A comprehensive review of the traditional plant based medicines for the treatment of rheumatism

Ganesh N Sharma¹, Harjinder Kaur*,¹, Birendra Shrivastava², Satish Chander Arora³

¹Department of Pharmacology, School of Pharmaceutical Sciences, Jaipur National University, Jaipur-302017, Rajasthan, India
²Department of Pharmachemistry, School of Pharmaceutical Sciences, Jaipur National University, Jaipur -302017, Rajasthan, India
³Department of Pharmaceutics, RKSD College of Pharmacy, Kaithal-136027, Haryana, India

Article History:
Received on: 12 Jun 2020
Revised on: 13 Jul 2020
Accepted on: 14 Aug 2020

Keywords:
Autoimmunity,
Inflammation,
Medicinal plants,
Rheumatism,
Traditional uses

ABSTRACT

Inflammation is a highly complex mechanism and can be described as the body’s first defensive immune system reaction. The immediate purpose is to guard against infectious invasions, the introduction of antigens, any cell and tissue disruption or harm. If it is not treated, it is persistent which progresses to serious degenerative conditions such as rheumatism, atherosclerosis and asthma. Rheumatism is a category of inflammatory disease with chronic conditions. The disease includes a rise in the amount of neutrophils, lymphocytes and monocytes, which primarily influence the synovial fluid of the movable joints and eventually cause cartilage and bone degradation across the joints. Many steroidal and nonsteroidal drugs (Methotrexate, Cyclosporine and Dpencillamine, Ibuprofen, Sulindac, Indomethacin) are prescribed as treatment therapies. But, unfortunately, all these drugs are having side effects. So, to enhance the pharmacological effects and decrease the side-effects of the available treatment therapies, there is a need to move towards alternative therapies. By keeping the limitations of the existing therapies, in the present review, we tried to summarize the data of traditional medicinal plants with maximum pharmacological activities with less side effects for the rheumatism patients. A systematic literature and electronic archive analysis was performed using internet search engines such as Google scholar, Pubmed, Medlineplus, and Science Direct from numerous academic publications. This review paper is summarized with total 500 articles out of which 330 articles are selected to review for extracts and parts used, chemical constituents, traditional uses and for reporting anti rheumatic activity.

*Corresponding Author
Name: Harjinder Kaur
Phone:
Email: ysdverma@gmail.com

ISSN: 0975-7538
DOI: https://doi.org/10.26452/ijrps.v12i1.4122

INTRODUCTION

Inflammation is a mechanism in which the body’s immune system is stimulated against damage and reaction to toxic agents in response to bacterial, virus or fungal infections. If the immune system completely eradicates these pathogenic infections and toxic compounds or heals an injury, the inflammation dissipates. The inflammation becomes severe at this point because if it does not heal, then the inflammation is persistent. Chronic inflammation leads to over activation of
macrophages, which ultimately causes over produc-
tion of prostaglandins, leukotrienes, and cytokines and thereby induces chronic degenerative dis-
eases like rheumatism, asthma, and atherosclerosis. Rheumatism is a chronic inflammatory autoimmune
disease characterized by soreness, stiffness, pain in joints including associated structures and restricted
cartilage movement due to increases in the number of cells of synovial membrane, movement of neu-
trophils, lymphocytes and monocytes into peripheral tissues and neovascularisation which ultimately
leads to articular and cartilage destruction (Patil et al., 2012). The extent of this disease throughout the
world is 1% and approximately 0.75% in India with male and female ratio of 1:3 (Gabriel et al., 2003). The available treatment therapy includes
steroidal and nonsteroidal antinflammatory drugs and immunosuppressant drugs like Methotrexate,
Cyclosporine and D-Pencillamine, Ibuprofen, Sulindac etc. The adverse-effects like skin reaction, bone
marrow depression and liver disorders limit their application. To minimize the adverse effects and
cost of the drug, there is a need to move towards alternative therapies. Plants derived medicinal
plants and natural agents will be a good alternative for the treatment of rheumatism at an afford-
able cost. Even today 80% of the world population depends on plant derived medicines for the primary health care because of least or no side
effects (Babushetty and Sultanpur, 2012). Scientists are also scrutinizing traditional plants to find complementar-
y and alternative anti inflammatory drugs.

Herein, we reviewed the plants derived herbal ther-
apy, and chemical components for rheumatism.

Abbreviations
AI- Abutilon indicum; AR- Asparagus racemosus; BP-
Bauhinia purpurea; CI- Calophyllum inophyllum; CP-
Celastrus paniculatus; CM- Callicarpa macrophylla; CQ- Cissus quadrangularis; CF- Coleus forskohlii; CC-
Commiphora caudate; CS- Costus speciosus; DS-
Dalbergia sissoo; ME- Mimusops elengi.

Herbal Therapy for the Treatment of Rheuma-
tism
From the time immemorial, herbal medicinal plants
are used for treatment of various diseases and it
will not be an overstatement that the use of medi-
cinal plants is as old as the mankind (Tandon and
Gupta, 2004). There are about 17,000 species of
higher plants, of which approximately 8,000
species are considered medicinal for the mainte-
nance of good health and used in different tra-
ditional medicinal systems such as the Ayurveda,
Unani, Siddha and Homeopathy. Moreover, because
of an increasing reliability of the use of medicinal
plants, less side effects and easy availability, the
industrialized societies also lead to the develop-
ment of several drugs and chemotherapeutic from
these plants as well as from traditionally used
rural herbal remedies by extraction of active con-
stituents. Thus now the plants have been most
widely investigated and analyzed source of medic-
inal compounds and chemical constituents of these
plants produces a required physiological action on
the body. The present review article uncovers differ-
ent parts of herbal plants for their traditional and
ethnobotanical uses, pharmacognostic and the
chemical constituents responsible for antirheumatic
activity. Thus make feasible the development of new
drugs for the treatment of rheumatism.

Search Strategy Used
The search terms used were ‘arthritis’, ‘rheumatism’,
‘anti rheumatic activity’, ‘herbal drugs for treatment
of rheumatism’, ‘inflammation’, ‘folk plants used for
the treatment of pain and stiffness’. The current
search and study was done by referring various text
books, Journals containing peer review and research
papers. The electronic databases used were Google,
Science Direct and PubMed, which provide free
access to Medline. Only published articles with dif-
ferent languages from 1950 to till date were used.
Reference lists of articles were also cross checked
for more elaborated study.

RESULTS AND DISCUSSION
The review of literature related to present study
was done in the period from April 2018 to till date.
A total of 500 articles were reviewed for status of
anti rheumatic plants. Out of which 330 articles
were selected. Data collected from different articles
were compiled to make the latest review article on
rheumatism. Scientific and common name, family, extract and parts used, chemical constituents possessing anti
rheumatic activity with their references are shown in Table 1. Followings are the examples of some tra-
ditional plants with geographical distribution, fam-
ily, parts used, extract/extracts used, doses used and
traditional uses and anti rheumatic activity studied
since from 1950 to till date.

Abutilon indicum (AI) (Malvaceae)
AI is a medicinal shrub commonly known as “Ati-
balá”, widely distributed in tropical and subtropical
countries of Asia, America, Africa and Australia. It is
a shrubby soft plant with purple tinge in color. Tra-
ditionally the leaves of AI are used as mouthwash,
toothache, quick ulcer healing and for the treatment
Table 1: List of medicinal plants reported to have anti rheumatic activity

| Botanical name            | Common name | Family       | Extract/Part used for anti rheumatic activity | Chemical Constituents                                                                 |
|---------------------------|-------------|--------------|-----------------------------------------------|---------------------------------------------------------------------------------------|
| *Arisaema rhizomatum*     | Xuelijian   | Araceae      | Methanol extract/Rhizome                      | $\beta$-sitosterol, daucosterin, apigenin, oldhamactam O-ethyllycorenine, $\alpha$-asarone, uridine |
| *Aristolochia bracteata*  | Worm killer | Aristolochiaceae | Petether, chloroform and methanol extract/Whole plant | $\beta$-sitosterol, stigmasterol, aristolochic acid, aristolactams, aporphines, benzylisoquinoline, isoqui-noline, proto-bererine, amides, flavonoids, lignans |
| *Asparagus racemosus*     | Shatavari   | Liliaceae    | Hydroalcoholic extract/Roots                  | Asparagamine, isoflavone, shatavaro-side A&B, sterols                                 |
| *Allium sativum*          | Lahsun      | Liliaceae    | Aqueous extract/Leaves                        | Allin, Alcin, flavonoids, sulphur, steroids, Terpenoids                                 |
| *Barleria lupulina*       | Vishalyakarani | Acanthaceae | Methanol extract/Leaves                      | Irridoid glycosides, barlerin acetyl barlerin, Shanzhiside, acetyl Shanzhiside          |
| *Barleria prrioni-tis*    | Vajardanti  | Acanthaceae  | Chloroform extract/Leaves                    | Irridod Glycoside, Barlerin, acetyl barlerin, lupalinoside, 7-methoxy dihydroside       |
| *Barringtonia racemosa*   | Mangrove    | Lecythidaceae | Methanol extract/Fruits                       | Pentacycl triterpenoids, saponins, tannins                                            |
| *Berberis orthobotrys*    | Berberry    | Berberidaceae | Aqueous and methanol extract/Roots            | Berberine, berberamine, kalashine, benzyl isoquinoline, chitraline                     |
| *Boswellia serrata*       | Salai Guggul | Burseraceae  | Methanol extract/Gum resin                    | $\beta$-sitosterol, tannins, pentosans, geraniol, linalool, terpenyl acetate, boswellic acid |
| *Cinnamomum cassia*       | Chinese cas- | Lauraceae    | Hydro alcoholic extract/Bark                  | Cinnamic aldehyde, cinnamic acid, coumarin, tannins, carbohydrates, cinnamic alcohol   |
| *Cissampelos Pareira*     | Harjori     | Menispermacae | Ethanol extract/Leaves                        | Bisbenzyloisoulinine alkaloids, Hyatine, arachidic acid, berberine, linoleic acid, quercitol, stearic acid |
| *Clematis orient-talis*   | Bailari chei-thi | Ranunculaceae | Aqueous ethanolic extract/Flowers             | Triterpenoid saponins-oleanolic acid, hedra-genin, epi hedragenin, 3,4, dimethoxy cinnamyl, gypsoegenin |

Continued on next page
| Botanical name                     | Common name       | Family            | Extract/Part used for anti rheumatic activity | Chemical Constituents                                                                 |
|-----------------------------------|-------------------|-------------------|-----------------------------------------------|---------------------------------------------------------------------------------------|
| *Cardiospermum halicacabum*       | Ballon plant      | Sapindaceae       | Ethanol extract/Leaves                        | Rutin, Quercetin, apigenin, protocatechuic acid                                        |
| *Capparis erythrocarrpos*         | Alcaparro         | Capparaceae       | Ethanol extract/Roots                         | Tannins, glycoside, coumarins, triterpenoids, alkaloids and flavonols                    |
| *Commiphora mukul*                | Guggul            | Burseraceae       | Alcohol extract/Gum                           | Z-guggal sterone, E-guggal sterone, sesamine, camphorene, cembrene                     |
| *Ficus bengalensis*               | Banyan            | Moraceae          | Methanol extract/Bark                         | Triacontene, heptatriacont, pentatriacont, β-sitosterol and metinisol                   |
| *Gentiana kurooro*                | Neilkanth         | Gentianaceae      | Methanol extract/Whole plant                  | Iridoids, xanthones, mangerferin and c-glucoflavones                                   |
| *Glycyrrhiza glabra*              | Mulethi           | Leguminosae       | Methanol extract/Rhizome                      | Liquiritin, isoliquiritin, pentalo, linaloal, glycyrrhizic acid, kanzonol, tetrametyl pyrazine |
| *Glyphaea brevis*                 | Masquerade stick  | Tiliaceae         | Aqueous ethanolic extract/Stem bark           | Mono tricosanoate, Palmarumycin, epicathechin, procyanid                                |
| *Heliopsis longipes*              | Golden root       | Asteraceae        | Hexane extract/Root                           | Spilanthol, Affinin, alkalimides                                                       |
| *Hibiscus hispidissimus*          | Comfort root      | Malvaceae         | Ethanol extract/Aerial parts                  | Hydroxy citric acid, garcinc acid, tritreperene and flavonoid - hibiscatin, gossyprin, gossypin |
| *Justicia gen drausa*             | Kalaadulsa        | Acanthaceae       | Ethanol extract/Leaves                        | Campesterol, stigmasterol, sitosterol, sitosterol-D-glucoside Eicosane, nonadecane, hexadeconic acid, octadeconic acid, benzoic acid,iso benzofuranone |
| *Lawsonia innermis*               | Henna             | Lythraceae        | Hydroalcoholic/Leaves                         | Momordicin I, Momordicin IV, Momordicoside                                             |
| *Momordica charantia*             | Karela            | Cucurbitaceae     | Ethanol and aqueous extract/Fruit             | Octadeconic acid, ascorbic acid, phytol, oleic acid, hexadeconic acid, 4-hydroxy-4-methyl-2-pentanone |
| *Moringa olfera*                  | Drumstick tree    | Moringaceae       | Ethanol extract/Leaves                        | Verbascoside, ursolic and oleanolic acid, apigenin, hesperetin296                      |
| *Moussonia deppeana*              | TLachichinole     | Gesneriaceae      | Ethanol extract/Aerial parts                  | Flavonoids, flavones, polyphenols and steroids                                          |
| *Muntingia calabura*              | Jam tree          | Tiliaceae         | Ethanol extract/Leaves                        |                                                                                       |

Continued on next page
| Botanical name        | Common name | Family            | Extract/Part used for anti rheumatic activity | Chemical Constituents                                                                 |
|----------------------|-------------|-------------------|-----------------------------------------------|---------------------------------------------------------------------------------------|
| Paullinia pinnata    | Dzuhkelong  | Sapindaceae       | Aqueous extract/Leaves                       | Flavones glycoside - diosmetin and tricetin, β-amyrin, β-sitosterol, 1-Quebrachitol, β-sitosterol glucopyranoside |
| Parmotrema tinctorum | Palm ruffle | Parmeliaceae      | Methanol extract/Whole plant                 | Lecanoric acid, methyl orsensillate, methyl lecronic acid, vitamin b and c, lichenin, isolichenin |
| Pergularia daemia    | Uttaranjutka| Asclepiadaceae    | Ethanol extract/Leaves and Root              | Benzic acid, phenolic compound-2-methoxy-4-vinylphenol, phthalic acid, ascorbic acid, eicosatetraenoate |
| Pentatropis capensis | Ambarvel    | Asclepiadaceae    | Aqueous extract/Leaves                       | α-amyrin, octacosanol, β-sitosterol, friedelin, Salicylic acid, β-sitosterol, stigmas terol, linolenic acid, hexadeconic acid, methyl ursolate, phytole, methyl linolenate |
| Phyllanthus amarus   | Stone breaker| Phyllanthaceae    | Aqueous extract                              | Flavonoid, triterpenoid, steroids, saponins |
| Piptadeniastrum      | African greenheart | Mimosaceae | Aqueous methanolic extract/Stem bark         | Pinnatol, allantoin, β-sitosterol, α-spinasterol, dulcitol, querctin, β-sitosterol glycoside |
| Pisonia grandis      | Bird Catcher tree | Nyctagenaceae    | Ethanol extract/Leaves                       | Amyrin, β-sitosterol,plumeride, scopetein, plumeride coumerate, Stigmasterol Isoflavones, diterpenes, triterpenes, saponins, glycosides and alkaloids309 |
| Plumeria alba        | White champa | Apocynaceae       | Hydro alcoholic extract/Leaves               | Munjistin, purpurin, pseudopurpurin, rubiadiin, rubiprasin A, B and C, garancin, mollugin, furomollugin Geraniol, linalool, benzyl alcohol, citronellyl actate nerol, salts of mallic acid and tartaric acid, riboflavin |
| Pterodon pubescens   | Sucupira     | Fabaceae          | Hydro alcoholic extract/Seeds                | Anthracene, phenols, amino acid, saponins, tannins and flavonoids |
| Rubia cordifolia     | Indiam madder | Rubiaceae        | Benzene extract/Seeds                        | |
| Rosa centifolia      | Cabbage Rose | Rosaceae          | Ethanol extract/Flowers                      | |
| Rhizophora mucronata | Asiatic mangroves | Rhizophoraceae   | Methanol extract/Leaves                      | |

*Continued on next page*
| Botanical name | Common name | Family | Extract/Part used for anti rheumatic activity | Chemical Constituents |
|----------------|-------------|--------|-----------------------------------------------|-----------------------|
| *Sesamum indicum* | Benniseed | Pedaliaceae | Ethanol extract/Seeds | Sesamol, sesamolin, oleic acid, palmitic acid, stearic acid, linoleic acid, tryptophan, α-tocopherol |
| *Stephania glabra* | Purha | Menispermaceae | Ethanol extract/Rhizomes | Gindarine, gindaricine, magnoflorine, rutidine, prototuberine, columbamine |
| *Strychnous potatorum* | Clearing nut tree | Loganiaceae | Aqueous extract/Whole seed powder | Diaboline, brucine, loganin, linolenic, oleic, palmitic and stearic acid, β-sitosterol, stigmasterol, triterpenes, manogalactans |
| *Synedrella nodiflora* | Node weed | Asteraceae | Chloroform and ethanol extract/Whole plant | β-caryophyllene, β-farnesene, germacrene-D, β-cubebene, triterpenoid saponin nodioloside A, β-sitosterol, stigmasterol, rosasterol |
| *Syzygium cumini* | Black plum | Myrtaceae | Pet ether/Stem bark | Anthrocyanins, ellagic acid, isoquercitin, Kaemferol and myricetin, alkaloid-jambosine, glycoside jambolonic, vitamin C and flavonoid |
| *Terminalia tomentosa* | Asan | Combretaceae | Aqueous and alcoholic extract/Bark | Tannins- arjunolic acid, arjunic acid, ellagic and gallic acid, triterpenoids - oleanolic,betulinic acid, steroids- β-sitosterol |
| *Elaeocarpus serratus* | Ceylon-olive | Elaeocarpacee | Ethanol extract/Leaves and Seeds | 8-amino caffeine, octadecanol, methanol, ricinoleic acid, triacontane, citronellyl isobutyrate |
| *Vitellaria paradoxa* | Shea | Sapotaceae | Methanol extract/Bark | Gallic acid, catechin, epicatechin, gallolatechin, quercitc, cinnamic acid |
| *Withania somifera* | Aswagandha | Solanaceae | Ethanol extract/Roots | Withanolides, withaferine, withanine, withasomnine |
| *Zingiber officinale* | Adarak | Zingiberaceae | Aqueous extract/Rhizomes | Shogaols, gingerols, zingiberene, zingiberol, vitamin A, C and E |
of inflammation of the bladder. The folk practitioner uses the whole plant for rheumatism, immune stimulating effect, for curing blood dysentery, as digestive, laxative, astrigent, analgesic and demulcent (Raja and Kailasam, 2015). The herb contains various constituents such as alkaloids, flavonoids, saponins, lactones, sesquiterpenes, aglycones, steroids, carbohydrates, phenols, tannins, glycosides, proteins, alkaline sulphates and amino acid. \(\alpha\)-tocopherol and \(\beta\)-sitosterol are isolated from leaves of Al. Fruits contain flavanoids and alkaloids. Some flavonoids like quercetin, kaemferol, gossypetin, and cyanidin 3-glucoside also have been isolated from \(A.\) indicum (Sankara and Nair, 1972). Different parts of Al show various biological activities such as analgesic, immunomodulatory, anti arthritic and anti oxidant, anti bacterial activity, diuretic, anti diabetic activity, anti microbial, anti convulsant, anti helminthic, anti diarrheal, wound healing, hepatoprotective, antitumor, anti inflammatory (Saraswathi et al., 2011) and free radical scavenging activity. In vitro antirheumatic activity of Al was done by using inhibition of protein denaturation and effect of membrane stabilization by using two different concentrations of 100 \(\mu\)g and 250 \(\mu\)g per kg body weight and the results were compared with acetyl salicylic acid 250 \(\mu\)g/ml. From the results it was concluded that Al possesses significant anti rheumatic activity (Tripathi et al., 2012).

**Asparagus racemosus** (AR) Liliaceae

AR is commonly known as “Shatavari”, which is a shrub; found throughout tropical and subtropical parts of Australia, China, Sri Lanka and India, up to an altitude of 1500 m. AR is climbing plant having tuberous roots. Roots are silvery white or ash color, smooth when fresh and develop longitudinal wrinkles on getting dry. Roots are mainly used for the treatment of rheumatism. AR is used as aphrodisiac, diuretic and for male genital dysfunctions. AR is also used as antiseptic, brain tonic, for the treatment of cardiac disorders, hypertension and epilepsy. It is also used to prevent ageing, dyspepsia, tumor, nervous disorders and for reducing inflammation. In women it is used to treat habitual abortions, to give strength to the uterus and to prevent excess bleeding during menstruation. The main constituents of AR are steroidal saponins i.e. shatavarin I-IV and Shatavarin V and Shatavarin VI-X is reported in the roots of AR. Other steroidal saponins isolated are asparagin, immunoside, diosgenin, sitosterol and Racemoside A, B and C. Quercitin, rutin and flavonoids are isolated from fruits. AR reported to have activities such as anti inflammatory and antirheumatic (Mittal and Dixit, 2013) hypolipidemic and antioxidant, anti diarrheal, anti depression, peptic ulcer healing property, anti cancer, antioxycotic, anti epileptic, antitussive. Antiarthritic activity of a hydro alcoholic extract of AR was studied by complete Freund’s adjuvant induced arthritis, method and the extracts showed significant anti rheumatic activity at the dose of 200mg/kg and 400mg/kg body weight. Increase in body weight and a reduction in paw volume and total arthritic scores of both the hind legs was observed. Thus, it was clear that the drug provides pharmacological rationale for the traditional use of inflammatory disorders such as rheumatoid arthritis (Mittal and Dixit, 2013).

**Bauhinia purpurea** (BP) Leguminosae

BP is commonly known as “Orchid tree”, medium size caducous tree thriftily grown in India, also native to Southern Asia, Southeast Asia, Taiwan and China. Traditionally it is used in the treatment of rheumatism, fever, ulcer and stomach cancer (Zakaria et al., 2012). BP Flowers are used as a laxative; the bark is used for diarrhea, menstruation and for treatment of leucorrhea and roots is used as carminative. It is also used for convulsion, sepsis and dementia. Different chemical constituents present in BP are glycosides, flavonoids, saponins, phenolic compounds and phytosterols. Main constituents are flavones glycoside, 5, 6-dihydroxy-7-methoxy flavone 6-O-\(\beta\)-D-xylpyranoside, \(\alpha\)-amyrin caprylate, a mixture of phytol, fatty esters, leutin and \(\beta\)-sitosterol, volatile oil, terpinene, limonene, myrcene, linalool, citronellyl acetate and a phenyl propanoid i.e. eugenol (Wassel et al., 1986). The study of BP reveals biological activities like anti arthritic (Sunil et al., 2019), antinociceptive, analgesic and anti-inflammatory (Shreedhara et al., 2009), antimicrobial activity, antineoplastic, anti diabetic, anti diarrheal, antioxidiant, anti malarial, anti fungial, antimicrobial, cytotoxic activity and wound healing activity (Asdaq et al., 2010). A hydro alcholic extract of the stem bark of BP at the doses of 50, 100 and 200mg/kg body weight showed a significant decrease in oxidative stress markers. Decrease in TNF alpha, interleukin-1 and an increase in the level of cytokine gives the conformation of anti arthritic effect of (Sunil et al., 2019).

**Calophyllum inophyllum** (CI) Clusiaceae

CI is commonly called as “Indian laurel”, a mangrove species found in Southern coastal India, Malaysia, Thailand and Myanmar. It is widely distributed in tropical areas and can be cultivated in different kind of soil, clay and degraded soil. CI oil is used for the treatment of rheumatism, pain in joints and for wound healings. CI is also used to treat eye irritation and ophthalmits, diabetes, sunburn, psor-
rissias and also for hair problems. Heartwood of CI contain xanthones (buchanaxanthone, brasilixanthone), leaves contains tannins and triterpenes (canophyllals, canophyllol and canophylic acid). CI also contain coumarin (Calcoumarin A, B and C), Arachid acid and alkaloid (carpaine). Study of different extracts possesses antirheumatic (Perumal et al., 2017), antiinflammatory, sedative or anxiolytic effect, antiproliferative, antidepressant and nootropic, wound healing activity, antioxidant, antibacterial and analgesic, termitcidal, antiinflammatory and CNS depressant and antimicrobial activities. It is also used in the treatment of HIV and leukemia. Antirheumatic activity of CI stems bark and seeds were evaluated by Freund’s complete adjuvant induced arthritis in the doses of 250μg/kg body weight and the result obtained was nearly equal to the standard drug (Zakaria et al., 2014).

**Celastrus paniculatus** (CP) Celastraceae

*Celastrus paniculatus* is commonly known as “Malkangani”, distributed all over India, mainly in Maharashatra, Orissa and Andaman and Nicobar group of Islands on an altitude of 1800 m. It climbs up to over 10 m. The leaves are ovate or elliptic in shape, smooth in texture with dentate margin. Seeds are ellipsoid or ovoid, yellowish or reddish brown in color and grow inside the capsules. CP seeds are used traditionally for relieving the pain, swelling and for rheumatic pain. The main portion of the plant is the seed which has many therapeutic uses. It is mainly used for the treatment of brain related disorders, improve memory. The seed oil is used for hair care and for treatment of rheumatism, as sedative and to strengthen the intellectual power and in paralysis. CP is also used for the treatment of piles, leprosy, diarrhea and bacterial infections. It also acts as anti emetic, appetizer and aphrodisiac. Herbal vendors of South India used the seeds of CP in the ointment which is externally applied to the wound. Different Parts of CP after extraction and fractionation gives different active constituents that are sesquiterpenes (Malkanguinol, malkangunin), Sesquiterpene alkaloids (Celapanin, celapanigin), Alkaloids (Celas-trine, paniculatine), fatty acids (Oleic acid, palmitic acid, linoleic acid, stearic acid, crystalline substance, tetracasanol and sterol (Gamlath et al., 1990). The CP also contains carbohydrates, saturated and mono and polyunsaturated fatty acid and vitamin C and tannins.

Different pharmacological activities are antirheumatic (Bhanumathy et al., 2010), antinociceptive, antiepileptic, antifungal, Nootropic activity, sedation and convulsion, antimalarial activity, antispermatogenic effect, anti anxiety, hypolipidemic and anti atherosclerotic effect and antioxidan.

Callicarpa macrophylla (CM) Verbenaceae

*Callicarpa macrophylla* is commonly known as “Priyangu”, extensively used in many traditional medicinal systems such a Siddha, Unani and Homeopathy system. It is distributed across India, China, Myanmar, and Nepal. In India it is widely distributed in Bihar, Assam, Meghalaya, Mizoram and Tripura up to an altitude of 1800 m. CM leaves are 12.5-23 cm long, ovate or lanceolate in shape with round base. Petioles are 6-13 mm long. Stems and branches have covering of stellate hairs on it. The seeds are used in the treatment of leprosy and as diuretic. Seed paste is used in treating oral ulcer. The bark of CM is used in rheumatism and gonorrhea. The plant is also used in fever, diarrhea, dysentery, headache, ulcer and diabetes. Leaf juice is used in burning sensation of stomach and to stop bleeding. Leaves are used in gout and rheumatism. Different active chemical constituents are present in different parts of CM are flavonoids, sesquiterpenes, diterpenoids (16α, 17- isopropylideno-3-oxy-phyllocladane), terpenes, diterpenes, fatty acid, phenyl propanoids and phytosterols. The leaves contain flavonoids such as luteolin and apigenin, Pentacyclic triterpenoid- ursolic acid and α-amyrin and Phytosterols such as β-sitosterol and daucosterol. Seeds and roots contain diterpenes such as callitrenopene, callitrenopene monoacetate and callitrenopene-17-acetate (Fujita et al., 1950). The bark contains beutilinic acid and tricosanonic acid. Reported pharmacological activities of CM are antiinflammatory, antifungal, antibacterial, hypoglycemic effect, wound healing activity, immunomodulatory and antioxidant activity. In vitro activity of flower of ethanol extract of CM was studied by using inhibition of protein denaturation and human red blood cell membrane stabilization method. The results obtained from the method used indicate that CM flower exhibit anti arthritic activity.

**Cissus quadrangularis** (CQ) Vitaceae

*Cissus quadrangularis* is commonly known as “Had-jod” (Bone Setter) in India because of its fracture healing properties. It is a climbing herb, found throughout India, Asia, Africa, Thailand, and Sri Lanka, Malaysia and West Africa. It can be cultivated on a plain coastal area or wasteland at an altitude of 500 m. The shrub is smooth, glabrous, buff color with a green tinge. It is one seed plant, with simple leaves having ovate shape and dentate margin.
In India it is widely used in Tamilnadu and Kerala. In Tamilnadu it is used for improving immunity and in Kerala its paste is used over fractured joints. In southern India, it is used to strengthen the bone and to repair the damage of epithelial cells due to an injury. In Ayurveda CQ is used for the treatment of rheumatoid arthritis, osteoporosis and osteoarthritis (Bah et al., 2007). Leaves and young shoots are used in the treatment of gastrointestinal disorders. The juice of the stem is used in the treatment of inflammation of the ear and to control the bleeding of the nose. Root powder is used in constipation and gout. Various chemical constituents are isolated from different extracts of CQ are flavonoids such as quercetin, kaempferol, triterpenes- alpha and beta amyrin, beta-carotene and beta-sitostanol. Stibene and quadrangularins A, B and C, steroids, phenols, tannins, vitamin A and Gallic acid derivatives are also found. Methyl gallate, myricetin, daidzein, geniotein and daucosterol also have been also isolated from CQ (Jain and Kohli, 2015). The stem extract contains phosphorous and calcium. Various medicinal activities are analgesic and anti inflammatory, antipyretic, anti rheumatic (Bhujade and Talmale, 2015), bone healing activity, anti ulcer, cytoprotective, anti epileptic and muscle relaxant activity, antioxidant and anti microbial and anti hemorrhoid activities. Anti arthritic activity was studied by using acetone extract of CQ at a dose of 100mg/kg body weight by using standard drug Cecocoxib and methotrexate. After analyzing histopathological section and radiography it was clear that the acetone extract of CQ reduces pain and inflammation of joints (Bhujade and Talmale, 2015).

**Colesus forskohlii** (CF) Lamiaceae

*Colesus forskohlii* is commonly known as “Pathar Chur” in Hindi, is a plant of Indian origin, distributed in the sub tropical Himalaya from Garhwal to Nepal at an altitude of 2500m above mean sea level and also in Sri Lanka and Thailand. CF is used as Ayurvedic medicine from the time immortal for the treatment of various ailments like cardiovascular diseases, CNS disorders and GIT and respiratory disorders (Ammon and Muller, 1985). CF is also used traditionally for treatment of eye disorders, cancer, asthma, insomnia, psoriasis, inflammation and hypothermia. Different chemical active constituents are isolated from CQ of which chief active constituent is forskohlin (Ammon and Muller, 1985). The other constituents present is volatile oils, diterpenoids and colonels. An ethanol extract of whole plant of CF contains two labdane diterpene glycosides i.e. forskoditerpenoside A and B and sesquiterpenes. Various Clinical activities of different extracts of CF reported are anti inflammatory, antimicrobial, anticataract, antioxidant, antibacterial, anti hypertensive, antispasmodic, bronchodilator and anti allergic. CF is also reported to have used in cardiovascular disorders, reducing intraocular pressure of eye, thyroid cell metabolism and as an antiobesity drug. Methanolic and aqueous shoot extract of CF at the dose of 200μg/ml possesses in vitro antioxidant and anti inflammatory activity, when tested by DPPH (2,2-diphenyl-1-picrylhydrazyl). BSA (Bovine Serum Albumin) anti denaturation and HRBC Membrane (Human Rell Blood Cell Membrane) stabilization method (Menon and Latha, 2011).

**Commiphora caudata** (CC) Burseraceae

*Commiphora caudata* is commonly called as “Hill mango”. CC is a medium size, aromatic tree found in Kerala, Andhra Pradesh, Tamilnadu, West Bengal, Karnataka and in Sri lanka. CC leaves are ovate, glabrous with uneven base. Folk Practitioner uses the CC leaves and gum resin for stomach diseases and fruits for the healing of injuries. Paste of leaves of CC is used for the treatment of inflammation at Koottupapampu in Kerala. The CC is also used in the treatment of ulcer, diarrhoea, diabetes, arthritis, sciatica, urinary retention, and obesity. Chemical studies show the presence of flavonoids, phenols, essential oil (β-pinene, verbenone, capric acid, carveol, carvophyllene and linalool acetate. Other constituents are linoleic acid (7(Z),10(Z)- Hexadecadienoic acid, cis-9,12,15-octadecatrienoic acid, heptacosane, pentacosane, methyl arachidate, triterpenoid (squalene), resin and gum. Medicinal activities of the CC are antirheumatic, anti hyperlipidemic, anti inflammatory, antioxidant, analgesic, anti inflammatory and antiilipderoxidation, learning and memory enhancing activity and larvicidal. Antirheumatic activity was done with ethanolic extract of *Commiphora caudata* at the dose of 200 and 400mg/kg body weight in rats, which produce reduction in paw volume and increase in red blood cells and erythrocyte sedimentation rate and decrease in white blood cells. Thus confirm the anti rheumatic potential of CC (Eggadi et al., 2014).

**Costus speciosus** (CS) Costaceae

*Costus speciosus* is commonly known as “Keukand”, Indian ornamental perennial herb, found in Himachal Pradesh, Assam, Karnataka, Tamilnadu, Andhra Pradesh and Ahmednagar, Odisha, Madhya Pradesh, Punjab, Gujarat, Rajasthan, Haryana and in Peninsular India. It grows up to a height of 2.7m, having leaves with lanceolate shape and flowers in clusters. The juice of the leaf and rhizome is used in Kerala and Assam for the treatment of diabetes. CS is also used traditionally for treat-
ment of arthritis, rheumatism and leprosy and asthma. Young stems are used in the treatment of diarrhoea and as an astringent, aphrodisiac, expectorant, anthelmintic, purifying and detoxifying agent and for abortion. The major constituent present in CS rhizome is diosgenin, which is a steroidal sapogenin. Other constituents present are dioscin, betasitosterol tigogenin and gracillin. CS rhizome also contains essential oil; the main constituents of the oil are pinocarveol, cineole, carvacrol. From the rhizomes Methyl 3-(4-hydroxyphenyl)-2E propontone was also isolated. The seed contains tocopherol, glucose, galactose and rhamnose. The roots of this plant also contain dioscin, gracillin, β-sitosterol-β-D-glucoside and pro sapogenins A and B. Root also contains 31- norcycloartanone, cycloartenol, cycloaudenol and cycloarteno. CS has been claimed to use as antiinflammatory, antimicrobial, anti hypercholesterolemic, anti inflammatory, antioxidant and antiangiogenic activity, antioxidant, antihyperlipidemic, anti depressant and in neuropharmacological evaluation. Aerial part of CS possesses antiarthritic activity at the doses of 400 and 800mg/kg body weight by suppressing the swelling of paw in both acute and chronic phases. The suppression of inflammation may be due to the presence of alkaloids and flavonoids in CS (Srivastava et al., 2012).

**Dalbergia sissoo** (DS) Fabaceae

_Dalbergia sissoo_ is commonly known as “Shisham”, a medium to large tree, 25m in height and 2-3m in diameter (Asif and Kumar, 2011). Leaves are 15cm long with the fine pointed tip. DS is found throughout India, Pakistan, Bangladesh, Nepal, Afghanistan, Persia, Iraq and Kenya. Shisham is used by folk practitioners for treatment of several ailments. Extract of DS bark is used to treat inflammation of piles and sciatica. DS is also used in burning sensation of stomach, digestive disorders, in scabies, to treat colo rectal cancer and jaundice. Aerial parts are used to treat sexually transmitted diseases like syphilis, gonorrhea and as expectorant. The flower oil is used for skin diseases like Leucoderma and ulcer and flower extract is used as a blood purifier and immune modifying agent. Extract of leaves is used to treat dandruff, to strengthen the hair and for treatment of eye and nose diseases. The leaf extract is used for skin diseases like Leucoderma and ulcer and antidiabetic and antidiarrheal activities. Antiarthritic activity of Ethanolic extract of _Dalbergia sissoo_ was studied by cotton pellet granuloma and inhibition of protein denaturation at the doses of 200 400, 800 and 1000μg/ml, which shows significant anti arthritic effect as compared to control drug dexamethasone.

**Mimusops elengi** (ME) Sapotaceae

Mimusops elengi is commonly known as “Bakul”, cultivated as an ornamental tree because of its flowers. The plant grows up to 16m in height. ME is found in India, Burma, Pakistan, Bangladesh, Thailand, Malaysia. Leaves are 6.3-10 in length and 3.2 -5 cm in width, elliptic in shape with acute or round base. Kalidas in his Sanskrit literature included ME flower as a symbol of Love and beauty. _Mimusops elengi_ is used from the ancient time to till now due to the large number of its therapeutic properties. Literature survey makes it clear that in ancient civilization, flowers of ME were the main diet of sages, hermits and people. In Ayurveda, taila prepared from the fruits of ME are used for strengthening the gum and teeth. In Unani medicines the bark is used for urinary diseases in males. Bark decoction is used to treat fever, throat and stomach pain. Flowers are used to treat kidney and bladder stones and for cardiac disorders. Roots are used for treatment of sexually transmitted diseases, to increase the flow of urine and good for gonorrhea. Phytochemical constituents present in ME are Beutelinic acid, ursolic acid, lupeol gum, tannis, wax and starch. Quercitol, β-sitosterol, mimusops and mimusopic acid, anthraqunone and cardiac glycosides such as mimusopside A and B, alkaloids like hentriacontane, saponins (mimusin), pentacyclic triterpenes -mimusopgenone and mimugenone are also present. Two α-glucosidase inhibitors, 3β-hydroxy-12-ursene-28-oic acid and 3β-(4-hydroxycinnamoyl)-12-ursen-28-oic acid were found from the methanolic extracts of ME. ME has high potential in wound healing activity (Aleti et al., 2015), antibacterial, anti inflammatory (Khatri et al., 2014), antimicrobial, _In vitro_ antioxidant, antiurolithiatic, Antinflammatory, analgesic and antipyretic activity (Koti et al., 2010), anticonvulsant, anthelmintic, antifungal, antiallergic, cognitive enhancing activity, diuretic, hepatoprotective and cytotoxic activity.

Many diseases, modifying anti rheumatic and non...
steroidal anti inflammatory drugs like methotrexate, cyclosporine and D- Pencillamine, ibuprofen, sulindac and indomethacin are available in the market for the treatment of rheumatism. Rheumatism can be controlled by these drugs to a certain extent, but these drugs also have severe side effects. These side effects can range from mild rashes, nausea and vomiting to fatal, bacterial, fungal or viral infections like infection of herpes zoster or hepatitis B or C. Even rituximab can cause congestive heart failure and central nervous system diseases. So there is a need to explore alternative methods, particularly traditional medicines, for the treatment of rheumatoid arthritis. Therefore, this review article is prepared to collect and compile data of herbal medicinal plants which shows beneficial effects on rheumatoid arthritis by controlling the level of pro-inflammatory cytokines such as IL-8, IL-6, IL-2 and TNF-α and thus inhibits inflammatory response with negligible side effects. In this review article, we have discussed the traditional plants with description of family, extracts, traditional uses and doses used for reporting antirheumatic activity.

CONCLUSIONS

The data discussed in this review show a latest data having good potential for anti rheumatic activity. Many medicinal plants discussed in the review used traditionally for rheumatism have not been explored for anti rheumatic activity yet. The major chemical constituents present in the herbal medicinal plants mentioned in review having good anti rheumatic activity can be explored further to investigate the lead compounds for more precision and lesser adverse effects. In some plants reported activity is done on whole plant so there is need to evaluate the parts responsible for the anti rheumatism activity.

ACKNOWLEDGEMENT

We are thankful to the School of Pharmaceutical Sciences, Jaipur National University for providing all the facilities required for the work done.

Funding Support

The authors declare that they have no funding support for this study.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Authors Contributions

Harjinder Kaur, Ganesh N Sharma, Birendra Shrivastava and Satish Chander Arora conceived the review idea and focus, drafting the article, critical revision and reference collection of article. Ganesh N Sharma, Birendra Shrivastava and Satish Chander Arora also supervised to the final revision of the manuscript.

REFERENCES

Aleti, S., Reddy, M. S., Sneha, J. A., Suvarchala, N. V. L. 2015. Wound Healing Activity of Mimusops elengi Leaves. Iranian Journal of Pharmacology and Therapeutics, 13(1):13–13.

Ammon, H. P., Muller, B. A. 1985. Forskolin: from an Ayurvedic remedy to a modern agent. Planta Med, 51(6):473–477.

Asdaq, S. M. B., Rao, G. S., Ananth, K. V., Asad, M., Kumar, N. P. 2010. Evaluation of wound healing potential of Bauhinia purpurea leaf extracts in rats. Indian Journal of Pharmaceutical Sciences, 72(1):122–122.

Asif, M., Kumar, A. 2011. Phytochemical investigation and evaluation of antinociceptive activity of ethanolic extract of Dalbergia sissoo (Roxb.) bark. Journal of Natural Science, Biology and Medicine, 2(1):76–76.

Babushetty, V., Sultanpur, M. C. 2012. Evaluation of anti-arthritis activity of Asystasia dalzelliana leaves. Int J Pharma Biol Arch, 3(2):377–382.

Bah, S., Jäger, A. K., Adsersen, A., Diallo, D., Paulsen, B. S. 2007. Antiplasmodial and GABAA–benzodiazepine receptor binding activities of five plants used in traditional medicine in Mali, West Africa. Journal of Ethnopharmacology, 110(3):451–457.

Bhanumathy, M., Harish, M. S., Shivaprasad, H. N., Sushma, G. 2010. Nootropic activity of Celas-trus paniculatus seed. Pharmaceutical Biology, 48(3):324–327.

Bhujade, A., Talmale, S. 2015. In vivo Studies on Antiarthritic Activity of Cissus quadrangularis against Adjuvant Induced Arthritis. Journal of Clinical & Cellular Immunology, 06(03):100027–100034.

Eggadi, V., Pashikanti, G., Kulunavelu, U., Jupalli, V., Sheshagiri, S. B. 2014. Anti-arthritic activity of Ethanolic extract from the leaves of Commiphora caudata (Linn.) in complete Freund’s adjuvant-induced arthritic rats. Nigerian Journal of Experimental and Clinical Biosciences, 2(1):42–42.

Fujita, E., Ochiai, M., Ichida, I., Chatterjee, A., Deshmukh, S. K. 1950. Confirmation of the structure of callitrispenone, a diterpene from Callicarpa macrophylla Vahl. Phytochemistry, 4:568–568.
Harjinder Kaur et al., Int. J. Res. Pharm. Sci., 2021, 12(1), 576-587

© International Journal of Research in Pharmaceutical Sciences 587