



Review on Medicinal Plants with Anti-arthritic Potential

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Received: 10-12-2022; Revised: 22-01-2023; Accepted: 28-01-2023; Published on: 15-02-2023.

ABSTRACT

Reason for the study: Traditional medicinal plants are practiced worldwide for the treatment of various acute and chronic diseases. The development of herbal products has many advantages, like better affordability, acceptability and reduction of side effects. Arthritis is the second most common disease found worldwide and India contributes 22-39 percentages of the global status. Rheumatoid Arthritis is a systemic autoimmune disease characterized by chronic inflammatory conditions. The symptoms of rheumatoid arthritis are pain, swelling, stiffness, destruction of cartilage and bone. The etiology of rheumatoid arthritis is not correctly known but release of the intermediates of cellular metabolism like interleukins (IL) and tumour necrosis factor alpha (TNF- α) from T-cells responsible for producing growth factors, cytokines and adhesive molecules on immune cells that result in inflammation and destruction of tissues.

Main findings: Several medicinal plants in the tribal and rural area were utilized for treatment of rheumatoid arthritis and it is a promising area for developing an anti-arthritic agent with reduced side effects. This review focused on the medicinal plants that elicited anti-arthritic activity in the different regions of the world (India, Srilanka, Africa etc.)

Principal conclusion: This review attempted to investigate the various medicinal plants and their isolated active ingredients showed anti-arthritic activity with scientific evidence and concluded that the area of herbal medicine is a hopeful area of research to develop anti-arthritic agents.

Keywords: Rheumatoid arthritis, Anti-arthritic activity, medicinal plants, inflammatory autoimmune disorder, Complete Freund 's Adjuvant study.

QUICK RESPONSE CODE →

DOI:

10.47583/ijpsrr.2023.v78i02.007



DOI link: <http://dx.doi.org/10.47583/ijpsrr.2023.v78i02.007>

INTRODUCTION

Rheumatoid arthritis is a chronic, systemic, inflammatory autoimmune disorder causing symmetrical polyarthritis of large and small joints, typically presenting between the ages of 30 and 50 years, that is associated with progressive disability, systemic complications, early death, and socioeconomic costs. The cause of rheumatoid arthritis is unknown, and the prognosis is guarded. Rheumatoid arthritis is characterized by synovial inflammation and hyperplasia ("swelling"), autoantibody production (rheumatoid factor and anti-citrullinated protein antibody [ACPA]), cartilage and bone destruction ("deformity"), and systemic features, including cardiovascular, pulmonary, psychological, and skeletal disorders^{1,2}.

It is a major cause of disability. It existed in early Native American populations several thousand years ago but might not have appeared in Europe until the 17th century.

Early theories on the pathogenesis of rheumatoid arthritis focused on autoantibodies and immune complexes. T-cell-mediated antigen-specific responses, T-cell-independent cytokine networks, and aggressive tumour-like behaviour of rheumatoid synovium have also been implicated. More recently, the contribution of autoantibodies has returned to the forefront. Based on the pathogenic mechanisms, specific therapeutic interventions can be designed to suppress synovial inflammation and joint destruction in rheumatoid arthritis.³

Early detection of suspected rheumatoid arthritis includes:

- Symptoms that last longer than two weeks
- Characteristics that suggest rheumatoid arthritis in recent-onset inflammatory arthritis
- Swollen joints, particularly in the hands (wrists, metacarpalphalangeal joints, proximal interphalangeals)
- Tenderness across the metatarsophalangeal joints
- Positive rheumatoid factor
- Positive anti- (can start asymmetrically)
- Lack of a different diagnosis, such as crystal arthritis or erosive osteoarthritis⁴.



To develop methods for the management of the disease, it is essential to comprehend the epidemiology of RA in India. In order to better understand the disease burden RA presents in India, a literature review of observational studies focusing on epidemiology and other disease features (comorbidities/extra-articular symptoms, functional abilities/quality of life, and therapeutic patterns) is necessary⁵.

In ancient times, people believed in herbal medicine and conducted more research. Which created a variety of herbal medicine with minimal side effects and better safety than synthetic medicine. About 60-90 percent of arthritis patients take traditional medications, which are safe and effective for managing rheumatoid arthritis associated with inflammatory mediators⁶.

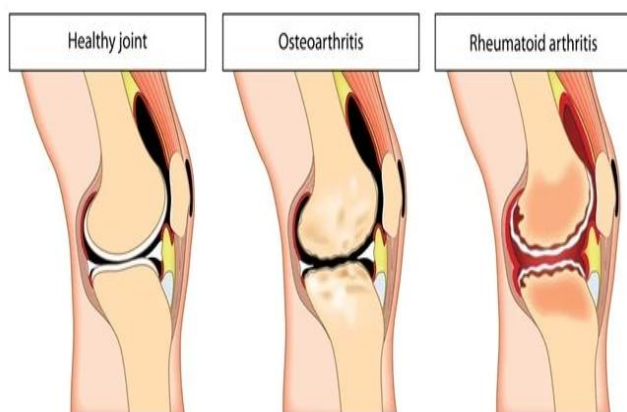


Figure 1: a. healthy joint, b. osteoarthritis, c. rheumatoid arthritis

Medicinal Plants with Anti Arthritic Activity

1. *Sophora flavescens* (Fabaceae)

Sophora flavescens is also known as Kushen (Chinese), and has been an important species in Chinese medicine since the Qin and Han dynasties. The root of *Sophora flavescens* has a long history in the traditional medicine of many countries, including China, Japan, Korea, India and some countries in Europe. In traditional Chinese medicine (TCM), *Sophora flavescens* has been used extensively, mainly in combination with other medicinal plants in prescriptions to treat fever, dysentery, hematochezia, jaundice, oliguria, vulvar swelling, asthma, eczema, inflammatory disorders, ulcers and diseases associated with skin burns.⁷

Dried roots of *Sophora flavescens* (*Sophora radix*) is an oriental traditional medicine. The roots of *Sophora flavescens* have long been used in Chinese medicine for the treatment of fever, inflammatory disorders, ulcers and skin burns. *Sophora flavescens* contains flavonoids and alkaloids. The main chemical components in Kushen include alkaloids, flavonoids, alkylxanthenes, quinones, triterpene glycosides, fatty acids, and essential oils.^{8,9,10}



Figure 2: *Sophora flavescens*

Jin et al., was conducted to develop a plant-based anti-inflammatory agent with a focus on chronic inflammatory disorders. To accomplish this, the alkaloid-free prenylated flavonoid-enriched fraction (PFS) of rhizomes of *Sophora flavescens* (figure 3) was prepared and its in vitro and in vivo anti-inflammatory activities were then evaluated for the first time. The results indicate that PFS from *Sophora flavescens* may have the potential for treatment of chronic inflammatory disorders such as rheumatoid arthritis.⁹

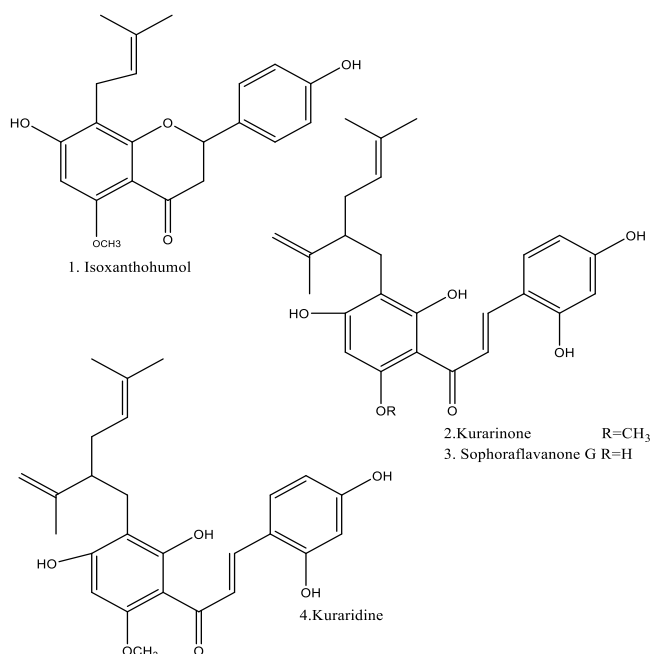


Figure 3: Chemical structures of the prenylated flavonoids isolated from the roots of *Sophora flavescens*

2. *Commiphora caudata* (Burseraceae)

Commiphora caudata (Wight & Arn.) Engl., is a small deciduous tree which is widely distributed in South India and Sri Lanka. Its local names are kilimaram, idingil, kizhuvam. Commonly known for its antibacterial, antifungal, analgesic, and anti-inflammatory activities.^{11,12}

It is commonly known as “hill mango”. In phytochemical analysis, the leaves of the plant showed the presence of flavonoids, glycosides, steroids, tannins, terpenoids,

sugars, lignans, etc. The bark of *C. caudata* revealed the presence of alkaloids, coumarins, tannins, glycosides, phytosterols, flavonoids, phenols, and saponins. Its bark and leaves have been used in folk medicine for treating low back pain, sciatica, fever, arthritis and urinary retention.^{13,14}



Figure 4: *Commiphora caudata*

Pashikant et al., reported that the ethanolic extract of *Commiphora caudata* leaves (EECL) showed significant anti arthritic activity in complete Freund's adjuvant-induced arthritic rats. The EECL-treated group showed significant reduction in paw volume, suggesting the anti-inflammatory activity of the leaves.¹⁵

3. *Cinnamomum zeylanicum* (Lauraceae)

It is also called Ceylon cinnamon or 'true cinnamon' and is indigenous to Sri Lanka and southern parts of India. The leaf and bark of *C. zeylanicum* are used as spices and for the production of volatile oils. These major bioactive are different from the volatile oils of other parts of *C. zeylanicum*, such as leaf, flowers, buds, fruits, root bark, and stem bark. The major compounds were found to be eugenol, cinnamaldehyde, cinnamyl acetate, copane, and camphor, along with other minor constituents. In Ayurvedic medicine, the bark is described as having stimulant, antifatulent, antiemetic and anti-diarrhoeal properties.^{16,17,18}



Figure 5: *Cinnamomum zeylanicum* leaves and bark

Vetal et al; isolated type-A procyanidine polyphenols (TAPP) from the bark of *C. zeylanicum* which reported anti-inflammatory and anti-arthritic activity through in-vivo study. Carrageenan-induced rat paw oedema (CPE) and adjuvant induced established arthritis (AIA) in rats were used as the experimental models for inflammation and arthritis respectively. The current study lacking analgesic activity and Immunomodulatory potential studies described TAPP as potential DMARD.¹⁹

4. *Glycyrrhiza glabra* L. (Family: Fabaceae)

G. glabra is a tall herbaceous plant which is commonly known as licorice, sweet wood, or mulaithi, that is indigenous to Eurasia, northern Africa, and western Asia. The main constituents are Glycyrrhizic acid, 18-β-glycyrrhetic acid, glycyrrhizin and licochalcones. Pharmacologically, *G. glabra* and its main constituents possess antimicrobial, antiparasitic, antiviral, antitussive, immuno-enhancing, antioxidant, anti-inflammatory, and anticancer effects. Moreover, they show hepatoprotective, anticoagulant, antidiabetic, and spasmolytic activities.²⁰

Licorice was also used as a flavouring agent in the tobacco and candy industries and to some extent in the pharmaceutical and beverage industries today. Leaves were used externally for the treatment of wounds. Rhizome and root were used orally to treat cystitis, kidney stones, lung ailment, diabetes, cough, stomach-ache, gastric ulcers, tuberculosis, Addison's disease, it was also used as mild laxative, contraceptive and to improve sexual function. it was also used in sore throat, influenza, cold, bronchodilator, ophthalmic, anti-syphilitic, anti-dysenteric, gastric imbalance, indigestion, vomiting, diarrhoea, swollen abscesses and as diuretic.²¹



Figure 6: *Glycyrrhiza glabra* leaves & flower

Mishra et al., reported the methanolic extract of *Glycyrrhiza glabra* rhizomes and n-hexane extract of *Boswellia serrata* gum resin prepared by cold maceration method and carried out in-vivo and invitro study. The anti-arthritic activity of *Glycyrrhiza glabra* and *Boswellia serrata* was assessed by significant reduction of paw oedema volume. In the present study, the activity of lysosomal

enzymes, liver enzymes in plasma was markedly increased in the adjuvant induced arthritic rats and significantly reduced after treatment with *Glycyrrhiza glabra* 150 mg/kg, *Boswellia serrata* 50 mg/kg and combined formulation of both *Glycyrrhiza glabra* and *Boswellia serrata* 100 mg/kg.²²

5. *Monocellate cobra* (Bungarinae)

The monocled cobra (*N. kaouthia*) is responsible for a large number of human envenomations in Eastern India and Southeast Asia. The cobras are in the genus *Naja*, subfamily *Bungarinae*. The Indian *Monocellate cobra* (*Naja kaouthia*) and Russell's viper (*Vipera russelli*) are common snakes of the East Indian sub-peninsula. The anticarcinogenic activities of their crude venoms were studied on carcinoma, sarcoma and leukaemia models.^{23,24,25}

Gomes et al., reported that The Indian *Monocellate Cobra* venom (NKV) showed anti-arthritic activity over Freund's complete adjuvant (FCA) induced arthritis in male albino rats by modulating anti-inflammatory markers. In this study, NKV treatment at two different doses showed a significant protection against FCA induced arthritic changes in different physical parameters like paw weight, paw and ankle diameters. NKV treatment increases GSH levels and, thereby, it may prevent peroxidation in arthritis. Cobra venom not only modulates inflammatory activity, but it also possesses anticomplementary activity.²⁶

6. *Euphorbia tirucalli* (Euphorbiaceae)

Euphorbia tirucalli L., one of the medicinal plants used as a fracture plant which belongs to the family *Euphorbiaceae*. And also called as pencil-tree, which is distributed in the paleotropical region of Madagascar, the Cape region (South Africa), and East Africa. It contains tannins, saponins and flavonoids. In East Africa, latex is used against sexual impotence, warts, epilepsy, toothache, hemorrhoids, snake bites, extraction of ecto-parasites and cough, among others.



Figure 7: *E. tirucalli* efflorescence

In Peninsular Malaysia, a poultice of the roots or stems is applied to nose ulceration, hemorrhoids and swellings. Root scrapings mixed with coconut oil are taken for

stomach-ache. In India, Kumar (1999) notes that it is an unavoidable plant in most traditional homesteads and used as a remedy for ailments such as: spleen enlargement, asthma, dropsy, leprosy, biliousness, leucorrhoea, dyspepsia, jaundice, colic, tumors, bladder stones, purgative in small doses and applied against toothaches, earaches, rheumatism, warts, cough, neuralgia and scorpion bites.^{27,28}

Chandrasenan et al., isolated triterpenoid from *Eurphobia tirucalli* Linn. (TET) in a collagen induced arthritis model (CIA). Oral administration of TET (200 mg/kg) exhibited significant anti-arthritic activity by decreasing the paw volume and normal body weight gain compared to CIA groups. This study reported that TET at a dose of 200mg/kg could normalize the altered paw volume, haematological and histological changes. Moreover, It proved that triterpenoids from *E. tirucalli* may be used as a potent natural anti-arthritic agent.²⁹

7. *Saussurea lappa* (Asteraceae)

Saussurea lappa is a potential long erect herb belonging to family Asteraceae. It is widely found in northern mountainous regions of Pakistan and India. Vernacular names are saw-wort, snow lotus; Malyalam: Kottam; English: Costus; Tamil: Kostum. *S. lappa* roots showed the presence of monoterpenes, sesquiterpenoids, flavonoids, lignans, triterpenes, steroids, glycosides. sesquiterpene lactone and triterpenes are the major active ingredients of *S.lappa*. They investigated different extracts of this plant and found the constituents exhibiting anti-inflammatory, anti-bacterial, anti-tumor, hepatoprotective, anti-ulcer and immunomodulatory activities.^{30,31,32}



Figure 8: *Saussurea lappa* flower bud.

A. B. Gokhale et al., conducted an investigation on anti-arthritic activity of *Saussurea lappa*, *Argyrea speciosa* and *Achyranthes aspera*. The effects of ethanol extract of *Saussurea lappa* roots on acute and chronic inflammation induced in mice and rats were examined by carrageenan and Freund's complete adjuvant. *S.lappa* considerably reduced paw edema.³³

8. *Boswellia serrata* (Burseraceae)

Boswellia serrata is an oleo gum-resin (Salai) and is a plant exudate of the genus *Boswellia*. It is a moderate to large sized branching tree that grows in dry mountainous regions of India, Northern Africa and the Middle East. Also called Salai/Salai guggul. The oleo gum-resins contain 30-60% resin, 5-10% essential oils, which are soluble in the organic solvents, and the rest is made up of polysaccharides (~ 65% arabinose, galactose, xylose) which are soluble in water. s. The resin is generally harvested all through the summer and autumn after the tree has been wounded in March or April.

In Malayalam and Tamil parangi, saambraani; in English Indian frankincense or Indian olibanum. Animal studies and clinical trials support the potential of *B. serrata* gum resin extract (BSE) for treatment of inflammatory bowel disease, rheumatoid arthritis, osteoarthritis and asthma. widely recognized for the treatment of inflammatory conditions, as well as in some cancerous diseases, wound healing and its antimicrobial activity.^{34,35}



Figure 9: *Boswellia serrata*

Umar *et al.*, investigated *Boswellia serrata* gum resin extract (BSE) was studied for its antioxidant and anti-arthritis properties in collagen-induced arthritis by using collagen induced arthritis (CIA) approach, and arthritis was generated in male wistar rats. *Boswellia serrata* extract (BSE) is thought to cause cartilage damage in experimental rats so it possesses potential antioxidant and free radical scavenging properties. It was found that BSE significantly reduced the free radical load, inflammatory mediators, and greatly reduced clinical signs of joint swelling in arthritic rats³⁶.

Mishra *et al.*, studied on the combined formulation of both *Glycyrrhiza glabra* and *Boswellia serrata*, which showed significant synergistic action by evaluating anti-arthritis activity²².

9. *Xanthium strumarium* L. (Asteraceae)

It is an annual herb, commonly grown in waste places, roadsides and along river banks in warmer parts. It is commonly called chotagokhru due to the shape of its fruit,

which looks like a cow's toe. In many parts of India, it is known as adhasisi, as this weed is used for the treatment of the common disease hemiparesis. pharmacological and phytochemical studies of *X. strumarium*, and more than 170 chemical compounds have been isolated and identified from this plant, including sesquiterpene lactones, phenols, glycoside, alkaloids, fatty acid and others. According to Ayurveda, the plant has cooling, laxative, fattening, anthelmintic, alexiteric, tonic, digestive, antipyretic activities and improves appetite, voice, complexion and memory.^{37,38}



Figure 10: *Xanthium strumarium*

Lin *et al.*, investigated anti-arthritis activity of *Xanthium strumarium* fruit by inducing complete Freund's Adjuvant (CFA) in rats. This study found that such a decrease in the spleen index, downregulation in the levels of COX-2, 5-LOX and pro-inflammatory cytokines TNF- α , IL-1 β in the serum of rats with CFA, and up-regulation in the concentration of the anti-inflammatory cytokine IL-10 in serum. so, it can be regarded as a potent anti-arthritis activity in ethanolic extract of *Xanthium strumarium*³⁹.

10. *Merremia tridentata* Linn. (Convolvulaceae)

It is a perennial herb that is extensively spread in India, Sri Lanka, Angola, Mauritius, and Madagascar. It has a short woody root stock, stems that are elongate and prostate-shaped, and an angular, glabrous body. According to phytochemical analysis, the plant contains p-hydroxy benzoic acid, vanillic acid, syringic acid, tannins, saponins, quinone, and phenolic acids. The aerial parts of the *M. tridentata* contain flavonoids, diosmetin, luteolin, and their 7-O- β -D-glucosides.⁴⁰

It is commonly known as "Mudiarkunthal" or "Savulikodi" or "Thrippan Pullu" in Tamil and "Prasarini" in Sanskrit. It is used for ailments like rheumatism, piles, swelling and urinary disease, in contrast to being a good laxative and astringent.^{41,42}



Figure 11: *Merremia tridentata* Linn flower and sword like leaves

Gopalakrishnan *et al.*, studied ethanolic extract of *Merremia tridentata* Linn whole plant. ethanol extract of *M. tridentata* significantly reduced the complete Freund's adjuvant (CFA) induced chronic inflammation in the knee joint of rats as compared with that of the standard drug. And revealed that it shows significant anti-inflammatory and anti-arthritic activities of the ethanol extract of *M. tridentata*⁴³.

Rajashekhara N. *et al.*, compared the effect of plants *Merremia tridentata* Hallier.f. and *Paederia foetida* Linn. in the form of Kvatha (Internally) and Taila (Externally) on Amavata (R.A.). One of the well-known herbs recommended by Ayurvedic texts for treating Amavata and Vata rogas is prasarani. Several sources of Prasarani, The plant *Paderia foetida* Linn. is mostly utilised in North India, and the plant *Merremia tridentata* Hallier.f., in South India. Both the plants *Merremia tridentata* Hallier.f. and *Paderia foetida* Linn. Showed good effect on the disease Amavata⁴⁴.

11. *Tridax procumbens* (Asteraceae)

It is a perennial plant, also known as "coat buttons". found as a weed throughout India. tridax daisy in English, jayanti veda in Sanskrit, ghamra in Hindi, gaddi chemanthi in Telugu, thata poodu in Tamil The leaves contained the phytochemicals such as alkaloids, carbohydrates, polyphenols and tannins respectively. This medicinal plant showed the presence of phytochemical compounds such as, b-amyron, b-amyrin, stigma sterol, lupeol, luteolin, campasterol, arachidic acid, fucosterol, palmitic acid and lauric acid.

Many bioactive compounds, such as procumbetin, 8,30 -dihydroxy-3,7,40 -trimethoxy-6-O-β-D-glucopyranosyl flavone, 6,8,30 -trihydroxy-3,7,40 -trimethoxyflavone; puerarin, centaurein, and centaureidin, have been successfully isolated from this plant. Traditionally, *Tridax procumbens* has been used to treat typhoid fever, fever, cough, epilepsy, asthma, diarrhoea, anemia, colds, inflammation, hepatopathies, antifungal, antiviral

treatment, vaginitis, stomach pain, diarrhoea, promotes growth of hairs and mucosal inflammations.^{45,46,47,49}



Figure 12: *Tridax procumbens* flower and leaves

Petchi, *et al.*, Arthritis was induced using FCA, and the anti-arthritic effect of the ethanolic extract of *T. procumbens* was studied. On preliminary phytochemical analysis, ethanolic extract of *T. procumbens* indicated the presence of alkaloids, tannins, flavonoids and saponins. *T. procumbens* ethanolic whole plant extract exhibits anti-arthritic activity by significantly changing the pathogenesis of FCA-induced arthritis in female SD rats without causing any side effects⁴⁸.

Jain *et al.*, Both *Tridax procumbens* ethanolic extract (TPEE) and *Tridax procumbens* ethyl acetate extract (TPEAE) suspension was used for investigation. Arthritis was evaluated by hind paw swelling, body weight, histopathology of knee joint and various other Physiological and Haematological parameters by inducing 0.1 of CFA in metatarsal footpad of male wistar rats. It may be concluded that TPEE at the dose of 300 mg/kg possesses significant anti-arthritic activity while TPEAE was less active. Steroids and flavonoids might be responsible the anti-arthritic property⁴⁹.

12. *Barringtonia racemosa* (Lecythideaceae)

It is also known as Putat, fish poison tree or powder puff tree. Commonly found throughout Eastern Africa, Polynesia, Africa and Asia, including Malaysia. It flowers twice a year: in spring as well as from January to April.

Various parts of the plant are known to possess multiple bioactivities and thus rich in antioxidant potentials. The seeds, stem-bark, and roots contain saponin and are used to stun fish. The bark, which also has a high tannin content, is frequently used in powdered form for this purpose. It may be easily found on India's west coast and typically grows on black mud by riverbanks. It has been used as folk medicine to cure conditions like fever, rheumatism, and stomach aches.^{50,51}



Figure 13: *Barringtonia racemosa*

Patil *et al.*, isolated bartogenic acid (BA) from fruits of *Barringtonia racemosa*, and evaluated the Complete Freund's Adjuvant (CFA)-induced arthritis in rats. The pentacyclic triterpenoid bartogenic acid (BA) has been shown to significantly affect the levels of such endogenous

pain mediators. Multiple pathological symptoms of CFA-induced arthritis in rats have seemed to respond favourably to BA. It validates the use of fruits of *Barringtonia racemosa* in treatment of pain and inflammatory condition⁵².

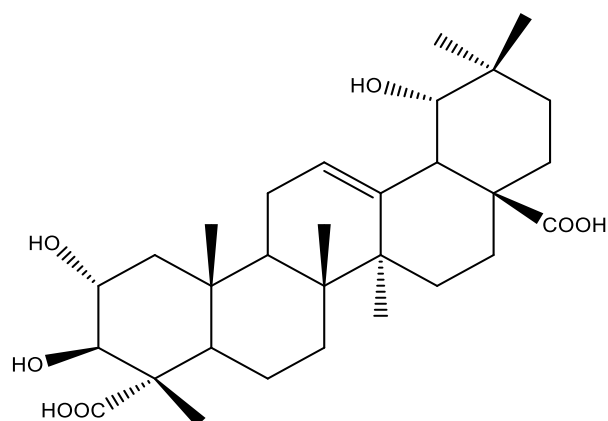


Figure 14: Chemical structure of BA (*2 α ,3 β ,19 β -trihydroxyolean12-en-23-28-dioic acid*)

Table 1: List of medicinal plants with Anti-arthritic activity

Sl.No	Plant name & family	Vernacular name	Geographical source	Plant part used	Year of publication	Reference
1	<i>Sophora flavescens</i> (Fabaceae)	"Kushen"	Chinese medicine	Rhizomes	2010	[9]
2	<i>Commiphora caudata</i> (Burseraceae)	English- Hillmango Malyalam- kilimaram, idingil, kizhuvam	South India and Sri Lanka	Leaves	2014	[15]
3	<i>Cinnamomum zeylanicum</i> (Lauraceae)	"Ceylon"	South India and Sri Lanka	Bark	2013	[19]
4	<i>Glycyrrhiza glabra</i> L. (Fabaceae)	licorice, sweet wood, or mulaithi	As, that is indigenous to Eurasia, northern Africa, and western Asia	rhizomes	2011	[22]
5	<i>Monocellate cobra</i> (Bungarinae)	Naja kaouthia	Eastern India and Southeast Asia	venom	2009	[26]
6	<i>Euphorbia tirucalli</i> (Euphorbiaceae)	Pencil tree	paleotropical region of Madagascar, Cape region (South Africa), East Africa		2016	[29]
7	<i>Saussurea lappa</i> (Asteraceae)	"saw-wort, snow lotus" Malyalam: Kottam English: Costus Tamil: Kostum	Pakistan and India.	roots	2002	[33]
8	<i>Boswellia serrata</i> (Burseraceae)	"Salai/Salai guggul"	dry mountainous regions of India, Northern Africa and the Middle East.	Gum resin	2014	[36]
				Combined formulation with <i>Glycyrrhiza glabra</i>	2011	[22]
9	<i>Xanthium strumarium</i> L. (Astereaceae)	Chotagokhru (like cow's toe shaped fruit) Adhasisi (in many parts of india)	waste places, roadsides and along river banks in warmer parts	Fruit	2014	[39]

10	<i>Merremia tridentata</i> Linn.(Convulvulaceae)	Tamil-Mudiarkunthal or Savulikodi Sanskrit Thrippan Pullu Prasarini	India, Sri Lanka, Angola, Mauritius, and Madagascar	Whole plant	2009	[43]
				Whole plant in form of taila and kvatha	2009	[44]
11	<i>Tridax procumbens</i> (Asteraceae)	coat buttons tridax daisy -English, cadillo c, Jayanti veda -Sanskrit, ghamra -Hindi, dagadi pala - Marathi, gaddi chemanthi -Telugu, thata poodu - Tamil	India	Whole plant	2013	[48]
				leaves	2012	[49]
12	<i>Barringtonia racemosa</i> (Lecythideaceae)	Putat, fish poison tree or powder puff tree.	commonly found throughout Eastern Africa, Polynesia, Africa and Asia including Malaysia	fruit	2011	[52]

CONCLUSION

Traditionally, various medicinal plants are used to cure patients with arthritis. Therefore, this review article helps to assemble medicinal plants having potential anti-arthritic activity. Plant parts like roots, rhizomes, leaves, gum resin, and whole plants are also used which possess anti-arthritic activity. The present review focused on the development and studies on traditional herbal medicines as anti-arthritic agents. This review concluded that herbal medicines have many advantages and they are very promising area of anti-arthritis drug development.

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Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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