bandicoot berry	Wh	Extract	[279]
<i>Leonotis nepetaefolia</i> R.Br.	Labiatae	Hejurchei, matijer	L	Decoction	[278]
<i>Leucas aspera</i> Spreng.	Labiatae	Chotahalkusa, tamba,	L	Juice	[296]
<i>Lipidium crassifolium</i> Hung.	Cruciferae	Hairy cress	S	Extract	[278]
<i>Lipidium sativum</i> Linn.	Cruciferae	Cress, chandrasura halim, chansaur	S	Paste	[51]
<i>Leucas linifolia</i> Spreng.	Labiatae	Dronapushpi, hulkussa	L, Fl	Infusion	[51]
<i>Linum usitatissimum</i> Linn.	Linaceae	Lins, uma, tisi	S	Poultice	[297]
<i>Litsea chinensis</i> Lam.	Lauraceae	Garur, adhavara, chamana	Be	Oil	[278]
<i>Litsea sebifera</i> Pers.	Lauraceae	Garbijaur, menda, medasak	B	Powder, paste	[51]
<i>Lolium temulentum</i> Linn.	Graminae	Darnel	S	Powder	[282]
<i>Lycopodium clavatum</i> Linn.	Lycopodiaceae	Clubmoss spores, wolf claw	Sp	Tincture	[51]
<i>Lygodium flexuosum</i> Linn.	Polypodiaceae	Vallipanna, kalazha	R	Oil	[51]
<i>Machilus macrantha</i> Nees.	Lauraceae	Kolamavu	B	Extract	[51]
<i>Marrubium vulgare</i> Linn.	Labiatae	White hore-hound, farasiyun	H	Infusion	[51]
<i>Matricaria chamomilla</i> Linn.	Compositae	Babunphul, camomile	Fl	Oil	[51]
<i>Melaleuca leucadendron</i> Linn.	Myrtaceae	Cajuput tree, kayaputi	L	Oil	[51]
<i>Melaleuca minor</i> Smith.	Myrtaceae	Kaya-puti, cajuput	L	Oil	[282]
<i>Melia azadirachta</i> Linn.	Meliaceae	Ravipriya, neem, nimb	B	Decoction	[51]
<i>Melia azedaracha</i> Linn.	Meliaceae	Mahanimba, persian lilac, bakayan	S	Oil	[51]
<i>Menthe piperita</i> Linn.	Labiatae	Peppermint, gamathi phudina	L	Oil	[51]
<i>Menyanthes trifoliata</i> Linn.	Gentianaceae	Bogbean, water shamrock	R	Extract	[278]
<i>Merremia tridentata</i> Hallier.	Convolvulaceae	Prasarini	Wh	Extract	[298]
<i>Mesua ferrea</i> Linn.	Guttiferae	Cobra's saffron, nagkesara	S	Embrocation	[51]
<i>Michella champaca</i> Linn.	Magnoliaceae	Golden champa, champaka	Fl	Oil	[51]
<i>Mimosa pudica</i> Linn.	Fabaceae	Humble plant, lajjavati, kandiri	Wh	Extract	[278]
<i>Mollugo cerviana</i> Ser.	Ficoideae	Taph-jhad, phanya, grishmasundara	R	Oil	[51]
<i>Momordica chirantia</i> Linn.	Cucurbitaceae	Bitter gourd, karavella, karela	F	Juice	[51]
<i>Momordica cochinchinensis</i> Spreng.	Cucurbitaceae	Gangerua, kakrol, krindana	R	Decoction	[278]
<i>Moniera cuneifolia</i> Michx.	Scrophulariaceae	Bama, brahmi, svetchammi	L	Juice	[278]
<i>Monarda punctata</i> Linn.	Labiatae	Horse-mint	L	Oil	[282]
<i>Morinda citrifolia</i> Linn.	Rubiaceae	Indian mulberry, barraal	L	Juice	[278]
<i>Moringa oleifera</i> Lam.	Moringaceae	Horse-radish, sobhanjana	S	Oil	[51]
<i>Mucuna gigantea</i> DC.	Papilionaceae	Kakuvalli	B	Powder	[51]
<i>Mukia maderaspatana</i> Linn.	Cucurbitaceae	Madras pea pumpkin, agumaki	L	Decoction	[13]
<i>Murraya exotica</i> Linn.	Rutaceae	Honey bush, ekangi, kamini	Fl, L	Infusion	[51]
<i>Murraya koenigii</i> Linn.	Rutaceae	Bristly bryoni	L	Powder	[13]
<i>Myristica fragrans</i> Houtt.	Myristaceae	Nutmeg, jati-phalam., jaiphal	S	Oil	[19]
<i>Myristica malabarica</i> Lamk.	Myristaceae	Malabar nutmeg, malati, kamuk	S	Embrocation	[51]
<i>Myropyrum similacifolium</i> Blume.	Oleaceae	Chatura-mallikei	L	Extract	[51]
<i>Myrtus caryophyllus</i> Linn.	Myrtaceae	Cloves, lavangaha, laung	F	Oil	[51]
<i>Myrtus communis</i> Linn.	Myrtaceae	Myrtle, murad	L	Oil	[51]
<i>Naregamia alata</i> W.& A.	Meliaceae	Goanese ipecacuanha, amlavalli	Wh	Extract	[278]
<i>Nicotiana tabacum</i> Linn.	Solanaceae	Tobacco, tambaku, tamrakuta	L	Decoction	[51]
<i>Nyctanthes arbor-tristis</i> Linn.	Oleaceae	Night jasmine, siharu, parijata	L	Infusion	[51]
<i>Ocimum gratissimum</i> Linn.	Labiatae	Shrubby basil, ramtulasi	Wh	Fumigations	[19]

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Table 2: Contd...

Botanical name	Family	Common name	Part used	Dosage form	References
<i>Ocimum sanctum</i> Linn.	Lam.iaceae	Basil	L	Decoction	[14]
<i>Odina wodier</i> Roxb.	Anacardiaceae	Jingini, ajashringi, jingan	L	Paste	[51]
<i>Oldenlandia heynei</i> Hk.	Rubiaceae	Nonganam-pillu	L	Extract	[51]
<i>Olea cuspidate</i> Wall.	Oleaceae	Kahu, zaitum	R	Ashes	[278]
<i>Onosoma bracteatum</i> Wall.	Boraginaceae	Goazaban, kazabun	Wh	Decoction	[51]
<i>Onosoma echoides</i> Linn.	Boraginaceae	Ratanjot, laljari, koame	Fl	Oil	[51]
<i>Origanum majorana</i> Linn.	Labiatae	Wild marjoram, sathra	Wh	Oil	[51]
<i>Origanum vulgare</i> Linn.	Labiatae	Sathra	Wh	Oil	[51]
<i>Oroxylum indicum</i> Vent.	Bignoniaceae	Prathusimbhi, miringa, snapatha	B	Powder	[51]
<i>Osmunda regalis</i> Linn.	Osmundaceae	Royal fern, osmonde	Wh	Extract	[51]
<i>Paederia foetida</i> Linn.	Rubiaceae	Prasarini, gandhali, Chinese flower plant	L	Juice	[51]
<i>Pandanus odoratissimus</i> Willd.	Pandanaceae	Ketaki, fragrant screwpine	F	Oil	[51]
<i>Pandanus tectorius</i> Soland.	Pandanaceae	Umbrella tree, keora, ketgi	Bt	Oil	[278]
<i>Panicum italicum</i> Linn.	Gramineae	Italian millet, kanku	S	Extract	[51]
<i>Papaver dubium</i> Linn.	Papaveraceae	Pale-red poppy	R	Cooked	[278]
<i>Papaver somniferum</i> Linn.	Papaveraceae	Opium poppy, khas khas	S	Liniment	[51]
<i>Pavetta indica</i> Linn.	Rubiaceae	Papat, Indian pellet kankra	W	Infusion	[278]
<i>Pavonia odorata</i> Willd.	Malvaceae	Kalavala, hribera, sugandhabala	R, Wh	Extract	[278]
<i>Pedaliium murex</i> Linn.	Pedaliaceae	Faribduti, gaja daunstree	L	Powder	[51]
<i>Peganum harmala</i> Linn.	Rutaceae	Foreign henna, harmal, kaladana	L	Decoction	[278]
<i>Peucedanum graveolens</i> Benth.	Umbelliferae	Dill, misroya, soya	S, R	Paste	[19]
<i>Pergularis daemia</i> Linn.	Apocynaceae	Utaran, akasan	L	Oil	[279]
<i>Pergularis extensa</i> N.E.	Asclepiadaceae	Sadowani, karial, vishanika	L	Juice	[278]
<i>Phaseolus Roxb.urghii</i> Linn.	Papilionaceae	Black gram, masha	P	Poultice, oil	[51]
<i>Physalis alkekenji</i> Linn.	Solanaceae	Strawberry tomato, rajaputrika	Sbe	Strawberries	[51]
<i>Pinus australis</i> Michaux.	Coniferae	Broom pine, yellow pine	Rs	Liniments	[282]
<i>Pinus balsamea</i> Linn.	Coniferae	American silver fir	St	Oil	[282]
<i>Pinus gerardiana</i> Wall.	Coniferae	Gunobar, neozapine edible pine	S	Confection	[51]
<i>Pinus picea</i> Du Roi.	Coniferae	Norway spruce	St	Extract	[282]
<i>Piper longum</i> Linn.	Piperaceae	Pippali, long-papper	F, R	Oil	[172]
<i>Pisonia aculeate</i> Linn.	Nictaginaceae	Baghachura, kuruindu	B, L	Extract	[51]
<i>Pittosporum floribundum</i> W.& A.	Pittosporaceae	Vchkali, tibilti	B	Decocotion	[51]
<i>Pittosporum napaulense</i> Rehdre.	Pittosporaceae	Yekadi, phurke, vehkali	B	Oil	[278]
<i>Plantago ispagula</i> Forsk.	Plantaginaceae	Ispaghula, snigdhaeera	S	Poultice	[51]
<i>Plantago major</i> Linn.	Plantaginaceae	Barhang, ripple grass, luhuriya	Wh	Extract	[278]
<i>Plantago ovate</i> Forsk.	Plantaginaceae	Shlakshnajira, bartang	S	Poultice	[278]
<i>Plumbago rosea</i> Linn.	lumbaginaceae	Chitraka, rose-colored lead-wort	R	Liniment	[51]
<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae	Ceylon leadwort, chitra	R	Powder	[19]
<i>Plumieria acuminata</i> Poir.	Apocynaceae	Gulchin, kshira	L	Juice	[51]
<i>Plumieria acutifolia</i> Poir.	Apocynaceae	Frangipani, gulachin, chameli	R-B	Extract	[278]
<i>Podphyllum peltatum</i> Linn.	Berberidae	May-apple, mandrake	Rh	Extract	[282]
<i>Poinciana elata</i> Linn.	Papilionaceae	Vayni	Wh	Extract	[51]
<i>Pongamia glabra</i> Vent.	Papilionaceae	Karanja, Indian beech	L	Decoction	[19]
<i>Polygala snega</i> Linn.	Polygonaceae	Rattle snake root	Rs	Extract	[282]
<i>Portulaca oleracea</i> Linn.	Portulacaceae	Pigweed, pursley	L	Juice, poultice	[13]
<i>Premna Hacea</i> Roxb.	Verbenaceae	Bharangi, bhargi	R	Juice	[51]
<i>Premna integrifolia</i> Linn.	Verbenaceae	Arni, agni-mantha	R	Decoction	[299]
<i>Prinsepia utilis</i> Royle.	Rosaceae	Vhekal	O	Oil	[51]
<i>Prosopis spicigera</i> Linn.	Fabaceae	Chhikura, jhand, bhadra	B	Extract	[278]
<i>Prunus persica stokes</i> bot.	Rosaceae	Peach tree, aru	F	Oil	[278]
<i>Prunus triflora</i> Roxb.	Rosaceae	Aruwa, gadharu	F	Oil	[278]
<i>Pseudarthria viscid</i> W.&A.	Papilionaceae	Sanaparni, neermali	Wh	Extract	[51]
<i>Psidium gujava</i> Linn.	Myrtaceae	Safedsafari, amrud, guava tree	L	Oil	[278]
<i>Psoralea corylifolia</i> Linn.	Papilionaceae	Babachi, avalguja, kamboji	S	Maceration	[278]
<i>Ptychotis ajowan</i> DC.	Umbelliferae	Yavanika, bishop's weed, ajowan	F	Oil	[51]
<i>Pueraria tuberosa</i> DC.	Fabaceae	Bilaikand, pona, saloha	R	Crushed	[278]
<i>Pyrethrum indicum</i> DC.	Compositae	Mitha akalakara	R	Paste, confection	[51]
<i>Pyrus malus</i> Linn.	Rosaceae	Sebhaphala, crab apple	F	Juice	[51]
<i>Randia dumetorum</i> Lamk.	Rubiaceae	Madana, emetic nut, mainphal	B	Paste	[19]
<i>Ranunculus avensis</i> Linn.	Ranunculaceae	Corn crow foot, devil's claws	Wh	Extract	[51]
<i>Ranunculus muricatus</i> Linn.	Ranunculaceae	Chambul	Wh	Extract	[278]
<i>Ranunculus trichophyllum</i> Linn.	Ranunculaceae	Water crowfoot	Wh	Extract	[278]
<i>Rhamnus catharticus</i> Linn.	Rhamnaceae	Buckthorn	Rbe	Juice	[282]
<i>Rhazya stricta</i> Dcne.	Apocynaceae	Sunwar, wena, sehar	R, St, L	Infusion	[51]
<i>Rhododendron campanulatum</i> D.Don.	Eriaceae	Cherallu, gaggar, surngar	L	Extract	[51]
<i>Rhododendron javanicum</i> Benn.	Eriaceae	Kechung	L	Extract	[51]

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Botanical name	Family	Common name	Part used	Dosage form	References
<i>Ribes nigrum</i> Linn.	Saxifragaceae	Currants, nabar	C	Currants	[51]
<i>Ricinus communis</i> Linn.	Euphorbiaceae	Castor oil plant, eranda, endi	S	Oil, poultice	[19]
<i>Ruta graveolens</i> Linn.	Rutaceae	Satap, garden rue, pismarum	L	Tincture	[207]
<i>Rubia cordifolia</i> Linn.	Rubiaceae	Madar, manjit, khuri	R	Decoction	[278]
<i>Rourea santaloides</i> W. & A.	Conoraceae	Vardara, wakeri	R	Tonic	[51]
<i>Rosa alba</i> Linn.	Rosaceae	Gulseoti, gulab bahupatrika	Fl	Oil	[278]
<i>Saccolabium pappulosum</i> Lindl.	Orchidaceae	Nakuli, rasna	Rs	Resins	[51]
<i>Salacia oblonga</i> Wall.	Celastraceae	Ponkoranti	R-B	Extract	[51]
<i>Salacia reticulata</i> Wight.	Celastraceae	Ekanayakam, koranti	R-B	Extract	[300]
<i>Salix alba</i> Linn.	Salicaceae	Huntingdon willow, bushan	B	Decoction	[301]
<i>Salvadora oleoides</i> Dcne.	Salvadoraceae	Kabber, mithidiari, jhal	S	Oil	[51]
<i>Salvadora persica</i> Linn.	Salvadoraceae	Pilu, tooth brush tree, chhota-pilu	Fl	Oil	[51]
<i>Samadera indica</i> Gaertn.	Simaroubaceae	Kathai, nibam, daraput	F	Oil	[278]
<i>Sambucus canadensis</i> Linn.	Adoxaceae	American elder	Fl	Oil	[282]
<i>Sambucus nigra</i> Linn.	Adoxaceae	Bore tree	Fl	Oil	[282]
<i>Sansevieria urghiana</i> Roxb and Schult.	Hemodoraceae	Muruva, murahri, katukapel	R	Extract	[51]
<i>Santalum rubrum</i> Linn.	Sapindaceae	Arishta, indian filbert, ritha	R, L	Extract, juice	[51]
<i>Sarcocephalus missionis</i> Wall.	Rubiaceae	Jalamdasa, nirvanji	B	Decoction, powder	[51]
<i>Sassafras officinale</i> Nees.	Laurineae	Sassafras	R	Oil	[51]
<i>Saussurea lappa</i> Clarke.	Compositae	Puskara, costus, kushta, kut	R	Infusion	[217]
<i>Schleichera trijuga</i> Willd.	Sapindaceae	Ceylon oak, gausam	S	Oil	[278]
<i>Schoenocaulon officinale</i> A.Gray.	Melanthaceae	Sabadilla	F, S	Ointment	[51]
<i>Scindapsus officinalis</i> Schitt	Araceae	Poriabel, gajapipal, shreyasi	F	Juice	[282]
<i>Semecarpus anacardium</i> Linn.	Anacardiaceae	Marking-nut tree, bhallataka, bhela	F	Juice	[302]
<i>Sesamum indicum</i> Linn.	Pedaliaceae	Gingelly, bariktel	S	Oil	[278]
<i>Sesbania aegyptiaca</i> Pers.	Papilionaceae	Jayantika, jetrasin	L	Poultice	[51]
<i>Sesbania grandiflora</i> Pers.	Papilionaceae	Agasta, hatiya	R	Paste	[278]
<i>Setaria italic</i> Beauv.	Graminae	Foxtail millet, kangu	Gr	Parching	[51]
<i>Shorea robusta</i> Gaertn.	Dipterocarpaceae	Sal tree, sakhu asvakarna,	B, Rs	Paste	[51]
<i>Sida acuta</i> Burm.	Malvaceae	Bariaca, bala, pranijivika	L	Oil	[19]
<i>Sida cordifolia</i> Linn.	Malvaceae	Bariar, batyalaka, simak	R, S	Oil	[51]
<i>Sida rhombifolia</i> Linn.	Malvaceae	Sahadeva, kharenti	R	Oil	[218]
<i>Siegesbeckia orientalis</i> Linn.	Compositae	Katampam, kau-kan	Wh	Tincture	[51]
<i>Skimmia laureola</i> Sieb.	Rutaceae	Ner	Wh	Extract	[279]
<i>Smilax china</i> Linn.	Liliaceae	Dwipautra, china root, chobchini	R	Decoction	[19]
<i>Smilax lanceifolia</i> Roxb.	Liliaceae	Bari-chobchini	R	Juice	[51]
<i>Smilax officinalis</i> Kunth.	Smilacaceae	Jamaica sarsaparilla	R	Powder, extract	[282]
<i>Smilax zeylanica</i> Linn.	Liliaceae	Chobchini, ramdatun	R	Paste	[278]
<i>Smithia conferta</i> Sm.	Papilionaceae	Smithia	Wh	Extract	[278]
<i>Solanum dulcamara</i> Linn.	Solanaceae	Kakmachi, bitter-sweet, rubabarik	Be	Decoction	[51]
<i>Solanum nigrum</i> Linn.	Solanaceae	Makoi, kambei, kamuni	L	Poultice	[51]
<i>Solanum xanthocarpum</i> Schrad & Wendll.	Solanaceae	Kantakari, warumba, bhutkatya	Wh, Be	Juice	[51]
<i>Spilanthes acmella</i> Murr.	Compositae	Pokormul, akarkara	L	Decoction	[278]
<i>Spondis pinnate</i> Kurz.	Anacardiaceae	Amarah, Indian hog plum, ambra	L	Juice	[278]
<i>Stachytarpheta indica</i> Vahl.	Verbenaceae	Aaron's rod	L	Juice	[278]
<i>Strychnos bournillonii</i> Trees.	Loganiaceae	Nirmali, clearing nut tree	R	Decoction	[278]
<i>Strychnos cinnamomifolia</i> Thw. Enum.	Loganiaceae	Etakirindiwel, welbeli	R	Decoction	[278]
<i>Strychnos nux-vomica</i> Linn.	Loganiaceae	Kupilu, poison-nut, kaghphala	S	Powder	[303]
<i>Strychnos potatorum</i> Linn.	Loganiaceae	Clearing-nut tree	S	Powder	[303]
<i>Teucrium polium</i> Linn.	Labiatae	Cat thyme, poley	L	Infusion	[280]
<i>Teramus labialis</i> Spreng.	Combretaceae	Masha-parui, mashani	B	Decoction	[51]
<i>Terminalia belerica</i> Roxb.	Combretaceae	Vibhitaki, bhaira	K	Oil	[51]
<i>Terminalia chebula</i> Retz.	Combretaceae	Pathya, myrobalan, Indian gall-nut	F	Powder	[19]
<i>Tinospora cordifolia</i> Miers.	Menispermaceae	Ambarvel, gharol, gulwel	R, St	Starch	[278]
<i>Tinospora malabarica</i> Miers.	Menispermaceae	Gurch, giloe, padmagaluncha	L, St	Extract	[278]
<i>Thevetia nerifolia</i> Juss.	Apocynaceae	Yellow oleander, pilakanir, ashvaha	S	Oil	[278]
<i>Thymus vulgaris</i> Linn.	Labiatae	Garden thyme	Wh	Oil	[282]
<i>Toddalia aculeate</i> Lamk.	Rutaceae	Kanchana, jangli-kali-mirch, limri	F, R	Oil	[51]
<i>Toddalia asiatica</i> Lam.	Rutaceae	Dahan, lopez root, forest pepper	F, R	Liniment	[278]
<i>Toddalia bilocularis</i> W. & A.	Rutaceae	Krishna-aguru, devadarom	W	Oil	[51]
<i>Toluijera pereirae</i> Baill.	Fabaceae	Peru balsam	B	Balsam	[282]
<i>Trewia nudiflora</i> Linn.	Euphorbiaceae	Pindara, pitoli, sivani	R	Decoction	[51]
<i>Tribulus terrestris</i> Linn.	Zygophyllaceae	Small caltrops, gokshura, chota-gokhura	F	Decoction	[19]
<i>Trichosanthes palmate</i> Roxb.	Cucurbitaceae	Indrayan, mahakala kaundal	F	Juice	[278]
<i>Trigonella foenum-gaeceum</i> Linn.	Papilionaceae	Methi, medhika	S	Confection	[247]
<i>Tylophora asthmatica</i> W. & A.	Acsepiadaceae	Jangli-pikvan, antamul	L	Powder, decoction	[51]

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Table 2: Contd...

Botanical name	Family	Common name	Part used	Dosage form	References
<i>Unona narum</i> Dun.	Anonaceae	Gunamanijhad, unaminigida	L	Extract	[51]
<i>Uraria lagopoides</i> DC.	Papilionaceae	Pitvan, prasniparni Dowla	Wh	Decoction	[51]
<i>Urena lobata</i> Linn.	Malvaceae	Latloti, kunjia, tapkote	R	Extract	[51]
<i>Urgenia indica</i> Kunth.	Liliaceae	Indian squill, jangli-piyaz, phaphor	Bu	Tincture, powder	[51]
<i>Urtica dioica</i> Linn.	Urticaceae	Common nettle, scaddie	L	Decoction, powder	[278]
<i>Vanda roxburghii</i> Br.	Orchidaceae	Rasna-nai, vandaka	R	Extract	[51]
<i>Vanda tessellate</i> Hook.	Orchidaceae	Rasna, Perasara	R	Decoction	[278]
<i>Valeriana officinalis</i> Linn.	Valerianaceae	Capon's tail, setwall	R	Oil	[278]
<i>Vateria indica</i> Linn.	Dipterocarpaceae	White damimer tree, kahruaba, ajakarna	S	Oil	[51]
<i>Vepris bilocularis</i> Engler.	Rutaceae	Vepris	W	Oil	[278]
<i>Veratrum viride</i> Solander.	Melanthaceae	Indian poke	Rh	Extract	[282]
<i>Verbascum thapsus</i> Linn.	Scrophulariaceae	Feltwort, blanket-leaf, rag paper	L	Paste	[278]
<i>Verbena officinalis</i> Linn.	Verbenaceae	Frog foot, karaita, tears of junco	L	Paste	[278]
<i>Vernonia anthelmintica</i> Willd.	Compositae	Somaraja, bakchi, purple fleabane	L, R	Extract	[51]
<i>Viola tricolor</i> Linn.	Violaceae	Flame flower, gardengate	Wh	Infusion	[278]
<i>Vitex negundo</i> Linn.	Verbenaceae	Nirgundi, mewri, sawbhalu	L	Poultice	[258]
<i>Vitex trifolia</i> Linn.	Verbenaceae	Jalanirgundi, nichindi, surasa	L	Infusion	[51]
<i>Vitis pallida</i> W.&A.	Vitaceae	Chunnampuvalli	L	Juice	[51]
<i>Vitis vinifera</i> Linn.	Vitaceae	Grapes, draksha, kishmish	F	Resins	[51]
<i>Withania somnifera</i> Dunal.	Solanaceae	Ashvagandha, winter cherry	R	Oil, Taila	[304]
<i>Xylia dolabriformis</i> Benth.	Papilionaceae	Schmsapa, irula	B	Decoction	[51]
<i>Zingiber officinale</i> Roscoe.	Taminaceae	Nagaram, ginger sonth	Rh	Infusion	[280]
<i>Zizyphus jujube</i> Mill.	Rhamnaceae	Badari, baer	R-B	Juice	[19]

L: Leaves, R: Roots, H: Herb, Wh: Whole plant, Rh: Rhizome, B: Bark, F: Fruit, Bu: Bulb, S: Seed, T: Tubers, Fl: Flowers, Mj: Milky juice, G: Grass, St: Stems, W: Wood, Be: Berries, Gm: Gum, K: Kernel, Sh: Shoot, C: Camphor, Rs: Resin, Br: Branches, Sg: Stigmas, Sp: Spores, Bt: Bracts, Sbe: Strawberries, Rbe: Ripeberries, Gr: Grain, C: Currants, O: Oil, P: Pulse, Sr: Sarocarp, Nt: Nuts, Al pt: Aerial parts, Ug pt: Underground parts-Ug pt

***Boswellia serrate* Roxb. (BS) (Family-Burseraceae)**

BS is a deciduous middle-sized tree, grown in tropical parts of Asia and Africa [64]. Boswellic acid is the first terpenoids isolated from oleo gum resins. The oleo gum resin of BS is used in various Unani and Ayurvedic preparations. Folkloric uses of BS are in the treatment of bronchitis, rheumatism, asthma, cough, intestinal problems, syphilitic, jaundice, dysentery, and pulmonary diseases. It acts as both internal and external stimulant, expectorant, diuretic, and stomachic [51,64]. *Boswellia* is a traditional natural remedy that has been used for thousands of years to treat swelling and inflammation in Ayurvedic medicine and traditional Chinese medicine. In 2003, medical researchers conducted a randomized blind placebo controlled trial of BS on 30 patients suffering from osteoarthritis of the knee. The data showed an increased range of motion and less swelling in their knees from arthritis than before they began the treatment. The essential oil of BS predominantly comprised monoterpenoids, of which β -pinene is the major constituent. Other monoterpenoids includes β -pinene, cis-verbenol, trans-pinocarveol, borneol, myrcene, verbenone, limonene, and p-cymene, while α -copaene was the only sesquiterpene identified [65,66]. BS possess an anti-inflammatory [67], analgesics [68], immunomodulatory [69], anticancer [70,71,72], hepatoprotective, hypolipidemic [73], antiasthmatic [74], osteoarthritis, and hypoglycemic activities [75]. The n-hexane extract of gum resins of BS in combination with methanolic extract of rhizomes of *Glycyrrhiza glabra* (GY) exhibited anti-arthritis activity at doses of 50 or 100 mg/kg in male wistar rats. The anti-arthritis activity is mainly by decreasing the activity of membrane marker enzymes such as alkaline phosphatase, serum glutamic oxaloacetic transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), and by the prevention

of leucocytes migration in the inflamed area. In conclusion, BS possesses a significant anti-arthritis activity on male albino wistar rats [76].

***Caesalpinia sappan* Linn. (CP) (Family-Leguminosae)**

CP commonly known as sappanwood, bakam or patang, is a native of South India, Madhya Pradesh, Orissa, West Bengal, Malaya, and Sri Lanka. The tree spreads to a height of 10 m and is cultivated for its large, ornamental penicels of yellow flowers. A very strong barrier is formed by the branches when they are interlaced [11]. The heartwood of the CP is traditionally used for the treatment of ulcers, leprosy, rheumatism, skin disease, diarrhea, dysentery, epilepsy, convulsions, diabetes, odontopathy, stomatopathy, and leucorrhoea. The heartwood of the CP is bitter, astringent, sweet, acrid, refrigerant, constipating, sedative, and hemostatic. In Yunani system, the decoction of wood was useful in rheumatism [77,78]. CP is reported to have an anti-anaphylactic [79], anti-coagulant [80], anti-bacterial [81-83], anti-fungal [83], anti-inflammatory [84], anti-tumor [85-87], anti-viral [88,89], immunostimulant [87], and semen coagulating activities [86]. CP also causes the inhibition of phosphodiesterase [90] and stimulation of glutamate pyruvate transaminase [91] and tyrosinase enzymes [92]. The ethanolic extract at doses 1.2, 2.4, and 3.6 g/kg of CP wood showed anti-arthritis activity on wistar rats by declining the levels of IL-1 β , IL-6, TNF- α , and prostaglandin E₂ (PGE₂) in serum. The study concluded that CP possesses an anti-arthritis activity on rats [93].

***Cannabis sativum* Linn. (CT) (Family-Urticaceae)**

CT, a pistillate plant, is a native of Persia, Western and central Asia, and is now largely cultivated all over India.

Table 3: Plants with reported anti-arthritic activity

Botanical name	Family	Common name	Part	Extract	Dose (p.o.)	Acute toxicity (p.o.)	Model	Mode of action	Reference
<i>Acyranthus aspera</i> Linn.	Amaranthaceae	Devil's horsewhip	S, R	Alcohol	15 mg/100 g	Safe upto 8 g/kg	FIA	Inhibition of secondary lesions	[281,305]
<i>Achyranthes aspera</i> Linn.	Amaranthaceae	Apamarga	R	Ethanol	100-200 mg/kg	Safe upto 8 g/kg	CFA	Prevented the recruitment of leukocytes	[217,305]
<i>Aconitum vimorinianum</i> Kom.	Ranunculaceae	Huang Cao Wu	R	Ethanol	10-100 mg/kg	D.N.A	CFA	Improvement of joint allodynia, swelling, hyperaemia and vascular permeability	[306]
<i>Ajuga bracteosa</i> Wall.	Labiatae	Ground pine	Wh	Ethanol	5, 10, 20 mg/kg	LD ₅₀ > 5 g/kg	TIA FOIA CFA CFA	COX-1 and COX-2 inhibition	[307,308]
<i>Ajuga decumbens</i> Thunberg.	Lamiaceae	Bugle weed	Wh	70% ethanol	30, 50, 150 mg/kg	D.N.A	CFA	Regulates the balance between bone resorption and bone formation	[309]
<i>Alistonia boonei</i> De Wild.	Apocynaceae	Cheese wood, pattern wood	St, B	Methanol	50, 100, 200, 400 mg/kg	D.N.A	FIA CFA	Inhibition of both the early and late phases of pain stimulus.	[310]
<i>Alistonia scholaris</i> Linn. R.Br.	Apocynaceae	Dita bark, devil tree	L	Ethanol	100, 200, 400 mg/kg	≥ 2 g/kg	CFA	Reduction of total leukocyte migration as well as lymphocytes and monocytes/macrophages migration	[27]
<i>Ammania brachifera</i> Linn.	Lythraceae	Acrid weed, tooth cup	L	Aqueous alcoholic	250, 500 mg/kg	≥ 5000 mg/kg	CFA	Decrease the ESR and WBC count	[2]
<i>Aristolochia bracteata</i> Lam.	Aristolochiaceae	Kidamari	Wh	Pet ether, chloroform, methanol	100, 200, 400 mg/kg	Safe upto 4 g/kg	CFA	Maintenance of synovial membrane and vascular permeability, thereby inhibiting cytokines and leukotriene infiltration	[43]
<i>Argyrea speciosa</i> Sweet.	Convulvulaceae	Elephant creeper	R	Ethanol	50-100 mg/kg	≥ 3000 mg/kg	CFA	Prevented the recruitment of leukocytes	[217,311]
<i>Arisaema rhizomatum</i> Fischer.	Aroideae	Jack in the pulpit	Rh	Methanol	130, 261, 522 mg/kg	Safe upto 40 g/kg	CIA	Inhibits arthritis deterioration the secretion of pro-inflammatory cytokines and RA factor	[3]
<i>Arnebia euchroma</i> Johnston.	Boraginaceae	Pink arnebia, demok	R	95% ethanol	2.5, 5, 10 mg/kg	D.N.A	CIA AIA	Suppressing the levels of TNF-α and IL-1β	[312]
<i>Artocarpus tonkinensis</i> A. Cheval.	Moraceae	Chay	L	Ethyl acetate	10-200 mg/kg	D.N.A	CIA	Apoptosis induction in activated T-cells	[6]
<i>Asystasia dalzelliana</i> Santapau.	Acanthaceae	Violet asystasia	L	Ethanol	200, 400, 800 mg/kg	≥ 2000 mg/kg	CFA	Decreasing synthesis/release of T-cell mediators	[4]
<i>Baccharis genistilloides</i> Linn.	Asteraceae	Carqueja	Ar pt	Aqueous	4.2 mg/kg	Safe upto 42 mg/kg	CIA	IL-1 induced production of progelatinase B and PGE2, and synovial fibroblast proliferation have been suppressed	[313]
<i>Bacopa monniera</i> Penell.	Scrophulariaceae	Herpestis monniera	Wh	Methanol	100 mg/kg	≥ 3000 mg/kg	CFA	Stabilizing action on lysosomal membranes	[283,314]
<i>Barleria lupulina</i> Lindl.	Acanthaceae	Hophead	L	Methanol	300, 600 mg/kg	D.N.A	CFA CIA	Assisting cell mediated immune responses	[7]
<i>Barleria prionitis</i> Linn.	Acanthaceae	Katsareya, karunta	Wh	Hydro-alcoholic	12.5, 25, 50, 100 mg/kg	Safe upto 3000 mg/kg	AIA	Lowers the ESR level and have an immune-modulatory activity	[315]
<i>Bauhinia variegata</i> Linn.	Caesalpinaceae	Kachnar, chingthrao	St	Ethanol	250 mg/kg	Safe upto 2000 mg/kg	CFA	Superoxide dismutase, catalase, glutathione peroxidase and lipid peroxide	[8,316]
<i>Bergenia stracheyi</i> Linn.	Saxifragaceae	Paashaanbhd	Rh	Pet ether and methanol	40 mg/kg	Safe upto 2000 mg/kg	AIA	Potential Th1/Th2 cytokine balancing activity	[317]
<i>Boerhaavia diffusa</i> Linn.	Nyctaginaceae	Punarnava	R	Pet ether	500-1000 mg/kg	≥ 1000 mg/kg	CFA	Inhibition of inflammatory 7 inhibitor	[63]
<i>Boswellia carterii</i> Birdw.	Bursaceae	Olibanum	Rs	70% aqueous acetone	0.90 g/kg	Safe upto 0.90 g/kg	CFA	Decrease the formation of leukotriene LTB4 and reduce the infiltration of leucocytes	[318]

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Table 3: Contd...

Botanical name	Family	Common name	Part	Extract	Dose (p.o.)	Acute toxicity (p.o.)	Model	Mode of action	Reference
<i>Boswellia serrata</i> Triana.	Burseraceae	Salai gugul	Rs	n-hexane	50 mg/kg	Safe upto 50 mg/kg	CFA	Lysosomal membrane stability modulating effect, inhibiting leukocyte migration, controlling the production of auto antigens and anti-proteinase activity	[76]
<i>Butea monosperma</i> Linn.	Fabaceae	Palash, keshu, bastard Teak	Wh	Pet ether	100-200 mg/kg	Safe upto 2000 mg/kg	CFA	Improvement in levels of hemoglobin and RBC; levels of WBC, ESR were suppressed	[319,320]
<i>Caesalpinia sappan</i> Linn.	Leguminosae	Sapanwood, suou	W	Ethanol	2.5, 5, 10 ug/ml	Safe upto 5000 mg/kg	In vitro, cartilage/ chondrocyte protection	Inhibited the expression of pro-inflammatory cytokines IL-1 β and TNF- α	[321,322]
<i>Caesalpinia sappan</i> Linn.	Leguminosae	Sappanwood, suou	W	Ethanol	1.2, 2.4, 3.6 g/kg	Safe upto 5000 mg/kg	CIA	Decreasing the levels of IL-1 β , IL-6, TNF- α and PGE2 in serum and the expression of COX-2 and transcription factor NF- κ B	[93,322]
<i>Calotropis gigantean</i> R.Br.	Asclepiadaceae	Milkweed	AI	Petroleum ether	50 mg/kg	Safe upto 2000 mg/kg	CFA	Pro-inflammatory cytokines as well as anti-inflammatory cytokines are reduced	[323,324]
<i>Calotropis procera</i> R.Br.	Apocynaceae	Sodom apple	AI	Methanol	50-500 mg/kg	Safe upto 2000 mg/kg	CFA	Inhibit cellular influx and vascular permeability	[325,326]
<i>Caltha palustris</i> Linn.	Ranunculaceae	Kingcup, marsh marigold	Wh	Methanol	10 mg/kg	D.N.A	CIA	Decrease in the percentage and the absolute count of splenic T-regulatory cells (CD4 ⁺ CD25 ⁺ FOXP3 ⁺)	[327]
<i>Cannabis sativum</i> Linn.	Cannabaceae	Ganja, indian hemp	L	Alcoholic	10, 25 mg/kg	D.N.A	CIA	Diminished CII-specific proliferation and IFN- γ production	[98]
<i>Capparis erythrocarpus</i> Isert.	Capparaceae	Flamingo lily	R	Ethanol	100, 300 mg/kg	D.N.A	AIA	Inhibit the release of pre-inflammatory cytokines and immunosuppressant action	[328]
<i>Capparis spinosa</i> Linn.	Capparaceae	Flinders rose	F	Hydroalcoholic	240-600 mg/kg	D.N.A	CFA	Conteract the effects of IL-1	[329]
<i>Cardiospermum halicacabum</i> Linn.	Spindaceae	Ballon plant	L	Ethanol	250-500 mg/kg	D.N.A	CFA	Reduction of RF and CRP levels in the serum	[284]
<i>Cassia uniflora</i> Mill.	Caesalpinaceae	One leaf senna	L	Methanol, pet ether, ethyl acetate	50, 100 mg/kg	\geq 1000 mg/kg	CFA	Histamine and prostaglandin synthesis inhibition	[330]
<i>Cayaponia tayuya</i> Cogn.	Cucurbitaceae	Tayuya	R	Hydroalcoholic	1 mg/kg	D.N.A	AIA	Modifying the cell infiltration and the expression of both nitric oxide synthase-2 and COX-2. Decreases TNF- α & IL-1 β production in lymphocytes	[331]
<i>Celastrus aculeatus</i> Merr.	Celastraceae	Gua shan fena	R, St	Ethanol	1-3 g/kg	LD ₅₀ = 20.5 mg/kg	CFA	Down modulation of immunological and biochemical mediator	[332,333]
<i>Centella asiatica</i> Urban.	Mackinlayaceae	Brahmi booti	L	Methanol	0.5 ml		HRBC-MS	Inhibition of protein denaturation membrane stabilization and proteinase inhibitory	[285]
<i>Cinnamomum zey/caninum</i> Breyn.	Lauraceae	Dalchini	B	Aqueous	8 mg/kg	D.N.A	CFA	Inhibition of leukocyte emigration and prostaglandins	[109]
<i>Cissampelos pareira</i> Linn.	Menispermaceae	Abuta, barbasco, butua	R	50% aqueous ethanol	200-400 mg/kg	Safe upto 2000 mg/kg	CFA	Levels of acid phosphatase and N-acetyl glucosaminidase were reduced and hexose, sialic acid increased.	[334,335]
<i>Chelidonium majus</i> Linn.	Papaveraceae	Tetterwort	AI	Methanol	40/400 mg/kg	D.N.A	CIA	Lower the absolute number of CD4 ⁺ T cells in spleen and lymph node, induce immunosuppressive response by lowering the CD4 ⁺ T-cells and enhancing CD8 ⁺ T-cells.	[336]

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Table 3: Contd...

Botanical name	Family	Common name	Part	Extract	Dose (p.o.)	Acute toxicity (p.o.)	Model	Mode of action	Reference
<i>Clematis chinensis</i> Osbeck.	Ranunculaceae	Wei Ling xian	R	Aqueous Methanol Acetone	100 mg/kg	D.N.A	LPS	Inhibited PGE2 production and COX-2 expression	[337]
<i>Cleome gyandra</i> L.	Cleomaceae	Shone cabbage	L	Ethanol	150 mg/kg	Safe upto 2000 mg/kg	CFA	Modifying the lysosomal membrane or by inhibiting the release of lysosomal enzymes	[286,338]
<i>Coriandrum sativum</i> Linn.	Apiaceae	Cilantro, dhania	S	Hydroalcoholic	8, 16, 32 mg/kg	Safe upto 2000 mg/kg	CFA	Inhibit the secretion of pro-inflammatory cytokines including TNF- α	[120,339]
<i>Costus speciosus</i> Sm.	Zingiberaceae	Keukand	AI	Methanol	400, 800 mg/kg	Safe upto 2000 mg/kg	CFA	Suppression of inflammatory mediators	[287,340]
<i>Curcuma longa</i> Linn.	Zingiberaceae	Turmeric	Rh	N-hexane	520 mg/kg	D.N.A	SCW	Activation of genes critical to articular inflammation	[130]
<i>Curcuma zoodaria</i> Rosc.	Zingiberaceae	White turmeric	R	Pet ether Chloroform	200, 400 mg/kg	Safe upto 5000 mg/kg	CFA	Decrease the latency time to explore	[341]
<i>Delonix elata</i> , Gambles.	Cesalpinoideae	White gulmohar, waykaran	B	Pet ether Chloroform	250 mg/kg	Safe upto 5000 mg/kg	CFA	Blocking the action of COX, LO and AT and thus preventing the generation of mediators	[288]
<i>Dipsacus asperoides</i> Linn.	Dipsacaceae	Japanese teasel root	R	Hydroalcoholic Aqueous	50-100 mg/kg	D.N.A	CIA	Reduced the levels of anti-CII IgG2a antibody, PGE ₂ , TNF- α , IL-1 β and IL-6	[342]
<i>Drynaria quercifolia</i> L.	Polypodiaceae	Oak leaf fern	Rh	Aqueous	100-200 mg/kg	Safe upto 2000 mg/kg	CFA	Inhibition of ROS release	[342,259]
<i>Elaeocarpus sphaericus</i> L.f.	Elaeocarpaceae	Blue marble tree, Indian oil fruit	Wh	Ethanol	250 mg/kg	Safe upto 2500 mg/kg	CFA	Immunosuppressant action and inhibition of leukocytes migration in inflamed areas	[344]
<i>Ephedra sinica</i> Staph.	Ephedraceae	Ma Haung	H	Water	50 ul s.c.	D.N.A	CFA	mRNA expressions of TNF- α and IL-6 genes restored to normal levels	[289]
<i>Euphorbia antiquorum</i> Linn.	Euphorbiaceae	Antique spurge	Wh	Aqueous, ethanol	400 mg/kg	≥ 2 g/kg	CFA	Inhibition of the arachidonic metabolites and suppression of cell-mediated immunity	[290]
<i>Ficus bengalensis</i> Linn.	Moraceae	Banyan tree bargad	St B	Methanol	100, 200, 300 mg/kg	Safe upto 4 g/kg	CFA FIA	Inhibition of early phase of inflammation	[291]
<i>Ginkgo biloba</i> Linn.	Ginkgoaceae	Maidenhair tree	L	Methanol	2 mg/kg	D.N.A	AGIA CFA CACW	Inhibition of NO production from the macrophages that infiltrated to the inflamed site	[345]
<i>Glycosmis pentaphylla</i> Linn.	Rutaceae	Orange berry	B	Ethanol	400, 800 mg/kg	Safe upto 4 g/kg	CFA	significant improvement of the hematological parameters like RBC count, Hb level and the ESR	[346]
<i>Glycyrrhiza glabra</i> Linn.	Fabaceae	Liquorice mulethi	Rh	Methanol	150 mg/kg	Safe upto 5 g/kg	CFA	Lysosomal membrane stability modulating effect, inhibiting leukocyte migration, controlling the production of auto antigens and anti-proteinase activity	[76]
<i>Hedera helix</i> Linn.	Araliaceae	European ivy	L	Ethanol	2.5-7.5 ml/kg	LD ₅₀ = 2.5 g/kg	FIA	Reduction in arthritic symptoms	[347,348]
<i>Hemidesmus indicus</i> R.Br.	Asclepiaceae	Indian sarsaparilla	R	Hydroalcoholic	450 mg/kg	LD ₅₀ > 2000 mg/kg	CFA	Inhibition of inflammation induced by caragenin, bradykinin and serotonin	[292]
<i>Hippocratea excels</i> H.B.K.	Hippocreataeae	Mata piojo, cancerina	B	Ethanol	25, 50, 100 mg/kg	D.N.A	FIA	Activity against both exudative and proliferative phases of inflammation	[349]
<i>Hybanthus emneaspermus</i> Muell.	Violaceae	Humpback flower	Wh	Aqueous Ethanol	500 mg/kg	Safe upto 5000 mg/kg	CFA	Inhibits the release of mediators like cytokines (IL-1 β and TNF- α), GM-CSF, IFN and PGDF	[350]

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Table 3: Contd...

Botanical name	Family	Common name	Part	Extract	Dose (p.o.)	Acute toxicity (p.o.)	Model	Mode of action	Reference
<i>Jatropha isabeliei</i> Mull.	Euphorbiaceae	Physic nut	Ug pt	Ethanol	100-300 mg/kg	Safe upto 300 mg/kg	MSUIA	Prevent the neutrophil infiltration	[293]
<i>Justicia gendarussa</i> Linn.	Acanthaceae	Willow leaved justice	L	Ethanol	100 mg/kg	LD ₅₀ =1000 mg/kg	CFA CIA	Inhibition of migration of leukocytes	[294]
<i>Lantana camara</i> Linn.	Verbinaceae	Lava	L	Ethanol	5, 10, 20 mg.kg	D.N.A	TIA	Lipoxygenase and/or cyclooxygenase inhibition	[151]
<i>Laportea bulbifera</i> Weddell.	Urticaceae	Mukago-irakusa	R	Ethanol	20, 40, 60 mg/kg	D.N.A	CIA	Decrease in the production of IFN- α and IL-2, an increase of IL-10 and TGF- β	[351]
<i>Lawsonia inermis</i> Linn.	Lythraceae	Henna, mehandi	L	70% aqueous ethyl alcohol	200, 400 mg/kg	Safe upto 400 mg/kg	CFA FOIA	Decrease in both acute and chronic phase of inflammation due to suppression of inflammatory mediators	[295]
<i>Leucas aspera</i> Willd.	Lamiaceae	Thumbai	Al pt	N-hexane chloroform ethyl acetate ethanol	100, 200 mg/kg	Safe upto 2000 mg/kg	CFA	Increased levels of CRP, TNF- α and IL-2 were decline	[296]
<i>Linum usitatissimum</i> Linn.	Linaceae	Flax	S	Petroleum ether	1, 3 ml/kg	Safe upto 5000 mg/kg	CFA, FIA	Inhibitory effect on arachidonate metabolism	[297,352]
<i>Lonicera japonica</i> Thunb.	Caprifoliaceae	Japanese honey suckle	L	Methanol	1-2 mg/kg i.p.	Safe upto 5000 mg/kg	CACW	Suppress T-cell proliferation	[353,354]
<i>Mallotus oppositifolium</i> Mull.	Euphorbeaceae	Geisel	L	Methanol	100 mg/kg	\geq 6000 mg/kg	FIA	Anti-proliferative activity	[355,356]
<i>Merremia emarginata</i> Burm.	Convolvulaceae	Kupit-kupit	Wh	Ethanol	100, 200, 400 mg/kg	Safe upto 2000 mg/kg	CFA	Improves ESR and hemoglobin values and restores body weight	[357]
<i>Merremia tridentata</i> Hall.	Convolvulaceae	Mudiarkunthal, savulikodi, thrippan-pullu	Wh	Ethanol	100, 200 mg/kg	LD ₅₀ =400 mg/kg	CFA	Inhibition of second phase of inflammation and release of kinins and PG's	[298]
<i>Operculina turpethum</i> Linn.	Convolvulaceae	Turpeth	R	Ethanol	200,400, 600, 800 ug/ml	\geq 2000 mg/kg	IPDN	Inhibit the denaturation of proteins	[358,359]
<i>Panax ginseng</i> C.A.Meyer.	Araliaceae	Ginseng	R	Ethanol	10 mg/kg	D.N.A.	CIA	Suppressed TPA-induced acute inflammation	[360]
<i>Phyllanthus amarus</i> Schum.and Thomm.	Euphorbiaceae	Chanca piedra	Wh	Aqueous	100, 200, 400 mg/kg	Safe upto 2000 mg/kg	CFA	ALT and IT levels were reduced	[165]
<i>Physalis angulate</i> Linn.	Solanaceae	Fisalia	L	Aqueous, ethanol, methanol	100-1000 ug/ml	Safe upto 5000 mg/kg	HRBC-MS	Inhibit the denaturation of proteins	[361,362]
<i>Pinus maritime</i> Roxb.	Pinaceae	Maritime pine	B	Hydroalcoholic	1%	Safe upto 4000 mg/kg	CIA	Inhibiting acute and chronic inflammatory lesions and production of NO	[363,364]
<i>Piper betle</i> Linn.	Piperaceae	Tambula	L	Hydroalcoholic	0.25, 0.5, 1, 2, 4 mg/kg	Safe upto 1000 mg/kg	CFA	Elevated levels of CD4+ T cell specific IFN-c in splenocytes are reduced	[365]
<i>Piper longum</i> Linn.	Piperaceae	Pippali	F	Aqueous	200, 400 mg/kg	\geq 2500 mg/kg	CFA	inhibited the adherence of neutrophils to endothelial monolayer by inhibiting the TNF- α induced expression of ICAM-1, VCAM-1 and E-selectin and also inhibits activation of NF-kB	[172,111]
<i>Pisonia grandis</i> R.Br.	Nyctaginaceae	Grand devil's-claws	L	Ethanol	300 mg/kg	Safe upto 2000 mg/kg	CFA	Release of mediators like cytokines, GM-CSF, interferons and PGDF are suppressed	[366]
<i>Pistia stratototes</i> Linn.	Araceae	Water lettuce	L	Aqueous Ethanol	30, 100, 300 mg/kg	LD ₅₀ =850 mg/kg i.p.	AIA	Low levels of C-reactive proteins and ESR	[367,368]

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Table 3: Contd...

Botanical name	Family	Common name	Part	Extract	Dose (p.o.)	Acute toxicity (p.o.)	Model	Mode of action	Reference
<i>Pleurotus sajorcaju</i> Singer.	Pleurotaceae	Oyster mushroom	F	Aqueous Methanol	500, 1000 mg/ kg	D.N.A.	AIA	Suppression of splenic lymphocytes	[369]
<i>Premna serratifolia</i> Linn.	Verbenaceae	Agnimantha	W	Ethanol	300 mg/kg	Safe upto 2000 mg/kg	CFA	Suppression of migration of leukocytes	[299]
<i>Pseudocedrea kotschy</i> Schweinf.	Meliaceae	Hard cedar, Senegals basari	L	Aqueous	200, 400 mg/kg	Safe upto 2000 mg/kg	COIA	Reduction in inflammation due to mediators suppression	[370]
<i>Punica granatum</i> Linn.	Lythraceae	Pomegranate	F	Solid phase extraction	13.6-34 mg/kg	Safe upto 2000 mg/kg	CIA	Inhibition of spectrum of signal transduction pathway	[196,371]
<i>Rhus verniciflua</i> Stokes.	Anacardeaceae	Chinese lacquer tree	B	N-hexane	50 mg/kg	5 g/kg	CIA	Suppressive effects on inflammatory cytokines/chemokines and angiogenic factor in IL-1 β -stimulated RA	[372]
<i>Ruta graveolens</i> Linn.	Rutaceae	Rue	Al pt	Aqueous	10 mg/kg	≥ 10 g/kg	CFA	Reduces cell influx, release of mediators, lipid peroxidation and oxidative stress	[207,373]
<i>Salacia reticulata</i> Wight.	Celastraceae	Kiothala himbutu	L	Ethanol	25 ug dry powder/ml	2000 μ g/ml	CIA	Inhibition of IL-1 β - activated cell proliferation and regulation of mRNA expression	[300]
<i>Salix nigra</i> Linn.	Saliaceae	Black willow	B	Methanol	100 mg/kg	D.N.A.	CIA	Inhibition of pro inflammatory inhibitors	[301]
<i>Saraca asoca</i> Roxb.	Rubeacea	Sorrow less	B	Methanol	1-5 g/kg	LD ₅₀ = 6.5 gm/kg	CFA	Antagonistic action against the pro-inflammatory cytokines and stabilizing effect on lysosomal membrane, reduction in release of acid hydrolase	[343,374]
<i>Saussurea lappa</i> Clarke.	Compositae	Kuth roots	R	Ethanol	50, 100, 200 mg/kg	Safe upto 2000 mg/kg	CFA	Inhibited TNF-release from LPS-stimulated murine macrophage cell line	[217,375]
<i>Semecarpus anacardium</i> Linn.	Anacardiaceae	Bhallatak	Nt	Nut milk extract	150 mg/kg	Safe upto 5 g/kg	CFA	Inhibition of cytokine production	[302,376]
<i>Sida rhombifolia</i> Linn.	Malvaceae	Cuban jute, jelly leaf	Al pt	Methanol, petroleum ether	30-100 mg/kg	Safe upto 5000 mg/kg	CFA	Generation of reactive oxygen species was suppressed	[218,377]
<i>Sinomenium acutum</i> Rehd.	Menispermaceae	Tudurafuji	R	Alcoholic	15, 50, 150 mg/kg i.p.	D.N.A.	CFA	Inhibition of lymphocyte proliferation and macrophage Function and reduction of the ESR	[378]
<i>Smithia sensitive</i> Smith.	Fabaceae	Odabirmi	Wh	Methanol pet ether chloroform	10 ml/kg	Safe upto 2000 mg/kg	FIA	Inhibition in the hypotonicity	[379]
<i>Sophora flavescens</i> Aoton.	Fabaceae	Kurara worm killer	R	Ethanol	100 mg/kg	D.N.A.	AIA	Inhibition of COX-2 -catalyzed PGE2 and iNOS	[380]
<i>Strobilanthus callosus</i> Nees.	Acanthaceae	Marudona	R	Pet ether	200, 400, 800 mg/kg	Safe upto 2000 mg/kg	CFA	Reduce levels of lipid peroxides, glutathione peroxidase and catalase	[381,382]
<i>Strychnus potatorum</i> Linn.	Loganaceae	Clearing nut tree	S	Water	200 mg/kg	D.N.A.	CFA	Suppressive action on mediators of inflammation	[303]
<i>Torilis japonica</i> Houtt.	Apiaceae	Upright hedge parsley	F	Methanol	90, 270 mg/kg	Safe upto 5000 mg/kg	CIA	Inhibitory effects on immune cell trafficking. CD4 T-cells	[200]
<i>Toxicodendron pubescens</i> P. Mill.	Anacardiaceae	Atlantic poison oak	Wh	aqueous	10 mg/kg	Safe upto 2000 mg/kg	CFA	Immunosuppressant activity	[383,384]
<i>Trewia polycarpa</i> Benth.	Euphorbiaceae	Gambhari, prathinidhi	R	Ethanol	100 mg/kg	Safe upto 3.2 g/kg	CFA	Superoxide dismutase, glutathione peroxidase, ascorbic acid levels were increase while lipid peroxide content was decrease	[385]

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Table 3: Contd...

Botanical name	Family	Common name	Part	Extract	Dose (p.o.)	Acute toxicity (p.o.)	Model	Mode of action	Reference
<i>Tridax procumbens</i> Linn.	Asteraceae	Ghamira	L	Ethanol	300 mg/kg	≥2000 mg/kg	CFA	Suppression of migration of leukocytes	[386]
<i>Trigonella foenum graecum</i> Linn.	Fabaceae	Fenugreek	S	Mucilage	75 mg/kg	D.N.A.	CFA	Reduces cell influx, release of mediators, and oxidative stress	[247]
<i>Urtica pilulifera</i> Linn.	Urticaceae	Roman nettle	L	Methanol	1.33, 2.0 g/kg	Safe upto 2 g/kg	CFA	Suppress the activation of NF-kB	[387]
<i>Vernonia cinerea</i> Less.	Asteraceae	Bitterleaf ndole	Fl	Ethanol	25-100 mg/kg	Safe upto 5000 mg/kg	CFA	Membrane stability-modulating effect	[388,389]
<i>Vitex negundo</i> Linn.	Verbenaceae	Nirgundi, sindhuvara	L	Ethanol	1 ml/100 g	LD ₅₀ > 2000 mg/kg	CFA	Immunosuppressive activity	[258,390]
<i>Withania somnifera</i> Dunal.	Solanaceae	Indian winter cherry	R	Hydralcoholic	500-1000 mg/kg	LD ₅₀ = 1750 mg/kg	UIA	Inhibiting the release of inflammatory mediators	[14]
<i>Xanthium strumarium</i> Linn.	Compositae	Cocklebur, burdock datura	L	Ethanol	200, 400 mg/kg	Safe upto 2000 mg/kg	CFA	Inhibiting the release of inflammatory mediators, lowers the elevated levels of NO, urinary hydroxyproline and neutrophil infiltration	[277]
<i>Yucca schidigera</i> Roehl.	Liliaceae	Spanish dagger	B	Hydro-alcohol	300-400 mg/kg	D.N.A.	APA	Inhibition of NFkB activation	[391]

CIA: Collagen induced arthritis, CFA: Complete Freund arthritis, SCW: Streptococcal cell wall induced arthritis, HRBC-MS: HRBC membrane stabilization, FIA: Formalin induced arthritis, TIA: Turpentine oil induced arthritis, IPDN: Inhibition of protein denaturation, APA: Anti-protocoll activity, MSUIA: MSU induced arthritis, CACW: *Candida albicans* cell wall, FOIA: Formaldehyde induced arthritis, COIA: Croton oil induced arthritis, ICAM-1: Intercellular adhesion molecule-1, VCAM-1: Vascular cell adhesion molecule-1, D.N.A.: Data not available, ESR: Erythrocyte sedimentation rate, WBC: White blood cell, RA: Rheumatoid arthritis, TNF- α : Tumor necrosis factor, IL: Interleukins, RBC: Red blood cell, PGE2: Prostaglandin E2, GM-CSF: Granulocyte-macrophage colony-stimulating factor, PGDF: Platelet-derived growth factor, TGF- β : Transforming growth factor beta, TPA: Tissue-type plasminogen activator, ALT: Alanine aminotransferase, IFN: Interferon, iNOS: Inducible nitric oxide synthase, NF: Nuclear factor

Dried flowering or fruiting tops are medicinally important. CT possesses traditional significance in infections of eye, local inflammation, neuralgia, acute mania, whooping cough, asthma, and to relieve pain in dysmenorrhea and menorrhagia. Oil extracted from seeds is used in rheumatism. The chief chemical constituent is a resin volatile oil composed of canabene, canabene hydride, canabinon, and canabin; which consist of cannabiniol, pseudo-cannabiniol, cannabiniin, and several terpenes [51,94]. Around more than 166 research papers confirm that cannabis and related therapies will be helpful in relieving the pain associated with arthritis. Moreover, cannabinoid component of cannabis shown to possess anti-arthritis activity. It has been claimed to use as anxiolytic, antidepressant [95,96] in schizophrenia [97] and RA. The active moiety of CT i.e. cannabidiol at a dose of 10 and 25 mg/kg, orally, administered in collagen-induced arthritic rat significantly decreases the arthritic score and inhibits the release of inflammatory mediators. Thus, it was concluded that the cannabidiol have an anti-arthritis activity by possessing anti-inflammatory and immunosuppressive action [98].

***Cinnamomum zeylanicum* Blume. (CZ)(Family-Lauraceae)**

CZ a topical evergreen tree grows to a height of 7-10 m in its mild state and has deeply veined ovate leaves that are dark green underneath. It is commonly known as cinnamon or Ceylon cinnamon. CZ is cultivated in Sri Lanka, Myanmar, and Southern Coastal strips of India. Treatment of vaginitis, rheumatism, neuralgia, wounds, toothache, diabetes, inflammation of eyes, impotence, and leucorrhoea is its traditional uses. CZ was also used to treat abdominal pain associated with diarrhea, dysmenorrhea, and amenorrhoea. The active constituents of the CZ are cinnamaldehyde and eugenol. The other constituents are camphene, sabinene, myrcene, fenchone, nerol, bornyl acetate, cinnamyl acetate, and geraniol [99]. The CZ is reported to have an analgesic, anti-pyretic [100], anti-fungal [101], anti-inflammatory, anti-microbial [102,103], insecticidal [104], anti-diabetic [105,106], and antioxidant activities [107,108]. The polyphenolic extract of the CZ bark at a dose of 8 mg/kg revealed anti-arthritis potential in male wistar rats in CFA model by improving the body weight and the level of serum C-reactive proteins when compared with control group. Thus, anti-arthritis activity was mediated through inhibition of leukocyte emigration and prostaglandin synthesis [109].

***Coriander sativum* Linn. (CS)(Family-Umbelliferae)**

CS is a herbaceous plant distributed all over India and used for its seeds, fruits and leaves. Traditionally, plant is used as stimulant, carminative, stomachic, diuretic, tonic, and aphrodisiac. Oil is very useful for rheumatism in a dose of 1-4 minims on sugar or in emulsion. Coriander oil which contains linalool, coriandrol, geraniol, and bornoneol, extracted from its fruit, is volatile and essential [51,110]. Externally seeda can be used as a lotion or have been bruised and used as a poultice for the treatment of arthritis. Cineole, one of

the 11 components of the essential oils, and linoleic acid, present in coriander, possess antirheumatic and anti-arthritis properties [111]. CS possesses an antibacterial [112,113], antispasmodic [114], antioxidant [115-117], anticarcinogenic [118], and hypolipidemic activities [119]. The hydroalcoholic extract of seeds at doses of 8, 16, and 32 mg/kg showed reduction in paw swelling induced by formaldehyde and CFA methods in male wistar rats by inhibiting the pro inflammatory cytokines and TNF- α . In conclusion, the extract of CS shows a potent anti-arthritis activity on rats [120].

***Curcuma longa* Linn. (CL)(Family-Scitamineae)**

CL is a perennial herb that measures up to 1 m high with a short stem, distributed throughout tropical and subtropical regions of the world, and is widely cultivated in Asian countries, mainly in India and China [121]. There are two varieties of CL one with rich-colored oval rhizomes and other with softer, larger, lighter-colored long rhizomes which are edible. Turmeric paste mixed with lime and saltpeter can be used externally in rheumatism. The major chemical constituents are curcumin, methylcurcumin, demethoxy curcumin, sodium curcumin, and Ar-turmerone. Traditionally, CL is used in wound healing, helminthic infections, fevers, skin eruption, conjunctivitis, cough, parasitic infections, and liver diseases [51,121]. Later on, it was investigated the effect of herbomineral formulation (combination of turmeric, ashwagandha, sallai guggul, and jasad bhasma based on Ayurveda medicinal system) on 90 patients suffering from arthritis. It was observed that there was significant reduction in disability and pain. The plant is reported to be highly valued as anti-inflammatory [122,123], antiprotozoal [124,125], nematocidal [126], antibacterial [127], anti-tumor [128], and hepatoprotective [129]. The anti-arthritis activity was shown by essential oils of rhizomes of CL with streptococcal cell wall induced arthritis. It can be concluded that the turmeric essential oil possess an anti-inflammatory as well as anti-arthritis activities [130].

GY (Family-Fabaceae)

GY commonly known as mulethi is a herb/shrub of 2 m height mainly found in subtropical or temperate areas. The underground growth of stem is up to 2 m and is highly branched consisting short taproot with number of rhizomes. GY is commercially grown in Spain, Sicily and England. In India, it is mainly cultivated in Punjab and Sub Himalayan tracts [51]. The plant is reported to be traditionally used in anemia, gout, asthma, epilepsy, fever, cough, skin disease, rheumatism, paralysis, and hemorrhagic diseases. Roots in the form of infusion, decoction, extract or lozenge are useful as a demulcent in inflammatory affections [10,51]. The clinical trials reveal that glycyrrhizin has favorable effects on RA, when administered along adrenocorticotropic hormone or cortisone, in comparison, when administered alone. Hence, it was suggested that the main effect of liquorice is to potentiate rather than mimic endogenous steroids. The active chemical constituent is glycyrrhizin present in the form of potassium and calcium salts of glycyrrhizic acid. GY also contains sucrose,

glucose, resins, bitter principles, mannites, asparagines, and fat [131]. GY have shown anti-microbial, hypolipidaemic, antiviral, hypotensive, anti-ulcer, anti-diuretic, anti-inflammatory, anti-mutagenic, expectorant, hepatoprotective, antioxidant, and antipyretic activities [132-134]. The methanolic extracts of rhizomes of GY at a dose of 150 mg/kg possess anti-arthritis activity in male wistar rats by inhibiting the leukocyte migration and auto antigens production and exhibit anti-proteinase activity. The study concluded that GY possess a significant anti-arthritis activity [76].

***Lantana camara* Linn. (LC)(Family-Verbinaceae)**

LC popular as lava or red sage is a low erect or subscandent vigorous shrub with tetragonal stem, stout recurved pickles and comprises strong odour of black currents. LC is native to India and reaches to a height of 1-3 m [135]. Traditionally, LC is used in the treatment of sores, chicken pox, measles, fever, cold, rheumatism, asthma, ulcers, and high blood pressure [135]. In Asian countries like India, the decoction of leaves of the plant LC was used traditionally for the treatment of rheumatism. In Ghana, the infusions of whole plant are used against arthritis. *Nyctanthes arbor tristis* is used in Bangladesh for treatment of fever, bacterial infections, and rheumatism as well as other ailments [136]. The active constituents are flavones, isoflavones, anthocyanins, coumarins, lignins, alkaloids, tannins, saponins, triterpenoids, catechins, and isocatechins [137]. LC is reported to have an antioxidant [138], anti-diabetic [139,140], anti-inflammatory [141], anti-motility [142], anti-fungal [143,144], anti-bacterial [145,146], anti-fertility [147], cytotoxic [148], larvicidal [149], and wound healing activities [17,150]. The ethanolic extract of leaves of LC at doses 5, 10 and 20 mg/kg proved to have anti-arthritis activity by inhibiting the lipoxygenase and cyclooxygenase [151].

***Phyllanthus amarus* Schum and Thomm. (PA)(Family-Euphorbiaceae)**

PA is a 10-60 cm tall herb which grows in tropical and subtropical sandy regions. Its common name is chancapiedra. Traditionally, PA is used in jaundice, dropsy, diarrhea, dysentery, urino-genital disease, scabies, ulcer, and wounds. In addition, it is used as astringent, stomachic, diuretic, antiseptic, bitter, and febrifuge [51,152]. In the Hand Book of African Medicinal Plants it is reported that PA was traditionally use for its anti-inflammatory activity. Moreover, in Amazonia and Brazil, the whole plant was used for the treatment of various inflammatory disorders like arthritis. PA comprised of active constituents found in all parts of the plant as lignans, glycosides, flavonoids, alkaloids, ellagitannins, and phenylpropanoids [152]. Studies have proved that PA have anti-inflammatory [153], anti-microbial [154,155], anti-cancer [156], anti-fertility [157], hepatoprotective [158], anti-diabetic [159], anti-diarrheal [160], antioxidant [161], anti-oedematogenic [162], diuretic [163] and chmoprotective [164] activity. The aqueous extract of whole plant at a dose of 100, 200, and 400 mg/kg shows anti-arthritis activity in male wistar rats. The extract at various doses reduced the levels of aspartate

transaminase and alanine transaminase and thus maintains its anti-arthritis activity [165].

***Piper longum* Linn. (PL)(Family-Piperaceae)**

PL is a slender, climbing, under shrub, creeping, and rooting below. The young shoots are downy, the leaves are 5-10 cm long; 5 cm wide; ovate; cordate with broad rounded lobes at the base; sub-acute and entire. PL is indigenous to North-Eastern and Southern India and Ceylon [51]. PL is used in cold cough, asthma, hoarseness, and snake bite since ancient times. In rheumatism, roasted aments are bitten up with honey and taken in a prescribed dose. In Java and Indonesia, the whole plant was applied topically, as it relieves muscular pains and inflammation [51,166]. Major constituents are piperine, piperlongumine, piperlonguminine, and methyl 3,4,5-trimethoxycinnamate. Others include resin, volatile oil, starch, fatty oil, and inorganic matter [167]. Medicinally, PL finds its importance as an anti-inflammatory [168], anti-amoebic [169], anti-asthmatic [170], hepatoprotective, and immune-modulatory activities [171]. The aqueous extract of seeds of PL at two doses (200 and 400 mg/kg) shows a 46.32% inhibition in paw swelling in Freund's complete adjuvant induced arthritis in rats by inhibiting the adherence of neutrophils to endothelial monolayer by suppressing the TNF- α induced expression of intercellular adhesion molecule-1, vascular cell adhesion molecule-1, E-selectin, and also inhibits the NF- κ B. In conclusion, PL possess a significant anti-arthritis activity on male wistar rats [172].

***Punica granatum* Linn. (PG)(Family-Lythraceae)**

PG is popular as pomegranate is a native of India, East Indies, Southern Asia, tropical Africa, California, and Arizona. PG grows tillan height of 12-16 feet with number of spiny branches and has long lifespan. Traditionally, PG is used in diarrhea, ulcers, and diabetes and also useful as antiparasitic agent and blood tonic [51,173]. In Iranian Traditional Medicinal system, the seeds and juice are considered as a tonic for the treatment of rheumatism. Pomegranate fruit consumption reduced composite disease activity index in RA patients, and this effect could be related to the anti-oxidative property of pomegranates. Dietary supplementation with pomegranates may be a useful complementary strategy to attenuate clinical symptoms in RA patients [174]. Some of the major chemical constituents present in the PG are gallic acid, anthocyanins, ellagitannins, flavones, flavonoids, anthocyanidins, sterols, quercetin, rutin, and other fatty acids [173]. The plant is of high value due to its anti-inflammatory [175], anti-carcinogenic [176,177], antioxidant [178,179], hypotensive [180], hypolipidaemic [181], anti-atheroseclerotic [182], and anti-diabetic activities [183]. PG is also used in the treatment of myocardial ischemia [184], prostate cancer [185,186], dental plaques [187], denture stomatitis [188], bacterial infections [189,190], erectile dysfunctions [191], male infertility [192], alzheimer's disease [193], and ischemic brain injury [194,195]. The fruits of PG show an anti-arthritis activity at doses of 13.6-34 mg/kg

by inhibiting the spectrum of signal transduction pathway in male wistar rats. Thus, it can be concluded that PG have potent anti-arthritis activity [196].

***Ruta graveolens* Linn. (RG)(Family-Rutaceae)**

Rue is an herbaceous perennial plant, originally growing in the Mediterranean region [197]. RG is traditionally used as antiseptic, anthelmintic, antispasmodic, stimulant, abortifacient, expectorant, and anti-rheumatic [51]. The major chemical constituents isolated from the RG are rutin, quercetin, rutacridone, rutacridone epoxide, graveoline, and gravacridonodiol [197]. RG is reported to have anti-inflammatory [198,199], analgesics [200], antiandrogenic [201,202], antihyperglycemic [203,204], antihyperlipidemic [205], anticancer activity [206], and anti-rheumatic properties. The polyphenolic fraction of aerial parts of RG at a dose of 10 mg/kg, b.w. showed an anti-arthritis activity in male wistar rats induced by CFA model. The polyphenolic fraction revealed its activity by inhibiting the prostaglandins synthesis, decreasing CRP level, ceruloplasmin, lipid peroxidation and release of other inflammatory mediators. In conclusion, RG possess anti-arthritis activity [207].

***Saussurea lappa* Clarke. (SL)(Family-Compositae)**

SL herbs grow abundantly on the Himalayas and Valley of Kashmir. Roots contain odorous principle composed of a solid resin, salt of valeric acid and ash which contains manganese. SL is mainly useful in asthma, helminthiasis, fever, cough, skin disease, rheumatism, malaria, and leprosy. Roots in the form of infusion with little cardamoms are used in chronic rheumatism. Oil of the root composed of camphene, phellandrene, costene, apotaxene, costol, and costic acid [51]. In the Southern part of Kashmir, Himalaya, and Punjab regions, the roots and root stalk are used for the treatment of rheumatism. In Unani system of medicine, it is useful in rheumatism [208]. The combination of *Cyperus rotundus*, *Tinospora cordifolia* and SL clinically proved to have an anti-arthritis activity through significant reduction of pain in double-blinded, comparative, parallel clinical trial design [209]. The SL extracts exhibited other biological activities including anti-diarrheal [210], antiulcerogenic [211,212], antibacterial [213], anticancer [214], anticonvulsant [212], hepatoprotective [215], antiviral [216], anti-inflammatory, antioxidant [217], and anti-arthritis activities. The ethanolic extract of SL at dose levels of 50-400 mg/kg showed potent anti-arthritis activity. A sesquiterpene lactone "cynaropicrin" isolated from SL strongly inhibited TNF- α release from lipopolysaccharide (LPS) - stimulated murine macrophage cell line and dose-dependently suppressed the proliferation of lymphocytes stimulated. Another sesquiterpene lactone "dehydrocostus lactone" from SL suppressed LPS-induced nitric oxide production. The investigation concluded that the SL shows a significant anti-inflammatory and anti-arthritis activity [217].

***Sida rhombifolia* Linn. (SR)(Family-Malvaceae)**

SR is a small erect under shrub having rough branches with stellate hairs commonly found in dry countries such as India

and Ceylon [218]. Traditionally, the plant is used as nutritive, tonic and for the treatment of gonorrhoea, piles, rheumatism, as diuretic, and aphrodisiac [51]. In Indonesia and Johore medicinal system, juice of whole plant pounded with little water is given indoses of ¼ seer for the treatment of rheumatism. β -phenethylamine, N-methyl- β -phenethylamine, S-(β) N- β -methyl tryptophan methyl ester, vasicinol, vasicinone, vasicine, choline, hypaphorine methyl ester, hypaphorine, and betaine [219] have been isolated from the plant. The reported activities of plant include cytotoxic [220], antimicrobial [221], antibacterial [222], anti-inflammatory, antipyretic [223], and anti-arthritis. The aqueous and ethanol extract of aerial parts of the SR at doses 30 and 100 mg/kg reduced the paw edema induced by CFA method. Thus, it is concluded that the plant possess a potent anti-arthritis activity [218].

***Terminalia chebula* Retz. (TC)(Family-Combrataceae)**

TC is a well-known traditional plant of Indian traditional medicinal system and the most frequently used herb in ayurveda. In tribal of Tamil Nadu in India, the TC is commonly known as Kadukkai and was used for treating various ailments such as fever, cough, diarrhea, gastroenteritis, skin diseases, candidiasis, urinary tract infections, and wound infections [51]. TC is a medium-sized deciduous tree of variable appearance with usually short cylindrical bole of 5-10 m length and 60-80 cm diameter. The phytoconstituents of TC are tannins, flavonoids, resins, fixed oil, fructose, amino acids, and sterols. Moreover, the active constituents of tannins include chebulic acid, ellagic acid, chebulagic acid, chebulinic acid, and gallic acid. TC was used in Thai traditional system as a carminative, expectorant, and antioxidant. A polyherbal formulation "Triphala" of TC, *Terminalia bellerica* and *Emblia officinalis* is commonly used in chronic constipation, detoxification, poor digestion and rejuvenator of the body [224]. TC possesses an anti-bacterial [225], anti-viral [226], anthelmintic [227], anti-fungal [228], anti-ameobic [229], anti-neoplastic [230], anti-plasmodial [231], antioxidant [232], anti-diabetic [233] and anti-ulcerogenic [234] activity. The TC reported to have an immunomodulatory [229], radioprotective [235], cytoprotective [236], cardioprotective [237], and hepatoprotective [238] activity. Moreover, the hydroalcoholic extract of TC produces a significant inhibition of joint swelling in formaldehyde induced arthritis and CFA induced arthritis models. The anti-arthritis potential of the extract was due to significant reduction in the levels of TNF- α , IL-6, and IL-1 β [239].

***Trigonella foenum-graecum* Linn. (TF)(Family-Papilionaceae)**

TF, commonly known as Fenugreek, is an herbaceous plant which has found wide applications as a food, a food additive, and as a traditional medicine. Albuminoids, soluble carbohydrates, woody fibers, and ash are present in TF [240,241]. The plant has wide uses in the traditional medicine and reportedly used to treat diabetes, high cholesterol, wounds, inflammation, and gastrointestinal ailments. Several confections of TF like methi modaka, *Svalpamethimodaka* etc., are used in rheumatism [51]. Fenugreek seeds have high

content of mucilage, choline, and trigonelline. Studies of its extract have shown antihyperglycemic [242], estrogenic [243], antioxidant [244], anticancer [245], anti-inflammatory [246], and antirheumatic activities. The fenugreek mucilage obtained from seeds of the TF at dose 75 mg/kg possess an anti-arthritis activity and decreased the elevated levels of SGOT, SGPT, CRP, nitrites, ESR, and white blood cell count. The TF may act by decreasing the oxidative stress, cell influx, and release of mediators associated with arthritis. In conclusion, TF showed anti-arthritis activity [247].

Vitex negundo Linn. (VN)(Family-Verbenaceae)

VN is referred to as five leaved chaste tree and a large aromatic shrub or sometimes a smaller slender tree with quadrangular, densely whitish tomentose branchlets. VN is originated in Southern India and Burma [51]. VN have its traditional use in rheumatism, headache, enlarged liver, syphilis, diarrhea, and cholera. Leaves along with garlic, rice and gul is a remedy for rheumatism. In Ayurvedic, Unani and Chinese medicine system the leaves extract of VN was used to treat the rheumatism and inflammation of joints. The Konkan community in Maharashtra used the plant for rheumatism [248]. The chief chemical constituents are nishindine, flavones, luteolin-7-glucoside, casticin, iridoid glycosides, vitamin C, β -sitosterol, and phthalic acid [249]. VN possess different pharmacological activities including anti-inflammatory, analgesic [250-253], anticonvulsant [254], antioxidant [250,255], insecticidal [256,257], and antirheumatic [249]. The active compound agnuside isolated from ethanolic extract of leaves administered at doses of 1.56 mg/10 ml, 3.12 mg/10 ml, 6.25 mg/10 ml and 1.25 mg/10 ml p.o. decreased the elevated levels of ESR, leukotriene B₄, PGE₂, cytokines, IL-17, TNF- α and interferon gamma. Hence, it can be concluded that the VN possess an anti-arthritis activity [258].

Xanthium strumarium Linn. (XS)(Family-Compositae)

XS commonly known as cochlebur, burweed or burdock datura is an indigenous of tropical parts of India. XS is an annual herb of 1m height with a short, stout, hairy stems, and commonly grows in waste places, roadsides and along river banks in warmer parts. Traditionally, it is used as laxative, anthelmintic, tonic, digestive, antipyretic and also improves appetite, voice, complexion, and memory. XS is also used to cure leukoderma, biliousness, poisonous bites of insects, epilepsy, salivation, and fever. The infusion of plant has been used in treatment of rheumatism in ayurvedic and Chinese medicine system. The active principle of aerial parts of XS are alkaloids; sesquiterpenes lactones such as xanthinin, xanthumin, xanthatin; sulphated glycoside such as xanthostrumarin, atractyloside, carboxyatractyloside; phytosterols, xanthanol, isoxanthanol, xanthosin, 4-oxo-bedfordia acid, hydroquinone, xanthanolides, and deacetyl xanthumin [259]. However, recently investigated that XS possess an anti-bacterial [260], anti-tumor [261], anti-cancer [262], anti-tussive [263], anti-fungal [264,265], anti-inflammatory [266,267], vasorelaxant [268], hypoglycaemic [269], antimitotic [270], anti-malarial [271],

anti-trypanosomal [272], diuretic [273], anti-allergic [274], and antioxidant activity [275,276]. Oral doses (200 and 400 mg/kg) of ethanolic extract of XS when administered exhibited anti-arthritis activity by inhibiting the release of inflammatory mediators. In conclusion, XS have a potent anti-arthritis activity [277].

DISCUSSION

Since Neanderthal times, the plants had been used for the prevention and cure of various ailments such as RA and other inflammatory diseases. Natural sources such as plants have been considered as the safest and valuable treatment for the disease. From the ethno botanical knowledge, we included the plants that are used in Indian traditional systems such as herbalism, folklore and shamanism. The review article includes more than 485 different plant species that are used for the prevention and cure of RA during last few decades. The botanical name of the plant, family, common name, part used, and various dosage forms studied are summarized in the Table 2. Around more than 100 families are included for 485 plants among them papilionaceae, fabaceae, euphorbiaceae, acanthaceae, compositae, ranunculaceae, malvaceae, rutaceae, liliaceae, labiatae, solanaceae, cruciferae, verbenaceae, lauraceae, and rubiaceae are in major proportion. As shown in Figure 1, around 485 plants have been mentioned in which 19 (4.4%) belongs to family papilionaceae, 17 (4%) to compositae and euphorbiaceae, 15 (3.5%) to rutaceae, 14 (3.3%) to vabenaceae, 13 (3%) to labiatae and fabaceae, 12 (2.7%) to malvaceae and cruciferae, 11 (2.5%) to solanaceae and acanthaceae, 10 (2.3%) to ranunculaceae and liliaceae, 9 (2.1%) to apocynaceae, lauraceae and rubiaceae, 8 (1.8%) to graminiae, meliaceae, and umbelliferae, and remaining (48.2%) are categorized as others [Figure 1].

From our review, we have noticed that majority of researches were carried mainly in developing countries such as India, China, Korea, and Nigeria. But some developed countries like USA and Japan also continue their research on RA so as to increase the potential benefits [Figure 2].

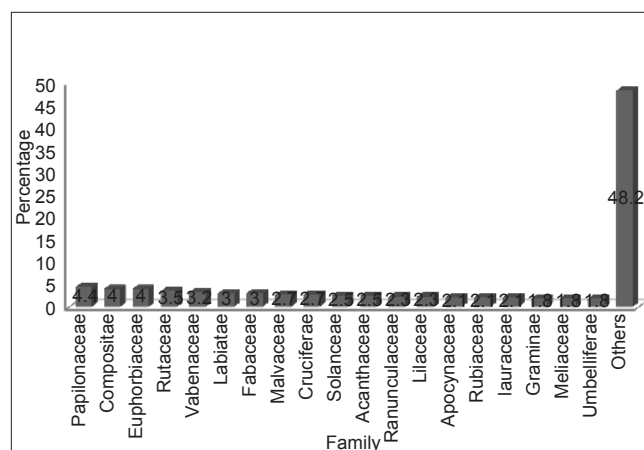


Figure 1: Plants in diverse families with % anti-arthritis activity

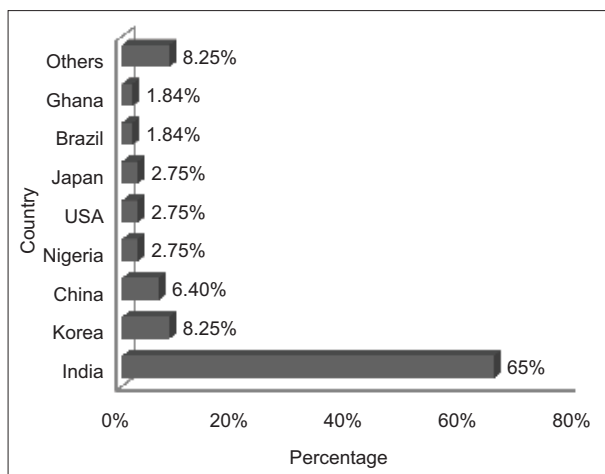


Figure 2: Geographical distribution of researches in the review

For the treatment of RA, various parts of plants are used such as leaves, roots, fruits, rhizomes, and seeds in distinguished dosage forms like extract, decoction, juice, infusion, paste, oil etc. The most potent anti-arthritis plants such as *Aconitum ferox*, *Balsamodendron mukul*, BD, *Boswellia serrata*, CS, CL, PL, *Ricinus communis*, *Plumbago zeylanica*, SL, SR, and *Strychnos nux vomica* have been elaborated in the review article. Among these listed plants, certain plants have been used in acute attack or in chronic pain or chronic rheumatism.

CONCLUSION

Traditional medicines used for the treatment of arthritis are used in various tribal/rural cultures worldwide. At present, investigation of anti-arthritis activity of traditional medicine has led to the development and studies of many herbal remedies employed for such purpose. The information that has been gathered from various sources is helpful in preserving folk indigenous knowledge as well as discovery of potential compounds having promising anti-arthritis activity. The information gathered from the data provides the information on toxicity profile and mechanism of action of tested extracts. Therefore, this review article has been prepared to provide the plants/their parts having specific traditional use in the treatment of arthritis upto year 2013. Moreover, this review has included latest data on new plant species/polyherbal formulations which are not covered in previous reviews on arthritis therapy as per our knowledge.

In conclusion, about 485 plant species mentioned in the list would have a promising anti-arthritis activity in humans. Information about the ethnic proof of the traditionally used anti-arthritis plants was cross-validated from various articles/reviews published in journals. Till now, no such review has analyzed which correlates the plant family, parts used, dosage form with anti-arthritis effects of the plants. Data mentioned in Table 2 show that papilionaceae family contains more plants with anti-arthritis activity whereas among parts, leaves have been maximally used in oil dosage form for the treatment of arthritis. Table 1 provides wealth of information indicates the

beneficial effects of polyherbal formulations in the treatment of the arthritis. These includes Rumalaya forte, Rumalaya-liniment, arthacure, ortho joint oil, rheum off gold, Majoon suranjan, HLXL, GHJTY, Sudard, and TBL-II [18,20-24]. The data mentioned in Table 3 in addition provides the dose, toxicity profile, and models with mechanism of action for anti-arthritis activity.

The data discussed in this review might be quite useful in obtaining monographs on plants and recommendations on their use. In this review, we mainly deal with the safety profile, mechanism of action, and toxicity studies of plant extracts. The plant extracts and polyherbal formulations would be served as an alternate therapy for the treatment of arthritis with lesser side effects. Moreover, current knowledge can be helpful in materializing the commercial products, where the evidence can be quite limited.

Future Needs

Majority of traditionally used plants which have been mentioned in Table 2, have not been experimentally proved to have anti-arthritis activity. In addition, data in Table 3 show experimentally, the plants possess anti-arthritis activity only on animals but no clinical data are provided for proving the activity in humans. The data also lack information on exact activity of isolated compounds. However, the emphasis should be given in an area that needs further investigations as studied in animals needs to be translates to humans in order for a natural extract to be recommended for the treatment of arthritis. Therefore, further research of such less explored plants is still needed to determine their anti-arthritis activity.

Limitations

The data studied and prepared had been collected from the literature published in English language only and ignoring the studies published in other languages. The data mentioned in other languages, if had been included, will also be helpful in validating the current data. Further studies on isolated compounds of plants are not included, which otherwise, might be useful in scrutinizing the cause of anti-arthritis activity of plants.

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