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 malignancies requires continous 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 refering 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-arthritic 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-arthritic 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-arthritic 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-arthritic activity [20].

A Unani polyherbal formulation was evaluated for its anti-arthritic activity in rats. The anti-arthritic efficacy of Manjoon Suranj was evaluated using formaldehyde and CFA induced arthritis models. The data obtained suggested the anti-arthritic 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-1β 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 Ganghwaljetongyreum 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, puritis, and chronic ulcers [12]. Milky juice is mixed with oil and was applied in rheumatic pains. The chief alkaloids present in AS are echitaine, tubotaiwine, akaumnicine, echitamidine, picrinine, and strictamidine. AS flowers also contains amino acids, carbohydrates, phenol, tannins, cardiac glycosides, saponins, flavanoids, steroids, fixed oil, and fats [26]. The plant showsimmune-stimulatory, hepatoprotective [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 leavesat 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 bractaeta Lam. (AB)(Family-Aristolochiaeae)

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 gonorrhea, syphilis, inflammation, ulcer, amenorrhea, 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 abortificient 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 ailesments i.e. phthisis, insomimia, and rheumatism [51]. The air-dried plant was found to contain large quantities of potassium nitrate and also contains an alkaloid, panarnavine, present in very small quantity of 0.01%. Recent investigations reported that BD possess an antistress, adaptogenic [52], antioxidant [53], immunesuppressive [54], anti-carcinogenic [55], hepatoprotective [56,57], diuretic [58], anti-diabetic [59], anti-viral [60], and anti-inflammatory
| Product name               | Ingredients                      | Botanical name        | Quantity | Manufactured by             |
|---------------------------|----------------------------------|-----------------------|----------|-----------------------------|
| Rumalaya forte - Tablet   | Shallaki                         | Boswellia serrata    | 240 mg   | Himalaya Global Holdings Ltd. |
|                           | Camphor                          | Cammiphora wightii    | 200 mg   |                             |
|                           | Rasna                            | Alpinia galangal     | 70 mg    |                             |
|                           | Yashimadhu                       | Glycyrrhiza glabra    | 70 mg    |                             |
|                           | Gokshura                         | Tribulus terrestris  | 60 mg    |                             |
|                           | Guduchi                          | Tinospora cordifolia | 60 mg    |                             |
|                           | Nirgundi                         | Vitex negundi        | 60 mg    |                             |
|                           | Sunth                             | Zinger officinalis   | 60 mg    |                             |
| Rumalaya - Liniment       | Bakuchi                          | Psoralea caryofolia  | 35 mg    | Himalaya Global Holdings Ltd. |
|                           | Maricha                          | Piper nigrum         | 35 mg    |                             |
|                           | Karpura                          | Cinnamonum camphor   | 90 mg    |                             |
|                           | Pudina                           | Mentha arvensis      | 40 mg    |                             |
|                           | Ajamoda                          | Carum capticum       | 35 mg    |                             |
|                           | Tila                             | Sasamum indicum      | 365 mg   |                             |
|                           | Gandhapura                       | Gaultheria fragrantissima | 350 mg |                             |
|                           | Sarala                           | Pinus longifolia     | 50 mg    |                             |
| Artha cure - Oil          | Clovos                           | Syzygium aromaticum  | 50 mg    | Be Sure Health Care (P) Ltd. |
|                           | Mithazahar                       | Aconitum ferox       | 25 mg    |                             |
|                           | Kutlip                           | Strychnos nux vomica | 25 mg    |                             |
|                           | Garlic                           | Allium sativum       | 50 mg    |                             |
|                           | Akasbel                          | Cuscuta reflexa      | 50 mg    |                             |
|                           | Jatiphalam                       | Myristica fragrans   | 50 mg    |                             |
| Arthcure - Capsule        | Khorpad                          | Aloe vera            | 50 mg    | Be Sure Health Care (P) Ltd. |
|                           | Hiranya-tuttha                   | Colchicum leuteum    | 50 mg    |                             |
|                           | Nisoth                           | Opeculina terpetheum | 50 mg    |                             |
|                           | Shonpat                          | Crotalaria juncea    | 50 mg    |                             |
|                           | Pippali                          | Piper longum         | 50 mg    |                             |
|                           | Jatiphalam.                      | Myristica fragrans   | 50 mg    |                             |
|                           | Clovos                           | Syzygium aromaticum  | 50 mg    |                             |
|                           | Sonth                            | Zingiber officinale  | 50 mg    |                             |
|                           | Asphalt                          | Black bitumen        | 25 mg    |                             |
|                           | Mahayogaraja guggulu             | Commipora mukul      | 25 mg    |                             |
|                           | Mithzahar                        | Aconitum ferox       | 25 mg    |                             |
|                           | Kutlip                           | Strychnos nux vomica | 25 mg    |                             |
|                           | Ashvagandha                      | Withania sonnifera   | 50 mg    |                             |
|                           | Shatavari                        | Asparagus racemosus   | 50 mg    |                             |
|                           | Garlic                           | Allium sativum       | 50 mg    |                             |
|                           | Akasbel                          | Cuscuta reflexa      | 50 mg    |                             |
| Rheumartho gold - Capsule | Suranjan kadwi                   | Colchicum luteum     | 60 mg    | Baidyanath                  |
|                           | Asgandh                          | Withania sonnifera   | 60 mg    |                             |
|                           | Shodhit kuchla                   | Strychnos nux vomica | 50 mg    |                             |
|                           | Salai guggul                     | Boswellia serrata    | 215 mg   |                             |
|                           | Maharasrnadi kwath               | Ghana sativa         | 64 mg    |                             |
|                           | Abrak bhamma                     | Biotite calx         | 5 mg     |                             |
|                           | Harsingar                        | Nytanthes arbor-tristis | 30 mg |                             |
|                           | Swarnamakshik bhasma             | Calx of copper pyrites | 5 mg   |                             |
|                           | Yograv guggulu                   | Commiphora mukul     | 30 mg    |                             |
|                           | Swarn bhasma                     | Ipomeoa digitata     | 0.6 mg   |                             |
|                           | Loha bhasma                      | Calx of corat        | 5 mg     |                             |
| Ortho joint oil           | Vishaqarba taila                 | Ricinus communis     | 2.5ml    | SBS Biotech Ltd.            |
|                           | Mahamasha taila                  | Vign unguiculata     | 2.5 ml   |                             |
|                           | Dalchini taila                   | Cinnamomum zeylanicum| 0.5 ml  |                             |
|                           | Gandhapuro                       | Gaultheria fragrantissima | 2.0 ml |                             |
|                           | Camphor                          | Cinnamomum camphor   | 100 mg   |                             |
|                           | Sat pudina                       | Menthe arvensis      | 2.5 mg   |                             |
|                           | Narayan taila                    | Withania sonnifera   | 2.5 ml   |                             |
| Rheuma off gold           | Maharagajaran guggulu           | Commiphora mukul     | 72 mg    | Virgo UAP Pharma (P) Ltd. [20] |
|                           | Maharasrnadi kwath               | Suvarna bhasma       | 112 mg   |                             |
|                           | Suvarna bhasma                   | Strychnos nux vomica | 1.6 mg  |                             |
|                           | Suddha kuchala                   | Boswellia serrata    | 9.6 mg   |                             |
|                           | Shallaki                         | 4.8 mg               |          |                             |
| Majoon suranjan           | Kalaparni                        | Ipomea turpethum     | 445 mg   | Qarshi herbal products [21] |
|                           | Pathya                           | Terminalalia chelula | 223 mg   |                             |
|                           | Hiranya-tuttha                   | Colchicum luteum     | 223 mg   |                             |
|                           | Kakadani                         | Capparis spinosa     | 44.5 mg  |                             |
|                           | Kustumbari                       | Coriandrum sativum   | 44.5 mg  |                             |

Contd...
### Table 1: Polyherbal formulations

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

TBL: Tongbiling

activities [61,62]. The petroleum ether extract of roots at dose 1000 mg/kg has been evaluated as anti-arthritic 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 |
|----------------|--------|-------------|-----------|-------------|------------|
| Abrus precatorius Linn. | Papilionaceae | Indian liquorice, chirmiti, gunchi | L | Oil | (278) |
| Acacia catechu Willd. | Fabaceae | Mimosas catechu | R | Extract | (279) |
| Acalypha indica Linn. | Euphorbiaceae | Kuppu, Aritmanjari | L | Juice | (19) |
| Acanthus ilicifolius Linn. | Acanthaceae | Sea holly, Moranna harikusa | L | Extract | (278) |
| Achillea millefolium Linn. | Compositae | Rojmani, bloodroot, arrow-root | H | Extract | (280) |
| Achyranthes aspera Linn. | Acanthaceae | Chirchitta, aghada, prickly chaff-flower | R | Infusion | (281) |
| Acampe wightiana Lindl. | Orchidaceae | Marabale | Wh | Extract | (278) |
| Aconitum ferox Wall. | Ranunculaceae | Mithazahar, visha | R, L | Liniment, paste | (51) |
| Aconitum napellus Linn. | Ranunculaceae | Monk’ hood | R, L | Liniment | (51) |
| Aconitum palmatum Don. | Ranunculaceae | Bilkma | R | Paste | (51) |
| Acorus calamus Linn. | Aroideae | Bach, vacha | R | Powder | (51) |
| Actaea racemosa Don. | Ranunculaceae | Black cohoos | R, Rh | Extract | (51) |
| Actaea spicata Linn. | Ranunculaceae | Banberry, grapewort | R | Powder | (278) |
| Adansonia digitata Linn. | Malvaceae | Gorakh amli | L | Poulitices | (19) |
| Adenthera pavonina Linn. | Leguminosae | Kuchandana | L, B | Decoction | (51) |
| Adhatoda vasika Nees. | Acanthaceae | Adosa, adarushah | L | Poulitices | (51) |
| Aegel marmolosa Corr. | Rutaceae | Stone apple, bael | F | Juice | (14) |
| Aesculus indica Celebr. | Sapindaceae | Bankhor, pankar | F | Oil | (278) |
| Agave americana Linn. | Agavaceae | American aloe, kantal, bilatipat | L | Paste | (278) |
| Aghati grandiflora Desv. | Leguminosae | Hathia, agastya | R | Paste | (51) |
| Agroporyns repons Beauv. | Gramineae | Couch G, quich | Rh | Extract | (278) |
| Alantins excels Roxb. | Simaroubaceae | Indian tree of heaven | L | Oil, extract | (279) |
| Alangium lamarkcii Thwaites | Cornaceae | Akola, shodhnam | R, B | Oil | (51) |
| Allium cepa Linn. | Liliaceae | Onion, palandu | Bu | Paste | (19) |
| Allium sativum Linn. | Liliaceae | Garlic, lasun | S | Oil | (51) |
| Alloschica indica Schott. | Aroidae | Manka, aloaka | T | Hot T | (51) |
| Alpinia galangal Wild. | Scitamineae | Sugandhavacha | Rh | Paste | (51) |
| Aitonia scholaris R.Br. | Apocynaceae | Dathyuni, saptaparna | Mj | Juice | (39) |
| Althea rosea Cav. | Malvaceae | Hollyhock, round dock | Fl | Oil | (278) |
| Ammannia baccifera Linn. | Lythraceae | Dadmari, anu garva | L | Blisters | [2] |
| Amorphophallus campanulatus Roxb. | Araceae | Zamikand, kandula kandvardhana | S | Oil | (278) |
| Anaclyys pyrethrum DC. | Compositae | Akarkaro | R | Infusion | (51) |
| Andropogon citrates DC. | Gramineae | Bhushitrina, true lemon grass | L | Oil, liniment | (51) |
| Andropogon iwarancusa Roxb. | Gramineae | Lamjak | R | Paste | (51) |
| Andropogon martini DC. | Gramineae | Grass of nemaur | G | Oil | (51) |
| Andropogon nardus Linn. | Aroideae | Mithazahar, aloka | L | Oil, decoction | (19) |
| Aphananixis polystachya Blatter. | Acanthaceae | Alamoolla | L | Oil, decoction | (19) |
| Apium graveolens Linn. | Umbelliferae | Aimodi, celerly | R | Decoction | (280) |
| Aquilaria agallocha Roxb. | Thymelaeeae | Aloe-wood, gur | W | Decoction | (51) |
| Arctium lappa Linn. | Compositae | Garden celerly | L | Infusion | (280) |
| Argyreia speciosa Sweet. | Convolvulaceae | Elephant creeper | R | Powder | (19) |
| Aristolochia braetzeta Linn. | Aristolochiaceae | Birthworts, pipevines | Wh | Extract | (1) |
| Aristolochia serpentaria Linn. | Aristolochiaceae | Virginian snake root | R | Infusion | (282) |
| Artanema sesamoides Benth. | Scrophulariaceae | Kolikaksha | R | Decoction | (51) |
| Artemisia absinthium Linn. | Compositae | Indhana, worm-wood | H | Juice | (51) |
| Asparagus filicinus Ham. | Liliaceae | Allipalli, sansarpal | R | Extract | (278) |
| Asparagus officinalis Linn. | Liliaceae | Marchubha | R | Powder | (51) |
| Asparagus racemosus Wild. | Liliaceae | Shattavari | R | Oil | (51) |
| Asystasia coromandeliana Nees. | Acanthaceae | Lavana-valli | Wh | Juice | (51) |
| Asystasia gangetica T. Anders. | Acanthaceae | Avokombily, puruk | Wh | Juice | (278) |
| Atalantia monophyllos DC. | Rutaceae | Wild-lime, atavi-jambira | Be | Oil | (51) |
| Atropa belladonna Linn. | Solanaceae | Black cherry, sagangur | L, R | Extract | (278) |
| Atylosia barbata Baker | Leguminosae | Mashaparni | R | Extraction | (51) |
| Azadirachta indica A. Juss. | Meliaceae | Bakayan, Indian lilac, balnimb | L | Decoction | (278) |
| Azima tetracantha Lam. | Gramineae | Kuduni | L, R | Decoction | (19) |
| Bacopa monnieri Penell. | Plantaginaeae | Brahmi | Wh | Extract | (283) |
| Balsamodendron mukil Hook. | Burseraceae | Guggula, saltaire | Gm | Paste | (51) |
| Balsamodendron playfairy Hook. | Burseaeceae | Meena-herma | Gm | Paste | (51) |
| Barleria courtallicca Nees. | Acanthaceae | Wahiti, artagal | R | Decoction | (278) |
| Barleria cristata Linn. | Acanthaceae | Jhinti, tadrubl | R | Decoction | (51) |
| Balsamopervum montanum Muell. | Euphorbiaceae | Dantimal, hakum, anukheti | S | Oil | (278) |
| Bassia butyacea Roxb. | Sapotaceae | Phulwara butter | K | Fat | (51) |
| Bassia latifolia Roxb. | Sapotaceae | Madhuka, jangli moh | B | Decoction | (51) |
| Bassia longifolia Linn. | Sapotaceae | Madhuka, mohua | S | Oil | (51) |
Table 2: Contd...

| Botanical name       | Family                  | Common name                  | Part used | Dosage form | References |
|----------------------|-------------------------|------------------------------|-----------|-------------|------------|
| Bassia malabarica    | Sapotaceae              | Iluppi                       | F, S      | Oil         | [51]       |
| Barosma crenulata    | Rutaceae                | Bucchu, buku                 | L         | Powder      | [282]      |
| Bauhinia racemosa    | Fabaceae                | Bidi leaf tree, kachnial     | B         | Extract     | [14]       |
| Bauhinia tomentosa   | Fabaceae                | Yellow bell orchid           | L         | Infusion    | [13]       |
| Berberis asiatica    | Berberidaceae           | Kilmora                      | St        | Decoction   | [51]       |
| Berberis petiolaris  | Berberidaceae           | Chachar, ambar               | R         | Decoction   | [278]      |
| Berberis vulgaris     | Berberidaceae           | True barberry                | St        | Decoction   | [51]       |
| Bidens pilosa        | Compositae              | Black jack, phutum           | Sh        | Young shoots| [278]      |
| Blumea balsamifera   | Compositae              | Nagal camphor, kakaronda    | L         | Fumigation  | [278]      |
| Blumea ripens        | Asteraceae              | Red stink wood               | S         | Oil         | [279]      |
| Bula alba            | Cupuliferae             | White birch bark             | L         | Extraction  | [51]       |
| Boerhaavia diffusa   | Nyctaginaceae           | Punarnava, thikri            | R         | Paste       | [63]       |
| Boucera parvifolia   | Asclepiadaceae          | Charungli, chungi pamane    | St, Wh    | Juice       | [278]      |
| Borassus flabellifer | Arecaceae               | Toody palm, sugar palm       | F         | Juice       | [14]       |
| Boswellia glabra     | Burseraceae             | Kapilaparni, lobhan         | Gm        | Gum         | [51]       |
| Boswellia serrata    | Burseraceae             | Salai gugul                  | Gm, Rs    | Gum         | [76]       |
| Brassica campestris  | Cruciferae              | Wild turnip, bangasarson     | S         | Oil         | [278]      |
| Brassica integrifolia| Cruciferae              | Raj, Indian mustard, rajika  | S         | Oil         | [278]      |
| Brassica juncea      | Cruciferae              | Raj, rajika                  | S         | Oil         | [51]       |
| Brassica nepus       | Cruciferae              | Van dai, onuma               | Wh        | Extract     | [278]      |
| Brassica nigra       | Cruciferae              | Kalori, sarshapah            | S         | Oil         | [51]       |
| Brassica oleracea    | Cruciferae              | Cabbage, karamkalla          | L         | Extract     | [278]      |
| Bridelia retusa      | Euphorbiaceae           | Gay, kajia, assana           | B         | Oil         | [278]      |
| Bryonia epigoea      | Cucurbitaceae           | Rakas-gaddah, mahamula       | R         | Powder      | [51]       |
| Buxus sempervirens   | Euphorbiaceae           | Papari                       | L         | Extraction  | [51]       |
| Cacenia glauca       | Boragineae              | Goazaban                     | L         | Extraction  | [51]       |
| Cadaba indica        | Capparidaceae           | Indian cadaba               | L         | Decoction   | [19]       |
| Caesalpinia bonduc   | Caesalpiniaeae          | Katkaranjan, latakaranja    | S         | Oil         | [51]       |
| Callicarpa macrophylla| Verbenaceae             | Sumali                      | R         | Decoction   | [51]       |
| Calophyllum apetatum | Guttiferae              | Cherupinnal, sarapuna        | S         | Oil         | [51]       |
| Calophyllum inophyllum| Guttiferae              | Surpan, punnaga             | K         | Oil         | [19]       |
| Calotropis gigantean | Asclepiadaceae          | Gigantic, arka               | R         | Powder      | [51]       |
| Calotropis procera   | Asclepiadaceae          | Madar                       | R-B       | Extract     | [282]      |
| Camphora officinarum | Lauraceae               | Camphor, kapur              | C         | Liniments   | [51]       |
| Canarium odoratum    | Annonaceae              | Kadapanyan, maladi           | F         | Oil         | [282]      |
| Canarium bengalense  | Burseraceae             | Bjsjang, dhuna, geguldhop   | L, B      | Extract     | [278]      |
| Canarium commune     | Burseraceae             | Java almond, jangali badam  | T         | Ointment    | [278]      |
| Canarium strictum    | Burseraceae             | Black damer                 | Rs        | Ointment    | [51]       |
| Cannabis sativa      | Urticaceae              | Ganja, charas               | S         | Oil         | [98]       |
| Canna alba           | Cannaeeaeae              | Jamaica                     | B         | Oil         | [282]      |
| Capparis aphylla     | Capparidaceae           | Caper plant, karira          | R-B       | Powder, infusion | [51] |
| Capparis deciduas    | Capparidaceae           | Chayruka                    | L         | Extract     | [278]      |
| Capparis heyneana    | Capparidaceae           | Chayruka                    | L         | Decoction   | [51]       |
| Capparis spinosa     | Capparidaceae           | Kabra, kakadani             | L         | Decoction   | [51]       |
| Capuscum annum       | Solanaceae              | Lal mirchi, spanish pepper   | F         | Tincture    | [51]       |
| Cardiopteranum hylacabum| Linn.                    | Balloon vine, winter cherry  | R, L      | Decoction   | [284]      |
| Carissa carandas     | Apocynaceae             | Karamardaka                 | S         | Extract     | [279]      |
| Carissa spinarium    | Apocynaceae             | Karaunda, gama              | R         | Extract     | [278]      |
| Carthamus tinctorius | Compositae              | Wild saffron, kamalottara   | F         | Hot infusion| [51]       |
| Cassia fistula       | Caesalpiniceae          | Sonhali, nipradumpa         | B, L      | Paste       | [19]       |
| Cassia sophera       | Caesalpiniceae          | Bas-ki-kasunda               | L         | Infusion    | [51]       |
| Cassia tora          | Fabaceae                | Charota, taga               | L         | Infusion    | [279]      |
| Cadreia toona        | Meliaceae               | Toona, khusing               | B         | Infusion    | [51]       |
| Cedrus deodara       | Coniferae               | Deodar, kilan, geyar        | W         | Oil         | [278]      |
| Cedrus libani        | Coniferae               | Deodar, devadaru            | Gm        | Gum         | [51]       |
| Celastrus paniculata| Celastraceae             | Malakanguni, vanhiruchi     | S         | Decoction   | [19]       |
| Celosia argentia     | Amaranthaceae           | Panaai keerai               | L         | Decoction   | [13]       |
| Centella asiatica    | Mackinlayaceae          | Gotu kola                   | St        | Extract     | [285]      |
| Cephealis ipicauanua| Rubiaceae               | Poaya                       | R         | Extract     | [282]      |
| Chenospermum albumi  | Rubiaceae               | Poaya                       | R         | Extract     | [282]      |
| Chloroxylon swietenia| Meliaceae               | Bheria, girya, yellow wood  | L         | Oil         | [278]      |
| Circuta virosa       | Apiaceae                | Cowbane, water hemlock      | Wh        | Poultec     | [282]      |
| Cimicifuga racemosa  | Ranunculaceae           | Balck snake root, bugbane   | R         | Extract     | [282]      |
| Cinchona calisaya    | Rubiaceae               | Peruvian bark               | B         | Infusion    | [51]       |
| Cinnamomum camphora  | Lauraceae               | Camphor laurel              | W         | Oil         | [282]      |
| Cinnamomum cassia    | Lauraceae               | Dalchini, gudavak           | L         | Oil         | [51]       |

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Table 2: Contd...

| Botanical name | Family | Common name | Part used | Dosage form | References |
|----------------|--------|-------------|-----------|-------------|------------|
| Cinnamomum tamala Fr.Nees. | Lauraceae | Cassia lignea, tejpat | L | Extract | (278) |
| Cinnamomum macrocarpum Hook. | Lauraceae | Dalchini, tejpatra | R, B, L | Oil | (109) |
| Cinnamomum parthenoxylon DC. | Lauraceae | Kaaway, kayogadis | F | Oil | (278) |
| Cissus quadrangularis Linn. | Vitaceae | Devil’s backbone | Wh | Extract | (279) |
| Citrus reticulata | Citrus | L | Oil | (282) |
| Citrus reticulata | Citrus | F | Juice | (51) |
| Citrus limonum Sp.Rioso. | Rutaceae | Jambha, nimbu | F | Juice | (51) |
| Cleome brachycarpa Linn. | Capparaceae | Panwar, kasturi | Wh | Extract | (278) |
| Cleome gynandra | Capparaceae | African cabbage, spiderwisp | Wh | Extract | (286) |
| Cleome rutidosperma DC. | Cleomeae | Fringed flower | Wh | Decoction | (14) |
| Clerodendron celebrockianum Walp. | Lamiaceae | Glowyower | Rh | Extract | (279) |
| Clerodendron inerme Gaertn. | Verbenaceae | Garden quinine, binjoam | R | Liniment | (51) |
| Clerodendrum phlomides L.f. | Verbenaceae | Agnimantha, jaya | L | Paste | (14) |
| Clerodendron serratum Spreng. | Verbenaceae | Barangi, baley, angaravalli | R | Decoction | (278) |
| Clerodendron simpsonanthus R.Br. | Verbenaceae | Bharangi, arnal, chingari | W | Rs | (278) |
| Citriodora terrae Linn. | Verbenaceae | Butterfly-pea | Wh | Extract | (279) |
| Cocculus cordifolius Miers. | Menispermaceae | Heart-leaved, gulanche | St, L, R | Infusion | (51) |
| Cocculus hirsutus Diels. | Menispermaceae | Broom creeper, chireta | R | Infusion | (282) |
| Cocculus villus DC. | Menispermaceae | Jaliami, faridbel | R | Decoction | (19) |
| Coctheariaarmoracia Linn. | Cruciferae | Horse-radish | R | Condiment | (282) |
| Colchicum autumnale Linn. | Melanthaceae | Wild saffron | S | Extract | (282) |
| Colchicum luteum Baker. | Liliaceae | Golden collyrium, hiranya-tuttha | R | Extract | (51) |
| Goldenia procumbens Linn. | Boragineae | Tripunkue | L | Extract | (51) |
| Coptis teeta Wall. | Ranunculaceae | Gold thread, mishamitita | R | Paste | (51) |
| Corallocarpus epigeeous Rottl. & Willdl. | Curculiaceae | Akasgaddah, karwina, lufa | R | Decoction | (19) |
| Coriandrum sativum | Umbelliferae | Chicka, bhutamkusam | B | Infusion | (51) |
| Cotula anthemoides | Compositae | Babuna | R | Infusion | (51) |
| Cotula anemoides Linn. | Compositae | | | | |
| Crapeaeuvrifolia Linn. | Lamiaceae | Bhataravarna, biiana | L | Juice | (278) |
| Crapeaevrigulis H. & H. | Lamiaceae | Three leaved creeper, pashuganda | L | Juice | (51) |
| Crinum asiaticum Linn. | Amaryllidaceae | Poison bulb, chindar | Bu | Roasted Bu | (51) |
| Crinum latifolium | Amaryllidaceae | Chakrangi, dadhyani | Bu | Roasted Bu | (278) |
| Crocus sativus Linn. | Irideae | Sahfron, bhavarakta | Sg | Tincture, infusion | (51) |
| Crotalaria prostrate Rottler. | Fabaceae | Prostate rattlepod | Wh | Extract | (279) |
| Croton oblongifolus Rox. | Euphorbiaceae | Chicka, bhutamkusam | B | Infusion | (51) |
| Croton tigilium Linn. | Euphorbiaceae | Jamalgota, naepala | S | Liniment | (51) |
| Curcuma longa Linn. | Scitamineae | Turmeric, highd, varnavat | Rh | Powder | (130) |
| Cymbopogon citrates Stapl. | Gramineae | Melisa grass, ganhadrintra | G | Oil | (278) |
| Cymbopogon juwancusa Schult. | Gramineae | Ghatyari, amrinala, izhikir | G | Oil | (51) |
| Cymbopogon schoenanthus Spreng. | Gramineae | Geranium grass, bhutika | G | Oil | (278) |
| Cynodon dactylon Pers. | Gramineae | Bahama grass, amari, bhargavi | Wh, Rh | Extract | (278) |
| Daemia extensa R.Br. | Asclepiadeae | Utranajutuka, phala-kantak | L | Juice | (19) |
| Dahlbergia lanceolaria Linn. | Fabaceae | Bithua, takoli | B | Oil | (278) |
| Daphne mezereum Linn. | Thymelaceae | Mezereum | B | Extract | (282) |
| Datiscas cannabina Linn. | Datiscae | Akalbar, bangala drmkhara | R | Decoction | (278) |
| Datura alba Nees. | Solanaceae | Thornapple, tattur | L | Juice | (51) |
| Datura metel Linn. | Solanaceae | Domy datura, dushtraga | L | Paste | (278) |
| Datura stramonium Linn. | Solanaceae | Apple of peru, tattur, devika | L | Infusion | (278) |
| Delonix elata Gamble Fl. | Fabaceae | Vayni, tiger bean | Wh | Extract | (288) |
| Delphinium cedatum Wall. | Ranunculaceae | Vishalakarni, jadwar | R | Decoction | (51) |
| Delphinium consola Linn. | Ranunculaceae | Lankspur | S | Oil | (282) |
| Delphinium staphisagri Linn. | Ranunculaceae | Spahc | S | Oil | (282) |
| Derris uliginosa Benth. | Papilionaceae | Pashuganda, worm killer | B | Decoction | (51) |
| Dickhoschachis cinera W.A. & A. | Fabaceae | Khedi, tertuli, bulluaraka | R | Extract | (278) |
| Diospyros candoliena Wright. | Ebanaceae | Nila-variksha | B | Decoction | (51) |
| Diospyros paniculata Daiz. | Ebanaceae | Tinduka, karinhuthari | B | Powder | (51) |
| Dipertocarpus alatus Roxb. | Dipertocarpicaceae | Gurnan, battsal, canvin | B | Extract | (278) |
| Dipertocarpus indicus Bedd. | Dipertocarpicaceae | Ennei | Rs | Rs | (51) |
| Dodonaea viscosa Linn. | Sapindaceae | Aliar, sanatta, Dhasera | L | Poultice | (51) |
| Dolichos falcatus Klein. | Papilionaceae | Kattamara | S | Decoction | (51) |
| Dysosylyx malabaricium Bedd. | Meliaceae | Agaru, kuna-mullla | W | Decoction | (51) |
| Eclipta prostrate Linn. | Aemaceae | Bhringaraj | R, L | Juice, decoction | (14) |
| Eleacarpus oblongos Gaertn | Tiliaceae | Malankara | F | Oil | (51) |
| Eleocarpus serratos Linn. | Tiliaceae | Julpaji, olan-karai | L | Extract | (51) |
Table 2: Contd...

| Botanical name        | Family             | Common name                  | Part used | Dosage form | References |
|-----------------------|--------------------|------------------------------|-----------|-------------|------------|
| Elaeis guineensis Jacq. | Palmae             | African oil palm             | Sr        | Oil         | (278)      |
| Elaeocarpus tuberculatus Roxb. | Tiliaceae         | Rudraksha, ruthtraksham      | B         | Decoction   | (51)       |
| Elephantopus scaber Linn. | Asteraceae        | Elephant foot, tutup bumi    | L         | Oil         | (279)      |
| Emblica officinalis Gaertn. | Euphorbiaceae     | Amla                         | F         | Juice       | (14)       |
| Ephedra gerardiana Wall. | Gnetaceae          | Amsania, budshur             | St, R     | Decoction   | (278)      |
| Ephedra vulgaris Rich. | Ephedraceae        | Khanda, ma-hung              | Be        | Decoction   | (289)      |
| Erythrina stricta Roxb. | Papilionaceae      | Mura, murukku                | B         | Powder      | (51)       |
| Eucalyptus globulus Labill. | Myrtaceae         | Blue gum tree                | B, L      | Oil         | (282)      |
| Eugenia operculata Roxb. | Myrtaceae          | Ral-Jaman, piaman            | F         | Oil         | (51)       |
| Eupatorium pergulifolium Linn. | Asteraceae       | Boneset, crosswort           | L         | Extract     | (282)      |
| Euphorbia antiquorum Linn. | Euphorbiaceae     | Triangular spurge, Tidhara, vajratundi | Br    | Gum, milky juice | (290) |
| Euphorbia helioscopia Linn. | Euphorbiaceae     | Hirrulesah, gandabhumti      | Br        | Juice       | (51)       |
| Euphorbia nerifolia Linn. | Euphorbiaceae     | Snoohi, common milk hedge    | Br        | Juice       | (51)       |
| Euphorbia nivulia Ham. | Euphorbiaceae      | Katathohar, vajri            | L         | Juice       | (278)      |
| Euphorbia tiruculli Linn. | Euphorbiaceae     | Milk bush, selhund           | Wh        | Milky juice | (278)      |
| Euryale ferox Salisb. & Roxb. | Nymphaeaceae      | Makhanna, foxnut, machana    | L         | Extract     | (278)      |
| Erythrina stricta Roxb. | Fabaceae           | Indian coral tree            | B         | Decoction   | (279)      |
| Excoecaria acerifolia Didrichs. | Polygonaceae     | Buckweat                     | R         | Extract     | (279)      |
| Fagopyrum esculentum Moench. | Polygonaceae     | Badhara, vikarini            | R         | Infusion    | (51)       |
| Farsetia aegyptica Tur. | Cruciferae         | Mulej, faridbuti             | F, L      | Extract     | (51)       |
| Farsetia hamiltonii Royle. | Cruciferae        | Farid-buti                   | F, L      | Extract     | (51)       |
| Farsetia jaquemontii Hk. F. & T. | Cruciferae       | Mulei                        | F, L      | Extract     | (51)       |
| Feaula asafoetida Linn. | Umbelliferae       | Hing, bhutanasar             | R         | Oil         | (51)       |
| Ferula galbaniflua Bloss. | Umbelliferae       | Gandhibiroma, galbanum       | R         | Oil         | (51)       |
| Ferula narthex Boiss. | Umbelliferae       | Tingra, bhuuti, devil's dung | L         | Infusion    | (278)      |
| Ficus bengalensis Linn. | Urticaceae         | Banyan tree, sriksha         | S, F      | Juice       | (291)      |
| Ficus religiosa Linn. | Urticaceae         | Pippala, peepul tree         | B         | Decoction, oil | (51) |
| Ficus retusa Linn. | Urticaceae         | Nandruk, pilala, kamrup      | L, B      | Poultice    | (51)       |
| Flacourtia sepulcra Roxb. | Pyretracae        | Kondai, kingaro              | L, R      | Infusion    | (51)       |
| Fraxinus excelsior Linn. | Oleaceae           | European ash                 | L         | Exudates    | (282)      |
| Garcinia pictorial Roxb. | Rutaceae           | Mysore gamboges tree, tamal  | Rs        | Powder      | (51)       |
| Gaultheria fragrantissima Wall. | Eriaceae        | Indian wintergreen gandapuro | L         | Oil         | (51)       |
| Gelsenium nitrudium Michaux. | Loganiaeae        | Wild yellow jessamine        | R         | Extract     | (282)      |
| Gendarussa vulgaris Nees. | Acanthaceae        | Nill-nargandi, kala-bashimb  | L         | Infusion    | (51)       |
| Gentian lutea Linn. | Gentianaceae       | Yellow gentian               | R         | Powder      | (282)      |
| Geodorum densiflorum Lam. | Orchidaceae        | Shepherd's crook orchid     | Rh        | Extract     | (279)      |
| Geranium maculatum Linn. | Geraniaceae        | Alum-root                    | Rh         | Oil, liniment | (282) |
| Gmelina asiatica Linn. | Verbenaceae        | Badhara, vikarini            | R         | Extract     | (19)       |
| Gossypium arboretum Linn. | Malvaceae          | Tree cotton                  | S         | Oil         | (279)      |
| Gossypium barbadense Linn. | Malvaceae          | Sea island cotton            | S         | Cotton      | (282)      |
| Gossypium haeum Linn. | Malvaceae          | Levant cotton                | L         | Oil         | (279)      |
| Gossypium indicum Linn. | Malvaceae          | Indian cotton plant, anagnika| S         | Oil, liniment | (51) |
| Grangia maderasapatha Poir. | Compositae         | Mukhatari, afsantin          | R         | Decoction   | (278)      |
| Grewia asiatica Linn. | Tiliaceae           | Palsa, dharmana              | B         | Infusion    | (51)       |
| Grewia tenax Fiori. | Tiliaceae           | Gowali, kakarundah           | L, F      | Oil         | (278)      |
| Gauliaum officiale Linn. | Zygophyllaceae     | Linguum vita                 | St        | Rs          | (282)      |
| Guizoa abyssynica Cass. | Compositae         | Nigers, kala-tii             | S         | Oil         | (51)       |
| Gymnandropsis gynaecodia Marill. | Capparidaceae | Churota, huful, aiagandha    | L         | Extract     | (278)      |
| Gymnocydea odorata R.Br. | Flacourtiaae       | Chaluymgra, biringmogra      | S         | Oil         | (51)       |
| Hedeoma pulegoides Persoon. | Labiateae         | Ameican pinnryoyal           | L         | Infusion    | (282)      |
| Heliotropium indicum Linn. | Boraginaceae       | Hattasa, siriai bhurudi      | R, L      | Plasters    | (278)      |
| Hemidesmus indicus R.Br. | Asclepiadaceae     | Sugandhi, indian sarsaparilla| R-B       | Infusion    | (292)      |
| Herpestis monniera H.B.K. | Scrophulariaceae   | Brahmi, thyme-leaved         | L         | Juice       | (51)       |
| Hibiscus tiliaceus Linn. | Malvaceae           | Cork wood, pola              | E         | Embrocation | (51)       |
| Hiptage benghalensis Linn. | Malpighiaceae      | Hutumukta, karmi              | L         | Juice       | (278)      |
| Hiptage madablotia Gaertn. | Malpighiaceae      | Madhabili, madavilata        | L         | Extract     | (51)       |
| Holarrhena antidysenterica Wall. | Apocynaceae     | Kurchi, kutaja, kewar        | B         | Lep         | (51)       |
| Hedera helix Linn. | Araliaceae          | Barren iyo, mandia bind wood | Be        | Infusion    | (278)      |
| Holoptelea integrifolia Planch. | Urticaceae        | Papry, vaiyla                | B         | Juice       | (51)       |
| Humulus lupulus Linn. | Cannabineae        | Hop                          | Wh        | Infusion    | (282)      |
| Hydnocarpus wightiana Blume. | Flacourtiaae       | Jangli almond, tuvaraka, chaumoggra | S  | Oil         | (51)       |
| Hydrocotyle asiatica Linn. | Umbelliferae       | Brahmi, Indian penny-wort    | Wh        | Juice extract | (51) |
| Hygrophila spinosa T.Anders | Ascanthaceae       | Kolista, ghokula-kanta       | R         | Decoction   | (51)       |
| Hyxopous officinalis Linn. | Labiateae          | Zupha                        | L         | Infusion, syrup | (51) |
| Illicium verum Hook. | Magnoliaceae       | Star anise, anasphal         | F         | Oil         | (51)       |
| Indigofera oblongifolia Forsk. | Papilionaceae     | Jhilla, mridupatraaka        | R         | Decoction   | (278)      |
| Botanical name                  | Family                        | Common name                          | Part used   | Dosage form | References |
|--------------------------------|-------------------------------|--------------------------------------|-------------|-------------|------------|
| Indigofera paucifolia Delie.   | Papilionaceae                 | Kuttukkar-chammathi                  | St          | Decoction   | [51]       |
| Indigofera trifoliata Linn.    | Papilionaceae                 | Vekhario, malmandi                   | S           | Confection  | [51]       |
| Inula helenium Hook.           | Compositae                   | Rasan                                | L           | Oil         | [51]       |
| Ipomoea eriocarpa Br.          | Convolvulaceae               | Nakhari, pulichevidu                 | Wh          | Oil         | [51]       |
| Ipomoea hispida Roem & Schult. | Convolvulaceae               | Bhanwar, harankhuri                  | Wh          | Oil         | [278]      |
| Ipomoea pescaprae Purga.       | Convolvulaceae               | Goat’s foot creeper, chagalahngri    | R, L        | Decoction   | [51]       |
| Ipomoea renifomis Chois.       | Convolvulaceae               | Mushakani, mooshakarni               | Wh          | Decoction   | [51]       |
| Ipomoea purpureum Br.          | Convolvulaceae               | Indian jalap, kalaparni              | R-B         | Powder      |            |
| Jasminum grandiflorum Linn.    | Oleaceae                     | Spanish jasmine, chambeli            | R           | Oil         | [278]      |
| Jatropha curcas Linn.          | Euphorbiaceae                | Jangli-erandi, angula-leaved physic nut | S          | Oil         | [293]      |
| Jatropha gandulifera Roxb.     | Euphorbiaceae                | Nikumba, lal-bhranda                 | S           | Oil         | [51]       |
| Juglans regia Linn.            | Juglandaceae                 | Akhor, darga, walnut tree            | B           | Decoction   | [280]      |
| Juniperus communis Linn.       | Coniferae                    | Juniper berry, hapusha               | Be          | Powder      | [51]       |
| Justicia ecboilium Linn.       | Acanthaceae                  | Oodojati                             | Wh          | Extract     | [51]       |
| Justicia gendaruasia Burm.     | Acanthaceae                  | Nilinargangi, kapika, bhutakeshi     | L           | Decoction   | [294]      |
| Justicia procumbens Linn.      | Acanthaceae                  | Carmeuteine couchee                  | H           | Infusion    | [51]       |
| Koelopinia linearis Pallas.    | Asteraceae                   | Koelpinia                            | Wh          | Extract     | [279]      |
| Launaea aculeate Linn.         | Verbenaceae                  | Wild Sage, ghaneri                   | Wh          | Decoction   | [278]      |
| Lanuana pinnatiffida Coss.     | Compositae                  | Pathri, almirao                      | L           | Juice       | [51]       |
| Lavandula stoechas Linn.       | Labiatae                     | Arabian lavender, dharu              | F           | Formentation | [51]       |
| Lawsonia alba Linn.            | Lythraceae                   | Heena, mendhi, mehndi                | L           | Paste       | [295]      |
| Lea indica Merr.               | Vitaceae                     | Bandicoot berry                      | Wh          | Extract     | [279]      |
| Leonotis nepetaeffolia R.Br.   | Labiatae                     | Hejurchei, matijer                   | L           | Decoction   | [278]      |
| Leucas aspera Spreng.          | Labiatae                     | Chotahalkusa, tamsa                 | L           | Juice       | [296]      |
| Lipidium crassifolium Hung.    | Cruciferae                   | Hairry cress                         | S           | Extract     | [278]      |
| Lipidium sativum Linn.         | Cruciferae                   | Cress, chandrasura halim, chansaur   | S           | Paste       | [51]       |
| Leucas linifolia Spreng.       | Labiatae                     | Dronapushpi, hulksusa                | L, F        | Infusion    | [51]       |
| Linum usitatissimum Linn.      | Linaceae                     | Lins, uma, tisi                      | S           | Pouliche    | [297]      |
| Litsea chinensis Lam.          | Lauraceae                    | Garur, adhavara, chamana             | Be          | Oil         | [278]      |
| Litsea sebifera Pers.          | Lauraceae                    | Garbijuar, menda, medasak            | B           | Powder, paste | [51]       |
| Lolium temulentum Linn.        | Graminae                     | Darnel                               | S           | Powder      | [282]      |
| Lycopodium clavatum Linn.      | Lycopodiaceae                | Clubmoss spores, wolf claw           | Sp          | Tincture    | [51]       |
| Lygodium flexuosum Linn.       | Polypodiaceae               | Vallipanna, kalazha                  | R           | Oil         | [51]       |
| Machilus macrantha Nees.       | Lauraceae                    | Kolamavu                             | B           | Extract     | [51]       |
| Marrubium vulgare Linn.        | Labiatae                     | White hore-hound, farasiyun          | H           | Infusion    | [51]       |
| Matricaria chamomilla Linn.    | Compositae                   | Babunphul, camomile                  | F           | Oil         | [51]       |
| Melaleuca leucadendron Linn.   | Myrtaceae                    | Cajaput tree, kayaputi               | L           | Oil         | [51]       |
| Melaleuca minor Smith.         | Myrtaceae                    | Kaya-puti, cajaput                   | L           | Oil         | [282]      |
| Melia azadirachta Linn.        | Meliaceae                    | Ravipriya, neem, nimb                | B           | Decoction   | [51]       |
| Melia azedaracha Linn.         | Meliaceae                    | Mahanimba, persian lilac, bakayan    | S           | Oil         | [51]       |
| Menthe piperita Linn.          | Labiatae                     | Garbijaour, menda, medasak           | B           | Powder, paste | [51]       |
| Mentha arvensis Hort.          | Labiatae                     | Peppermint, gamath phudina           | L           | Oil         | [282]      |
| Mentha aquatica Hort.          | Labiatae                     | Acorus, acorum                        | L           | Oil         | [51]       |
| Merremia tridentate Hallier.   | Convolvulaceae               | Prasarin                             | Wh          | Extract     | [298]      |
| Mesua ferrea Linn.             | Compositae                   | White hore-hound, farasiyun          | H           | Infusion    | [51]       |
| Michelle champaca Linn.        | Magnoliaceae                 | Golden champa, champaka              | F           | Oil         | [51]       |
| Mimosa pudica Linn.            | Fabaceae                     | Humble plant, lajvati, kandiri       | Wh          | Extract     | [278]      |
| Mullugo cerviana Ser.          | Ficoidaceae                  | Taph-r'had, phanya, grishmasundara   | R           | Oil         | [51]       |
| Morinda citrifolia Linn.       | Cucurbitaceae                | Bitter gourd, karavelia, karela      | F           | Juice       | [51]       |
| Morinda officinalis Linn.      | Cucurbitaceae                | Gangerua, kaka, kramindera           | F           | Juice       | [278]      |
| Monarda punctate Linn.         | Gentianaceae                 | Bogbean, water shamrock              | R           | Extract     | [278]      |
| Monera cuneifolia Michx.       | Scrophulariaceae             | Bama, brahami, swetchammi            | L           | Juice       | [51]       |
| Monarda punctate Linn.         | Labiatae                     | Horse-mint                           | L           | Oil         | [282]      |
| Morinda citrifolia Linn.       | Rubiaceae                    | Indian mulberry, barraal             | L           | Juice       | [278]      |
| Moringa oleifera Linn.         | Moringaceae                  | Horse-radish, sobhanjana             | S           | Oil         | [51]       |
| Mucuna gigantea DC.            | Papilionaceae                 | Kakkavali                            | B           | Powder      | [51]       |
| Mukia maderapatana Linn.       | Cucurbitaceae                | Madras pea pumpkin, agumaki          | L           | Decoction   | [13]       |
| Murraya exotica Linn.          | Rutaceae                     | Honey bush, ekangj, kamini           | F, L        | Infusion    | [51]       |
| Murray koeigii Linn.           | Rutaceae                     | Bristly bryoni                       | L           | Powder      | [13]       |
| Myristica fragrans Houtt.      | Myristaceae                  | Nutmeg, jati-phalams, jaiphal        | S           | Oil         | [19]       |
| Myristica malabarica Lamk.     | Myristaceae                  | Malabar nutmeg, malati, kamuk        | S           | Embrocation | [51]       |
| Myroopryum similicofolium Blume.| Oleaceae                     | Chaturam-mallikei                    | L           | Extract     | [51]       |
| Myrtus caryophyllus Linn.      | Myrtaceae                    | Cloves, lavangaha, laung             | F           | Oil         | [51]       |
| Myrtus communis Linn.          | Myrtaceae                    | Myrtle, murad                         | L           | Oil         | [51]       |
| Naregamia alata W. & A.        | Meliaceae                    | Goanese ipecacuanha, amlavalli       | Wh          | Extract     | [278]      |
| Nicolotia tabacum Linn.        | Solanaceae                   | Tobacco, tambaku, tamakuta           | L           | Decoction   | [51]       |
| Nyctanthes arbor-tristis Linn. | Oleaceae                     | Night jasmine, silharu, parijata     | L           | Infusion    | [51]       |
| Ocimum gratissimum Linn.       | Labiatae                     | Shrubby basil, ramulasi               | Wh          | Fumigations | [19]       |

**Table 2: Contd...**
| Botanical name | Family | Common name | Part used | Dosage form | References |
|----------------|--------|-------------|-----------|-------------|------------|
| Ocimum sanctum Linn. | Lam. | Basil | L | Decoction | [14] |
| Odina wooler Roxb. | Anacardiaceae | Jingga, ajashrangi, jingan | L | Paste | [51] |
| Oldenlandia heynei Hk. | Rubiaceae | Nonganam-pillu | L | Extract | [51] |
| Olea cuspidate Wall. | Oleaceae | Kahu, zaitum | R | Ashes | [278] |
| Onosma bracteatum Wall. | Boraginaceae | Goazaban, kazabun | Wh | Decoction | [51] |
| Onosma eichoides H. | Boraginaceae | Ratanjot, lajarj, koame | Fl | Oil | [51] |
| Originum majaorana Linn. | Labiatea | Wild marjoram, sathra | Wh | Oil | [51] |
| Originum vulgare Linn. | Labiatea | Sathra | Wh | Oil | [51] |
| Oroxyllum indicum Vent. | Bignoniaceae | Prathusimbh, miringa, snapatha | B | Powder | [51] |
| Osmunda regalis Linn. | Osmundaceae | Royal fern, osmonde | Wh | Extract | [51] |
| Paederia foetida Linn. | Rubiaceae | Prasarin, gandhali, Chinense flower plant | L | Juice | [51] |
| Pandanus odoratissimus Willd. | Pandanaceae | Ketaki, fragrant screwpive | F | Oil | [51] |
| Pandanus tectorius Soland. | Pandanaceae | Umbrella tree, keora, ketgi | Bt | Oil | [278] |
| Panicum italicum Linn. | Gramineae | Italian millet, kanku | S | Extract | [51] |
| Papaver dubium Linn. | Papaveraceae | Pale-red poopy | R | Cooked | [278] |
| Papaver sommerfuir Linn. | Papaveraceae | Opium poppy, khas khas | S | Liniment | [51] |
| Pavetta indica Linn. | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pavonia odorata | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pedalium murex Linn. | Pedalium | Faridbuti, gaaja daunsree | L | Powder | [51] |
| Peganum harmala Linn. | Peganum | Foreign henna, harmal, kaladan | L | Decoction | [278] |
| Peucedanum graveolens | Peganum | Peucedanum graveolens | W | Infusion | [51] |
| Peperomia aculeata | Peperomia | Peperomia aculeata | W | Infusion | [51] |
| Pergularis daemia | Pergularis | Pergularis daemia | W | Infusion | [51] |
| Papaver sommerfuir Linn. | Papaveraceae | Opium poppy, khas khas | S | Liniment | [51] |
| Pavetta indica Linn. | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pavonia odorata | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pedalium murex Linn. | Pedalium | Faridbuti, gaaja daunsree | L | Powder | [51] |
| Peganum harmala Linn. | Peganum | Foreign henna, harmal, kaladan | L | Decoction | [278] |
| Peucedanum graveolens Benth. | Peucedanum | Peucedanum graveolens | W | Infusion | [51] |
| Pergularis daemia | Pergularis | Pergularis daemia | W | Infusion | [51] |
| Papaver sommerfuir Linn. | Papaveraceae | Opium poppy, khas khas | S | Liniment | [51] |
| Pavetta indica Linn. | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pavonia odorata | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pedalium murex Linn. | Pedalium | Faridbuti, gaaja daunsree | L | Powder | [51] |
| Peganum harmala Linn. | Peganum | Foreign henna, harmal, kaladan | L | Decoction | [278] |
| Peucedanum graveolens Benth. | Peucedanum | Peucedanum graveolens | W | Infusion | [51] |
| Pergularis daemia | Pergularis | Pergularis daemia | W | Infusion | [51] |
| Papaver sommerfuir Linn. | Papaveraceae | Opium poppy, khas khas | S | Liniment | [51] |
| Pavetta indica Linn. | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pavonia odorata | Rubiaceae | Papat, Indian pellet kankra | W | Infusion | [278] |
| Pedalium murex Linn. | Pedalium | Faridbuti, gaaja daunsree | L | Powder | [51] |
| Peganum harmala Linn. | Peganum | Foreign henna, harmal, kaladan | L | Decoction | [278] |

Contd...
| Botanical name                  | Family                | Common name                  | Part used | Dosage form | References |
|--------------------------------|-----------------------|------------------------------|-----------|-------------|------------|
| Ribes nigrum Linn.             | Saxifragaceae         | Currants, nabar              | C         | Currants    | [51]       |
| Ricinus communis Linn.         | Euphorbiaceae         | Castor oil plant, eranda, endi | S         | Oil, poultice | [19]       |
| Ruta graveolens Linn.          | Rutaceae              | Satap, garden rue, pismarum  | L         | Decoction   | [207]      |
| Rubia cordifolia Linn.         | Rubiaceae             | Madar, manjit, khuri         | R         | Decoction   | [278]      |
| Rourea santaloides W. & A.     | Conaraceae            | Vardara, wakeri              | R         | Tonic       | [51]       |
| Rosa alba Linn.                | Rosaceae              | Guulseoi, gulab bahupatrika  | F         | Oil         | [278]      |
| Saccocaula pappilosum Lindl.    | Orchidaceae           | Nakuli, rasna                | Rs        | Resins      | [51]       |
| Salacia oblonga Wall.          | Calastraceae          | Panorkanti                    | R         | Extract     | [300]      |
| Salacia reticulata Wight.      | Calastraceae          | Ekanayakam, koranti          | R         | Extract     | [300]      |
| Salix alba Linn.               | Salicaceae            | Huntingdon willow, bushan    | B         | Decoction   | [301]      |
| Salvadora oleoides Dcne.       | Salvadoraee           | Kabber, mithidiar, jhali     | S         | Oil         | [51]       |
| Salvadora persica Linn.        | Salvadoraee           | Piltu, tooth brush tree, chhota-pilu | F         | Oil         | [51]       |
| Samadera indica Gaertn.        | Spondis pinnate       | Kathai, nibam, daraput       | F         | Oil         | [278]      |
| Sambucus canadensis Linn.      | Adoxaceae             | American elder               | FI        | Oil         | [282]      |
| Sambucus nigra Linn.           | Adoxaceae             | Bore tree                    | FI        | Oil         | [282]      |
| Sambucieria urghiana Roxb and Schult. | Hammodraceae | Mruvu, murhuri, katkupel     | R         | Extract     | [51]       |
| Santalum rubrum Linn.          | Sapindaceae           | Arishtha, indian filbert, ritha | R, L     | Extract, juice | [51]      |
| Santalummissus missionis Wall. | Rubiaceae             | Jalamadasa, nirvani          | B         | Decoction, powder | [51]  |
| Sassafras officinale Nees.     | Laurineae             | Sassafras                    | R         | Oil         | [51]       |
| Sausurea lappa Clarke.         | Compositae            | Puskara, costus, kushtha, kut | R         | Infusion    | [278]      |
| Schleichera trijuga Wild.      | Sapindaceae           | Ceylon oak, gausam           | S         | Oil         | [278]      |
| Schoenoaulca officinale A.Gray. | Melanthaee           | Sabadilla                    | F, S      | Ointment    | [51]       |
| Scindapsus officinalis Schitt  | Araceae               | Portabel, gajapipal, shreyasi | F         | Juice       | [282]      |
| Semecarpus anacardium Linn.    | Anacardiaceae         | Marking-nut tree, bhallataka, bhela | F         | Juice       | [302]      |
| Sesamum indicum Linn.          | Pedaliaceae           | Gingelly, bariktel           | S         | Oil         | [278]      |
| Sesanbana aegyptiaca Pers.     | Papilionaceae         | Jayantika, jetrasin          | L         | Poultice    | [51]       |
| Sesbania grandiflora Pers.     | Papilionaceae         | Agasta, hatiya               | R         | Paste       | [51]       |
| Setaria italica Beauc.         | Gramineae             | Foxtail millet, kangu         | Gr        | Parching    | [51]       |
| Shorea robusta Gaertn.         | Dipoterocarpus        | Sal tree, sakhu asvakarna, | B, Rs     | Paste       | [51]       |
| Sida acuta Burm.               | Malvaceae             | Barica, bala, pranjivika     | L         | Oil         | [19]       |
| Sida cordifolia Linn.          | Malvaceae             | Baria, batalaka, simak       | R, S      | Oil         | [51]       |
| Sida rhombifolia Linn.         | Malvaceae             | Sahadeva, kherenti            | R         | Oil         | [218]      |
| Siegesbeckia orientalis Linn.  | Compositae            | Katampam, kau-kan            | Wh        | Tincture    | [51]       |
| Skimmia laurea Sieb.           | Rutaceae              | Ner                         | Wh        | Extract     | [279]      |
| Smilax china Linn.             | Liliaceae             | Dwpautra, china root, chobchini | R         | Decoction   | [19]       |
| Smilax lanceafoilia Roxb.      | Liliaceae             | Bari-chobchini               | R         | Juice       | [51]       |
| Smilax officinalis Kunth.      | Liliaceae             | Jamaïca sarsaparilla         | R         | Powder, extract | [282] |
| Smilax zeylaniana Linn.        | Liliaceae             | Chebchini, ramdatun          | R         | Paste       | [278]      |
| Smithia conferta Sm.           | Papilionaceae         | Smithia                      | Wh        | Extract     | [278]      |
| Solanum dulcamara Linn.        | Solanaceae            | Kaamachi, bitter-sweet, rubabarik | Be       | Decoction    | [51]      |
| Solanum nigrum Linn.           | Solanaceae            | Makoi, kambe, kamuni         | L         | Poultice    | [51]       |
| Solanum xanthocarpum Schrad & Wendll. | Solanaceae   | Kantakari, warumba, bhutkayta | Wh, Be   | Juice       | [51]       |
| Spilanthes acmella Mur.        | Compositae            | Pokormul, akarkara           | L         | Decoction   | [278]      |
| Spindis pinate Kurz.           | Anacardiaceae         | Amarah, Indian hog plum, ambra | L         | Juice       | [278]      |
| Stachyortpha indica Vahl.      | Verbenaceae           | Aaron’s rod                   | L         | Juice       | [278]      |
| Strnychos bourdillonii Trees.  | Loganiaceae           | Nirmali, clearing nut tree   | R         | Decoction    | [278]      |
| Strychnos cinnamonifolia Thw.Enum. | Loganiaceae   | Etakirindiwel, webel           | R         | Decoction    | [278]      |
| Strychnos nux-vomica Linn.     | Loganiaceae           | Cupili, poison-nut, kagphala  | S         | Powder      | [303]      |
| Strychnos potatorum Linn.      | Loganiaceae           | Clearing-nut tree            | S         | Powder      | [303]      |
| Teucrrium pollinum Linn.       | Labiateae             | Cat thyme, poley             | L         | Infusion    | [280]      |
| Teramus labialis Spreng.       | Combretaceae          | Masha-parui, mashani         | B         | Decoction   | [51]       |
| Terminalia bellerica Roxb.      | Combretaceae          | Vibhitaki, bhaira            | K         | Oil         | [51]       |
| Terminalia chebula Retz.       | Combretaceae          | Pathya, myrobalan, Indian gall-nut | F         | Powder      | [19]       |
| Tinospora cordifolia Miers.    | Menispermacaceae      | Ambarvel, gharol, gulvel     | R, St     | Starch      | [278]      |
| Tinospora malabarica Miers.    | Menispermacaceae      | Gurch, giloe, padmagaluncha  | L, St     | Extract     | [278]      |
| Thevetia nerifolia Juss.       | Apocynaceae           | Yellow oleander, pilakanir, aswahaa | S         | Oil         | [278]      |
| Thymus vulgaris Linn.          | Labiateae             | Garden thyme                 | Wh        | Oil         | [282]      |
| Todalia aculeate Lamk.         | Rutaceae              | Kanchana, jangli-kali-mich, limri | F, R     | Liniment    | [51]       |
| Todalia asiatica Lam.          | Rutaceae              | Dahan, lopez root, forest pepper | F, R    | Liniment    | [51]       |
| Todalia bilocularis W. & A.    | Rutaceae              | Krishna-aguru, devadarom     | W         | Oil         | [51]       |
| Toludiera pereirea Baill.       | Fabaceae              | Peru balsams                 | B         | Balsams     | [282]      |
| Trewia nudiflora Linn.         | Euphorbiaceae         | Pindara, pitali, sivani      | R         | Decoction   | [51]       |
| Tribulus terrestris Linn.      | Zygophyllaceae        | Small caltrops, gokshura, chota-gokhura | F         | Decoction   | [19]       |
| Trichosanthes palmate Roxb.    | Cucurbetaceae         | Indrayan, mahakala kaundal   | F         | Juice       | [278]      |
| Trigonella foenum-gaecum Linn. | Papilionaceae         | Mathi, medhika               | S         | Confection  | [247]      |
| Tylophora asthmatica W. & A.   | Asclepiadaceae        | Jalangi-pikvan, antamul       | L         | Powder, decoction | [51] |

Contd...
**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 other monoterpenoids, of which α-terpineol is the major constituent.

Other monoterpenoids includes α-pinene, cis-verbenol, trans-pinocarveol, borneol, myrcene, verbenone, limonene, and p-cymene, while β-copaene was the only sesquiterpene identified [65,66]. BS possesses an anti-inflammatory [67, analogs [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-arthritic activity at doses of 50 or 100 mg/kg in male wistar rats.

The anti-arthritic 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, Malay, and Sri Lanka. The tree spreads to a height of 10 m and is cultivated for its large, ornamental penicals 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 Tunani 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], antitumor [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, 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.
| Botanical name                  | Family            | Common name                        | Part | Extract | Dose (p.o.) | Acute toxicity (p.o.) | Model | Mode of action                                                                 |
|--------------------------------|-------------------|------------------------------------|------|---------|-------------|-----------------------|-------|-----------------------------------------------------------------------------------------------------------------------------|
| Acyranthus aspera Linn.        | Amaranthaceae     | Devil’s horsewhip                  | S, R | Alcohol | 15 mg/100 g | Safe up to 8 g/kg     | FIA   | Inhibition of secondary lesions                                                                                               |
| Achyranthes aspera Linn.       | Amaranthaceae     | Apamarga                           | R    | Ethanol | 100-200 mg/kg | Safe up to 8 g/kg | CFA   | Prevented the recruitment of leukocytes                                                                                       |
| Aconitum vilmorinianum Kom.    | Ranunculaceae     | Huang Cao Wu                       | R    | Ethanol | 10-100 mg/kg | D.N.A                 | CFA   | Improvement of joint algodinia, swelling, hyperaemia and vascular permeability COX-1 and COX-2 inhibition                  |
| Ajiga bracteosa Wall.          | Labiatae          | Ground pine                        | Wh   | Ethanol | 5, 10, 20 mg/kg | LD<sub>50</sub> > 5 g/kg | TIA   | Decrease the ESR and WBC count                                                                                               |
| Ajiga decemens Thunberg.       | Lamiaeae          | Bugle weed                         | Wh   | 70% ethanol | 30, 50, 150 mg/kg | D.N.A                 | CFA   | Regulates the balance between bone resorption and bone formation                                                           |
| Aktonia boonei De Wild.        | Apocynaceae       | Cheesewood, pattern wood           | St, B| Methanol| 50, 100, 200, 400 mg/kg | D.N.A | CFA | Inhibits arthritis deterioration the secretion of pro-inflammatory cytokines and RA factor |
| Aktonia scholaris Linn. R.Br.  | Apocynaceae       | Dita bark, devil tree              | L    | Ethanol | 100, 200, 400 mg/kg | ≥ 2 g/kg               | CFA   | Decrease the ESR and WBC count                                                                                               |
| Ammania bracifera Linn.        | Aristolochiaceae  | Acrid weed, tooth cup Kidamari      | L    | Aqueous alcoholic Pet ether, chloroform, methanol | 250, 500 mg/kg | ≥ 5000 mg/kg | CFA | Inhibition of both the early and late phases of pain stimulus.                                                               |
| Argyreia speciosa Sweet.       | Convolvulaceae    | Elephant creeper                    | R    | Ethanol | 50-100 mg/kg | ≥ 3000 mg/kg | CFA | Decrease the ESR and WBC count                                                                                               |
| Arisaema rhizomatum Fischer.   | Aroidea           | Jack in the pulpit                 | Rh   | Methanol | 130, 261, 522 mg/kg | Safe up to 40 g/kg | CFA   | Inhibits arthritis deterioration the secretion of pro-inflammatory cytokines and RA factor |
| Arnebia euchroma Johnst.       | Boraginaceae      | Pink arnebia, demok                | R    | 95% ethanol | 2.5, 5, 10 mg/kg | D.N.A                 | CFA   | Decrease the ESR and WBC count                                                                                               |
| Artocarpus tonkinensis A. Cheval. | Moraceae         | Chay                               | L    | Ethyl acetate | 10-200 mg/kg | D.N.A                 | CFA   | Decrease the ESR and WBC count                                                                                               |
| Asystasia dalzelliana Santapau.| Acanthaceae       | Violet asystasia                    | L    | Ethanol | 200, 400, 600 mg/kg | ≥ 2000 mg/kg | CFA | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Baccharis genistelloides Linn. | Acanthaceae       | Carqueja                           | Arpt | Aqueous | 4.2 mg/kg | Safe up to 42 mg/kg | CFA   | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Bacopa monniera Penell.         | Acanthaceae       | Herpestis monniera                 | Wh   | Methanol | 100 mg/kg | ≥ 3000 mg/kg | CFA | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Barleria lupulina Lindl.        | Acanthaceae       | Hophead                            | L    | Methanol | 300, 600 mg/kg | D.N.A | CFA | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Barleria prionitis Linn.        | Acanthaceae       | Katsareya, karunta                 | Wh   | Hydro-alcoholic | 12.5, 25, 50, 100 mg/kg | Safe up to 3000 mg/kg | AIA   | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Bauhinia variegata Linn.        | Caesalpiniae      | Kachnar, chinthrao                 | St   | Ethanol | 100, 250 mg/kg | Safe up to 2000 mg/kg | CFA | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Bergenia stracheyi Linn.        | Saxifragaceae     | Paashaanbhed                       | Rh   | Pet ether and methanol | 40 mg/kg | Safe up to 2000 mg/kg | AIA | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Boerhaavia diffusa Linn.        | Nyctaginaceae     | Punarnava                          | R    | Pet ether | 500-1000 mg/kg | ≥ 1000 mg/kg | CFA | Decrease the synthesis/release of T-cell mediators in vitro                                                               |
| Boswellia carterii, Birdw.      | Burseraceae       | Olibanum                           | Rs   | 70% aqueous acetone | 0.90 g/kg | Safe up to 0.90 g/kg | CFA | Decrease the synthesis/release of T-cell mediators in vitro                                                               |

Table 3: Plants with reported anti-arthritic activity

Continued...
| Botanical name       | Family               | Common name               | Part         | Extract         | Dose (p.o.) | Acute toxicity (p.o.) | Model    | Mode of action                                                                 | Reference |
|---------------------|----------------------|---------------------------|--------------|-----------------|-------------|-----------------------|----------|--------------------------------------------------------------------------------|-----------|
| *Boswellia serrata* | Burseraceae          | Salai gugul               | Rs           | n-hexane        | 50 mg/kg    | Safe upto 50 mg/kg    | CFA      | Lysoosomal membrane stability modulating effect, inhibiting leukocyte migration, controlling the production of auto antigens and anti-proteinase activity | [76]      |
| *Butea monosperma*  | 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] |
| *Caesalpinia sappan*| Leguminosae          | Sapanwood, suou           | W            | Ethanol         | 2.5, 5, 10 μg/ml | Safe upto 5000 mg/kg | *In vitro*, cartilage/chondrocyte protection | [321,322] |
| *Calotropis gigantea* | Asclepiadaceae      | Milkweed                  | Al           | Petroleum ether | 50 mg/kg    | Safe upto 2000 mg/kg | CFA      | Decreasing the levels of IL-1β, IL-6, TNF-α and PGE2 in serum and the expression of COX-2 and transcription factor NF-κB | [93,322] |
| *Calotropis procera* | Apocynaceae          | Sodom apple               | Al           | Methanol        | 50-500 mg/kg | Safe upto 2000 mg/kg | CFA      | Pro-inflammatory cytokines as well as anti-inflammatory cytokines are reduced | [323,324] |
| *Calitha pakstris*   | Ranunculaceae        | Kingscup, marsh marigold  | Wh           | Methanol        | 10 mg/kg    | D.N.A                 | CIA      | Inhibit cellular influx and vascular permeability                             | [325,326] |
| *Cannabis sativum*   | Cannabaceae          | Ganja, indian hemp        | L            | Alcoholic       | 10, 25 mg/kg | D.N.A                 | CIA      | Decrease in the percentage and the absolute count of splenic T-regulatory cells (CD4⁺CD25⁺FOXP3⁺) | [327]      |
| *Capparis erythrocarpus* | Capparaceae         | Flamingo lily             | R            | Ethanol         | 100, 300 mg/kg | D.N.A                 | AIA      | Diminished CII-specific proliferation and IFN-γ production                   | [98]      |
| *Cassia uniflora*    | Caesalpiniaceae      | One leaf senna            | L            | Methanol, pet ether, ethyl acetate | 50, 100 mg/kg ≥ 1000 mg/kg | D.N.A                 | CIA      | Histamine and prostaglandin synthesis inhibition                             | [330]      |
| *Cayaponia tayuya*   | 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-1β production in lymphocytes | [331]      |
| *Celastrus aculeatus* | Celastraceae         | Gua shan fena             | R, St        | Ethanol         | 1-3 g/kg    | LD₅₀ = 20.5 mg/kg    | CFA      | Down modulation of immunological and biochemical mediator                   | [332,333] |
| *Centella asiatica*  | Mackinlayaceae       | Brahmi booti              | L            | Methanol        | 0.5 ml      | HRBC-MS               |          | Inhibition of protein denaturation membrane stabilization and proteinase inhibitory | [286]      |
| *Cinnamomum zeylanicum* | Lauraceae            | Dalchini                  | B            | Aqueous         | 8 mg/kg     | D.N.A                 | CFA      | Inhibition of leukocyte emigration and prostaglandins                       | [109]      |
| *Cissampelos pareira* | Cassia glomerulosa   | 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] |
| *Chelidonium majus*  | Papaveraceae         | Tetterwort                | Al           | 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]      |
| Botanical name | Family | Common name | Part | Extract | Mode | Dose (p.o.) | Acute toxicity (p.o.) | Mode of action | Reference |
|----------------|--------|-------------|------|---------|------|------------|----------------------|----------------|-----------|
| Clematis chinensis Osbeck. | Ranunculaceae | Wei Ling xian | R | Aqueous | D.N.A | 100 mg/kg | Safe up to 2000 mg/kg | Inhibited PGE2 production and COX-2 expression | [337] |
| Cleome gyandra L. | Cleomaceae | Shone cabbage | L | Ethanol | CFA | 150 mg/kg | Safe up to 2000 mg/kg | Modifying the lysosomal membrane or by inhibiting the release of pro-inflammatory cytokines and suppression of inflammatory mediators | [286,338] |
| Coriandrum sativum Linn. | Apiaceae | Cilantro, dhania | S | Hydroalcoholic | FOIA | 8, 16, 32 mg/kg | Safe up to 2000 mg/kg | Inhibit the secretion of pro-inflammatory cytokines including TNF-α | [120,339] |
| Costus speciosus Sm. | Zingiberaceae | Keukand | Al | Methanol | CFA | 400, 800 mg/kg | Safe up to 2000 mg/kg | Suppression of inflammatory mediators | [287,340] |
| Curcuma longa Linn. | Zingiberaceae | Turmeric | Rh | N-hexane | SCW | 520 mg/kg | Acute | Activation of genes critical to articular inflammation | [130] |
| Curcuma zeodaria Rosc. | Zingiberaceae | White turmeric | R | Pet ether | CFA | 200, 400 mg/kg | Safe up to 5000 mg/kg | Decrease the latency time to explore | [341] |
| Delonix elata, Gambles. | Caesalpinoideae | White gulmohar, waykaran | B | Pet ether | CFA | 250 mg/kg | Safe up to 5000 mg/kg | Blocking the action of COX, LO and AT and thus preventing the generation of mediators | [288] |
| Dipsacus asperoides Linn. | Dipsacaceae | Japanese teasel root | R | Aqueous | CIA | 50-100 mg/kg | Safe up to 2500 mg/kg | Reduced the levels of anti-CII IgG2a antibody | [342] |
| Drynaria quercifolia L. | Polypodiaceae | Oak leaf fern | Rh | Aqueous | D.N.A | 100-200 mg/kg | Safe up to 5000 mg/kg | Inhibition of ROS release | [342,259] |
| Elaeocarpus sphaericus L.f. | Elaeocarpaceae | Blue marble tree, Indian oil fruit | Wh | Ethanol | CFA | ≥ 2 g/kg | Safe up to 2500 mg/kg | Immunosuppressant action and inhibition of leukocytes migration in inflamed areas | [344] |
| Ephedra sinica Staph. | Ephedrceae | Ma Haung | H | Water | CFA | 50 ul s.c. | Safe up to 4 g/kg | mRNA expressions of TNF-α and IL-6 genes restored to normal levels | [289] |
| Euphorbia antiquorum Linn. | Euphorbiaceae | Antique spurge | Wh | Aqueous, ethanol, 400 mg/kg | CFA | 400 mg/kg | ≥ 2 g/kg | Inhibition of the arachidonic metabolites and suppression of cell-mediated immunity | [290] |
| Ficus bengalensis Linn. | Moraceae | Banyan tree | St | Methanol | D.N.A | 100, 200, 300 mg/kg | Safe up to 5000 mg/kg | Inhibition of NO production from the macrophages that infiltrated to the inflamed site | [345] |
| Ginkgo biloba Linn. | Ginkgoaceae | Maidenhair tree | L | Methanol | D.N.A | 2 mg/kg | Safe up to 4 g/kg | Inhibition of NO production from the macrophages that infiltrated to the inflamed site | [346] |
| Glycosmis pentaphylla Linn. | Rutaceae | Orange berry | B | Ethanol | FIA | 400, 800 mg/kg | Safe up to 4 g/kg | Lysosomal membrane stability modulating effect, inhibiting leukocyte migration, controlling the production of auto antigens and anti-proteinase activity | [76] |
| Glycyrrhiza glabra Linn. | Fabaceae | Liquorice | Rh | Ethanol | FIA | 150 mg/kg | Safe up to 5 g/kg | Inhibition of NO production from the macrophages that infiltrated to the inflamed site | [346] |
| Hedera helix Linn. | Araliaceae | European ivy | L | Ethanol | FIA | 2.5-5 mg/kg | Safe up to 4 g/kg | ESR and significant improvement of the hematological parameters like RBC count, Hb level and the platelet count | [347,348] |
| Hemidesmus indicus R.Br. | Asclepdiaceae | Indian sarsaparilla | R | Hydroalcoholic | CFA | 450 mg/kg | LD 50>2000 mg/kg | Inhibition of inflammation induced by caragenin, bradykinin and serotonin | [292] |
| Hippocratea excels H.B.K. | Hipocreataeceae | Mata piojo, cancerina | B | Ethanol | CFA | 25, 50, 100 mg/kg | LD 50>2000 mg/kg | Activity against both exudative and proliferative phases of inflammation | [349] |
| Hybanthus enneaspermus Muell. | Violaceae | Humpback flower | Wh | Aqueous, ethanol | CFA | 500 mg/kg | Safe up to 5000 mg/kg | Immobilization of both phases of inflammation | [350] |
| Botanical name        | Family               | Common name          | Part       | Extract | Dose (o.o.) | Acute toxicity (p.o.) | Mode of action | Model       | Reference |
|----------------------|----------------------|----------------------|------------|---------|-------------|-----------------------|----------------|-------------|-----------|
| Jatropha isabellei    | Euphorbiaceae        | Physic nut           | Ug         | Ethanol | 100-300 mg/kg Safe up to 300 mg/kg | Safe up to 300 mg/kg | CFA, TIA     | MSUIA     | [293]    |
| Justica gendarussa   | Acanthaceae          | Willow leaved justice | L          | Ethanol | 5, 10, 20 mg/kg | Safe up to 400 mg/kg | CFA, TIA     | CFA, TIA   | [294]    |
| Lantana camara       | Verbenaceae          | Lava                 | M.         | Ethanol | 20, 40, 60 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [151]    |
| Lepisanthes nervosa  | Lythraceae           | L.                   | L          | Ethanol | 100 mg/kg     | ≥ 6000 mg/kg          | FOVA          | FOVA       | [355]    |
| Lepisanthes nervosa  | Lamiaceae            | L.                   | L          | Ethanol | 5, 10, 20 mg/kg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [356]    |
| Lepisanthes nervosa  | Lamiaceae            | L.                   | L          | Ethanol | 100 mg/kg     | ≥ 6000 mg/kg          | FOVA          | FOVA       | [357]    |
| Lawsonia inermis     | Lythraceae           | Henna, mehendi       | L          | 70% aqueous ethyl alcohol | Safe up to 400 mg/kg | CFA, TIA     | CFA, TIA   | [295]    |
| Leucas aspera        | Lamiaceae            | Thumbai              | Al         | N-hexane, chloroform, methyl acetate, ethanol | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [296]    |
| Linum usitatissimum  | Linaceae             | Flax                 | L          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [358]    |
| Lonicera japonica    | Caprifoliaceae       | Japanese honeysuckle | L          | Ethanol | 200, 400, 600 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [359]    |
| Mallotus oppositifolium | Euphorbiaceae    | Geisel               | L          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [360]    |
| Merremia emarginata  | Convolvulaceae       | Kupit                 | L          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [361]    |
| Merremia tridentata  | Convolvulaceae       | Kupit                 | L          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [362]    |
| Operculina turpethum | Convolvulaceae       | Turpeth              | L          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [363]    |
| Panax ginseng        | Araliaceae           | Ginseng              | R          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [364]    |
| Phyllanthus amarus   | Euphorbiaceae        | Gundi                 | L          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [365]    |
| Pinus maritime       | Pinaceae             | Maritime pine        | B          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [366]    |
| Pisonia grandis      | Nyctaginaceae        | Grandclaws           | Grand      | Ethanol | 30, 100, 300 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [165]    |
| Pteris angusta       | Polypodiaceae        | Water lettuce        | L          | Ethanol | 100, 200, 400 mg | Safe up to 2000 mg/kg | CFA, TIA     | CFA, TIA   | [367]    |
| Botanical name | Family | Common name | Part | Extract | Dose (p.o.) | Acute toxicity (p.o.) | Model | Mode of action | Reference |
|---------------|--------|-------------|------|---------|------------|-----------------------|-------|----------------|-----------|
| Pleurotus sajorcaju Singer. | Pleurotaceae | Oyster mushroom | F | Aqueous Methanol | 500, 1000 mg/kg | D.N.A. | AIA | Suppression of splenic lymphocytes | [369] |
| Premna serratifolia Linn. | Verbenaceae | Agnimantha | W | Methanol | 300 mg/kg | Safe upto 2000 mg/kg | CFA | Suppression of migration of leukocytes | [299] |
| Pseudacacia kotschyi Schweinf. | Meliaceae | Hard cedar, Senegals basari | L | Aqueous | 200, 400 mg/kg | Safe upto 2000 mg/kg | CFA | Reduction in inflammation due to mediators suppression | [370] |
| Punica granatum Linn. | Lythraceae | Pomegranate | F | Solid phase extraction | 13.6-34 mg/kg | Safe upto 2000 mg/kg | CFA | Inhibition of spectrum of signal transduction pathway | [196,371] |
| Rhus verniciflua Stokes. | Anacardiaceae | Chinese lacquer tree | B | N-hexane | 50 mg/kg | 5 g/kg | CIA | Suppressive effects on inflammatory cytokines/chemokines and angiogenic factor in IL-1β-stimulated RA | [372] |
| Ruta graveolens Linn. | Rutaceae | Rue | A | Ethanol | 10 mg/kg | ≥ 10 g/kg | CFA | Reduces cell influx, release of mediators, lipid peroxidation and oxidative stress | [207,373] |
| Salacia reticulate Wight. | Celastraceae | Khothala himbutu | L | Ethanol | 25 ug dry powder/ml | 2000 μg/ml | CIA | Inhibition of IL-1β-activated cell proliferation and regulation of mRNA expression | [300] |
| Salix nigra Linn. | Salicaceae | Black willow | B | Methanol | 100 mg/kg | LD₅₀ = 6.5 gm/kg | CFA | Inhibition of pro-inflammatory inhibitors | [301] |
| Saraca asoca Roxb. | Fabaceae | Sorrow less | B | Methanol | 1-5 g/kg | ≥ 10 g/kg | CFA | Antagonistic action against the pro-inflammatory cytokines and stabilizing effect on lysosomal membrane, reduction in release of acid hydrolase | [343,374] |
| Saussurea lappa 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] |
| Semecarpus anacardium Linn. | Anacardiaceae | Bhallatak | Nt | Nut milk extract | 15, 50, 150 mg/kg i.p. | Safe upto 5 g/kg | CFA | Inhibition of cytokine production | [302,376] |
| Sida rhombifolia Linn. | Malvaceae | Cuban jute, jelly leaf | Al | Methanol, petroleum ether | 30-100 mg/kg | Safe upto 5000 mg/kg | CFA | Generation of reactive oxygen species was suppressed | [218,377] |
| Sinomenium acutum 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] |
| Smithia sensitive Smith. | Fabaceae | Odabirni | Wh | Methanol pet ether chloroform | 10 ml/kg | Safe upto 2000 mg/kg | FIA | Inhibition in the hypotonicity | [379] |
| Sophora flavescens Aton. | Fabaceae | Kurara worm killer | R | Ethanol | 100 mg/kg | D.N.A. | AIA | Inhibition of COX-2-catalyzed PGE2 and iNOS | [380] |
| Strobilanthes callosus Nees. | Acanthaceae | Marudona | R | Pet ether | 100 mg/kg | D.N.A. | CFA | Reduce levels of lipid peroxides, glutathione peroxidase and catalase | [381,382] |
| Strychnos potatorum Linn. | Loganiaceae | Clearing nut tree | S | Water | 200 mg/kg | D.N.A. | CFA | Suppressive action on mediators of inflammation | [303] |
| Torilis japonica Houtt. | Apiaceae | Upright hedge parsley | F | Methanol | 90, 270 mg/kg | Safe upto 5000 mg/kg | CFA | Inhibitory effects on immune cell trafficking. CD4 T-cells | [200] |
| Toxicodendron pubescens P. Mill. | Anacardiaceae | Atlantic poison oak | Wh | aqueous | 10 mg/kg | Safe upto 2000 mg/kg | CFA | Immunosuppressant activity | [383,384] |
| Trewia polyacarpa Benth. | Euphorbiaceae | Gambahari, 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] |
| Botanical name               | Family         | Common name | Part | Extract          | Dose (p.o.)          | Acute toxicity (p.o.) | Model | Mode of action                                                                 | Reference |
|-----------------------------|----------------|-------------|------|------------------|----------------------|------------------------|-------|--------------------------------------------------------------------------------|-----------|
| Tridax procumbens Linn.     | Asteraceae     | Ghamra      | L    | Ethanol          | 300 mg/kg            | ≥ 2000 mg/kg           | CFA   | Suppression of migration of leukocytes                                          | [386]     |
| Trigonella foenum raecum Linn. | Fabaceae     | Fenugreek   | S    | Mucilage         | 75 mg/kg             | D.N.A.                 | CFA   | Reduces cell influx, release of mediators, and oxidative stress                | [247]     |
| Urtica pilulifera 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]     |
| Vernonia cinerea Less.      | Asteraceae     | Bitterleaf ndole | Fl  | Ethanol         | 25-100 mg/kg         | Safe upto 5000 mg/kg  | CFA   | Membrane stability-modulating effect                                           | [388,389] |
| Vitex negundo Linn.         | Verbenaceae    | Nigundi, sindhuvara | L    | Ethanol         | 1 ml/100 g           | LD₅₀ > 2000 mg/kg      | CFA   | Immunosuppressive activity                                                     | [258,390] |
| Withania somnifera Dunal.   | Solanaceae     | Indian winter cherry | R    | Hydralcoholic    | 500-1000 mg/kg       | LD₅₀ = 1750 mg/kg      | UIA   | Inhibiting the release of inflammatory mediators                               | [14]      |
| Xanthium srtuarium Linn.    | Compositeae    | 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]     |
| Yucca schidigera Roezl.     | 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-protozoal activity, MSU: MSU induced arthritis, CACW: Candida albicans cell wall, FOIA: Formaldehyde induced arthritis, COIA: Croton oil induced arthritis, ICAM-I: Intercellular adhesion molecule-1, VCAM-I: 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 cannabinol, pseudo-cannabinol, cannabinin, 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-arthritic 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 rats significantly decreases the arthritic score and inhibits the release of inflammatory mediators. Thus, it was concluded that the cannabidiol have an anti-arthritic activity by possessing anti-inflammatory and immunosuppressive action [98].

**Cinnamomum zeylicanium** 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, dysmenorrhoea, and amenorrhoea. The active constituents of the CZ are cinnamaldehyde and eugenol. The other constituents are emphene, sibnine, myrcene, fenchone, nerol, bornyl acetate, cinnamyl acetate, and geranial [99]. The CZ is reported to have an analgesic, anti-odynalgic [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-arthritic 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-arthritic 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 minim on sugar or in emulsion. Coriander oil which contains linalool/coriandrol, geraniol, and boborneol, extracted from its fruit, is volatile and essential [51,110]. Externally seeds 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 anti-inflammatory and anti-arthritic properties [111]. CS possesses an antibacterial [112,113], anti-spasmodic [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-arthritic activity on rats [120].

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

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 saltwater can be used externally in rheumatism. The major chemical constituents are curcumin, methylecurcumin, demethoxy curcumin, sodium curcuminate, and Ar-tumerone. 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 (comination 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], antiproteozal [124,125], nematocidal [126], antibacterial [127], anti-tumor [128], and hepatoprotective [129]. The anti-arthritic 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-arthritic 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 anti-protinase activities [132-134]. The methanolic extracts of rhizomes of GY at a dose of 150 mg/kg possess anti-arthritic activity in male wistar rats by inhibiting the leukocyte migration and auto antigens production and exhibit anti-protinase activity. The study concluded that GY possess a significant anti-arthritic activity [76].

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

LC popular as lava or red sage is a low erect or subscandent vigorous shrub with tetangular stem, stout recurved pickles and comprises strong odour ofblack 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, triterpinoids, 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-arthritic 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, urinary-gential 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 aslignans, glycosides, flavonoids, alkaloids, ellagittannins, and phenylpropanoids [152]. Studies have proved that PA have anti-inflammatory [153], anti-microbials [154,155], anti-cancer [156], anti-fertility [157], hepatoprotective [158], anti-diabetic [159], anti-diarrheal [160], antioxidant [161], anti-oxidant [162], 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 PA at doses 5, 10 and 20 mg/kg showed an anti-arthritic activity at doses of 13.6-34 mg/kg of PG show an anti-arthritic activity at doses of 13.6-34 mg/kg [131]. GY have shown anti-microbial, hypolipidaemic, antiviral, hypotensive, anti-ulcer, anti-diuretic, anti-inflammatory, anti-mutagenic, expectorant, hepatoprotective, antioxidant, and anti-protinase activities [132-134]. The methanolic extracts of rhizomes of GY at a dose of 150 mg/kg possess anti-arthritic activity in male wistar rats by inhibiting the leukocyte migration and auto antigens production and exhibit anti-protinase activity. The study concluded that GY possess a significant anti-arthritic activity [76].

**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-trimehoxycinnamate. Others include resin, volatile oil, starch, fatty oil, and inorganic matter [167]. Medicinally, PL finds its importance as an anti-inflammatory [168], anti-amoebie [169], anti-asthmatic [170], hepto-protective, 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-kB. In conclusion, PL possess a significant anti-arthritic 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 aregallic acid, anthocyanins, ellagittannins, flavones, flavonoids, antocyanids, sterols, quercitin, 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-artherosclerotic [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-arthritic 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, antihelminthic, antispasmodic, stimulant, abortifacient, expectorant, and anti-rheumatic [51]. The major chemical constituents isolated from the RG are rutin, quercitin, rutacridone, rutacridone epoxide, graveoline, and gravacridonodiol [197]. RG is reported to have anti-inflammatory [198,199], analgesic [200], antiandrogenic [201,202], antihyperglycemic [203,204], antihiperlipidemic [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-arthritic 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-arthritic 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. The aqueous and ethanol extract of aerial parts of RG at a dose of 10 mg/kg, b.w. showed an anti-arthritic 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-arthritic activity [207].

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

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 phytocconstituents 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 “Taphala” of TC, *Terminalia bellirica* and *Emblica 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], antiinflammatory [227], anti-fungal [228], anti-amoebic [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-arthritic potential of the extract was due to significant reduction in the levels of TNF-α, IL-6, and IL-1β [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

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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-arthritic 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-arthritic 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 branches. 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 gud 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, caetin, iridoid glycosides, vitamin C, β-sitosterol, and phthalic acid [249]. VN possess different pharmacological activities including anti-inflammatory, analgesic [250], antioxidant [250-253], insecticidal [256,257], and antirheumatic [249]. The active compound agnusideisolated from ethanolic extract of leaves administered at doses of 1.56 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-arthritic 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 xanthostrostrumarin, atractyloside, carboxyatractyloside; phytosterols, xanthanol, isoxanthanol, xanthosin, 4-oxo-bedfordia acid, hydroquinone, xanthanolides, and deacetylxanthumin [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-arthritic 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 gramineae, meliacae, 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-arthritic activity](image-url)
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-arthritic 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-arthritic 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-arthritic 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. Moreover, this review has included latest data on new plant species/polyherbal formulations which are not covered in previews reviews on arthritis therapy as per our knowledge.

In conclusion, about 485 plant species mentioned in the list would have a promising anti-arthritic activity in humans. Information about the ethnic proof of the traditionally used anti-arthritic 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-arthritic effects of the plants. Data mentioned in Table 2 show that papilionaceae family contains more plants with anti-arthritic 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, Rumalayaliniment, 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-arthritic 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-arthritic activity. In addition, data in Table 3 show experimentally, the plants possess anti-arthritic 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-arthritic 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-arthritic activity of plants.

**ACKNOWLEDGMENT**

The authors would like to acknowledge UGC, New Delhi for granting Minor Research Project for conducting this study. The authors would also acknowledge Director, Institute of Pharmaceutical Sciences, Kurukshetra University, Kurukshetra for providing necessary facilities for carrying out this work.

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For example, Choudhary et al. (2015) conducted a comprehensive review on the pharmacological activities of various plant species, including their anti-inflammatory, antispasmodic, and antipyretic effects. They highlighted the importance of traditional medicinal practices and the need for further research to validate these traditional uses. The review also underscored the potential of these plants for developing new drugs and therapies.

For instance, the study by Choudhary et al. (2015) found that the methanolic extract of a certain plant species exhibited significant anti-inflammatory activity. This aligns with previous research by Kim et al. (2006) and Lee et al. (2006), who also reported anti-inflammatory effects of plant extracts.

In another study, the antipyretic activity of another plant species was investigated by Lee et al. (2006). They demonstrated that the ethanolic extract of this plant species significantly reduced fever in a mouse model, further supporting its traditional use in fever management.

Overall, the review by Choudhary et al. (2015) underscores the potential of traditional medicinal practices in identifying new therapeutic agents. Further research is needed to translate these traditional uses into scientifically validated therapies.
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Source of Support: Nil, Conflict of Interest: None declared.