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Ethnopharmacognosy, phytochemistry and pharmacology of genus *Caesalpinia*: A review

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Abstract

The genus *Caesalpinia* belongs to family Caesalpiniaceae and includes 280 species, distributed in tropic and sub-tropic regions of the world. Historically, species of the genus *Caesalpinia* have been used to treat a wide range of ailments such as malaria, ascariasis, dysentery, fever, rheumatism and influenza. Phytochemical works led to the isolation of triterpenoids, diterpenes, flavonoids, steroids and phenolic compounds. Pharmacological studies have shown that the extracts and compounds isolated from this genus exhibited anticancer, anti-inflammatory, anti-malarial, anti-pyretic, anti-microbial, anti-rheumatic, antiulcer and anti-diabetic activities. Therefore, the aim of this review is to provide a comprehensive overview of the ethnopharmacognosy, phytochemistry and pharmacology of the genus *Caesalpinia*.

Keywords: *Caesalpinia*, ethnopharmacognosy, phytochemistry, pharmacology

Introduction

Caesalpiniaceae mostly comprises of trees, shrubs and climbers, while herbs are very rare. *Caesalpiniaceae* contains 152 genera and 2800 species distributed mostly in tropical and sub-tropical regions. *Caesalpinia* L. is one of the important genus of family *Caesalpiniaceae*. It includes shrubs, trees and woody climbers and about 280 species, distributed in tropics and sub-tropics [1]. Several members of *Caesalpinia* have medicinal, horticultural and economical importance. Many species have been used in ethnomedicine in different parts of the world [2]. Previous studies showed that the species of this genus exhibited a wide range of pharmacological activities such as anticancer, anti-inflammatory, anti-pyretic, anti-microbial, anti-malarial, anti-rheumatic, antiulcer and anti-diabetic activities. Chemical investigation reveals the presence of triterpenoids, diterpenes, flavonoids, steroids and phenolic compounds in this genus. The diterpenes isolated from this genus are a group of highly structurally diverse compounds and they exhibited a variety of pharmacological activities [3]. Following species of *Caesalpinia* are reported in literature, with their medicinal uses, phytochemistry and pharmacology.

1. *Caesalpinia benthamiana* (Baill.) Herend. & Zarucchi.
2. *C. bonduc* (Linn.) Roxb.
3. *C. cacalaco* Humb. & Bonpl.
4. *C. coriaria* (Jacq.) Willd.
5. *C. decapetala* (Roth) Alston.
6. *C. digyna* Rottl.
7. *C. echinata* Lam.
8. *C. ferrea* Mart.
9. *C. gilliesi* (Hook.) Dietr.
10. *C. major* (Medik.) Dandy & Exell
11. *C. melanadenia* (Rose) Standl
12. *C. mexicana* A.Gray
13. *C. mimosoides* Lamk
14. *C. minax* Hance.
15. *C. nuga* Ait.
16. *C. paraguariensis* Burk
17. *C. pannosa* Brandegees.
18. *C. pauciflora* (Griseb.) C. Wright ex Sauvalle.
19. *C. platyloba* S.Watson.
20. *C. pulcherrima* (Linn.) Swartz.
21. *C. sappan* L.
22. *C. spinosa* (Molina) Kuntze.

23. *C. spicata* Dalz.
 24. *C. tortura* Roxb.
 25. *C. volkensis* Harms.

Ethnopharmacognosy

<i>C. benthamiana</i> (Baill.) Herend. & Zarucchi.	
Part	Ethanopharmacognosy
Roots	Used in erectile dysfunction ^[4] .
Whole plant	Used in topical infections, wounds ^[5] .
<i>C. bonduc</i> (Linn.) Roxb.	
Bark	It is reported as febrifuge, anthelmintic, antimalarial, hypoglycemic, antipyretic, anti-inflammatory and antirheumatic ^[6, 7] .
Leaves	Used in inflammation, liver disorders, burns and reported as emmenagogue, laxative, tonic, carminative, emetic, antipyretic and cathartic ^[6, 8, 9, 10] .
Root	It is reported as antiperiodic, antispasmodic, emmenagogue and purgative ^[6, 8] .
Seeds	Used in skin diseases, intestinal worms, dyspepsia, cough, leprosy, colic, haemorrhoids, dysentery and reported as febrifuge antiperiodic, antipyretic, astringent, anthelmintic, digestive, stomachic, liver tonic, anti-inflammatory, antirheumatic, antimalarial and hypoglycemic ^[6, 10, 11, 12] .
Whole plant	Used in asthma, diabetes, convulsion, skin diseases, cough, headache, stomach upset, intermittent fever, diarrhea and reported as antipyretic, antiperiodic, antispasmodic, antirheumatic, purgative, hypoglycemic, nematocidal, abortifacient, antimicrobial, anthelmintic and anti-inflammatory ^[13, 14, 15, 8, 16, 17] .
<i>C. coriaria</i> (Jacq.) Willd.	
Pods	Used in bleeding piles ^[20] .
Whole plant	Used in freckles, acute colic pain ^[20] .
<i>C. decapetala</i> (Roth) Alston.	
Leaves	Used in biliousness, stomach disorders, burns and reported as purgative and emmenagogue ^[22, 23] .
Roots	It is reported as purgative and emmenagogue ^[22, 23, 24] .
Whole plant	Used in jaundice and reported as immunomodulatory, anti-inflammatory, carminative, tonic, laxative and antipyretic ^[22, 23, 24] .
<i>C. digyna</i> Rottl.	
Roots	Used in phthisis, scrofulous affections, diabetes, sores and reported as astringent and antipyretic ^[26, 27] .
Whole plant	It is reported as hepatoprotective, antiseptic, antioxidant, antidiabetic and anti-inflammatory ^[28] .
<i>C. echinata</i> Lam.	
Bark	Used in dysentery, diarrhea and reported as to strengthen the gums ^[29] .
Seed	It is reported as astringent and tonic ^[30] .
<i>C. ferrea</i> Mart.	
Bark and pods	Used in broncho-pulmonary diseases, diabetes, inflammation, pain, diarrhea, gastrointestinal disorders and rheumatism ^[32] .
Fruit	Used in cough, diabetes and injuries ^[33, 34] .
Root	It is reported as antipyretic ^[33] .
Stem bark	Used in diarrhea, enterocolitis and diabetes ^[33, 35, 36] .
Whole plant	Used in wounds, bruises, chronic cough, asthma and reported as anti-inflammatory, analgesic, antipyretic and antimicrobial ^[33, 37] .
<i>C. major</i> (Medik.) Dandy & Exell	
Roots	Used in back-ache, rheumatism and reported as tonic and anthelmintic ^[39] .
Seeds	It is reported as expectorant and anti-tussive ^[39] .
<i>C. melanadenia</i> (Rose) Standl.	
Aerial parts	Used in gastrointestinal, respiratory and skin diseases ^[40] .
<i>C. mimosoides</i> Lamk.	
Flowers	Used in dizziness and reported as carminative ^[41] .
Leaves	Used in epilepsy, dizziness, boils and reported as appetizers and carminative ^[2, 41] .
Roots	Used in ulcer, arthritis, wound and reported as anthelmintic ^[2] .
Shoots	Used in boils, dizziness, skin diseases and reported as appetizers, carminative and blood purifier ^[41, 42] .
Sprouts	Used in dizziness and reported as carminative ^[2] .
Whole plant	Used in epilepsy, joint disorder and reported as appetizers ^[2, 42] .
<i>C. minax</i> Hance.	
Seeds	Used in common cold, dysentery, rheumatism and fever ^[43, 44, 45, 46] .
<i>C. paraguariensis</i> Burk.	
Whole plant	Used in diarrhea, tuberculosis, stomach aches, nervous disorder, dysentery, malaria and skin infections ^[47] .
<i>C. pulcherrima</i> (Linn.) Swartz.	
Aerial parts	Used in malarial infection, bronchitis and reported as anti-inflammatory and abortifacient ^[51] .
Bark	Used in liver disorders, ulcers, fever, fungal infection, malarial infection, bronchitis and reported as abortifacient, astringent, emmenagogue and wheezing ^[52, 53, 54, 55, 56] .
Flowers	Used in asthma, intestinal worms, malaria, cough, sores, oxidative stresses, bronchitis, catarrh, pyrexia, wheezing and reported as Anthelmintic ^[52, 53, 55, 56, 57] .
Fruits	Used in bleeding diarrhea and dysentery ^[52, 58] .
Leaves	Used in liver disorders, ulcers, fever, fungal infection, malarial infection, pyrexia, wheezing, bronchitis and reported as purgative, tonic, emmenagogue, antipyretic, cathartic and abortifacient ^[52, 53, 54, 55, 56, 57, 59, 60] .
Roots	Used in liver disorders, ulcers, fever, fungal infection, convulsions, intermittent fevers, skin and lungs diseases ^[52, 53, 56, 59, 60] .
Seeds	Used in gum troubles, ring worm infections, breathing difficulties, cough and chest pains ^[56, 57] .
Stem	It is reported as abortifacient and emmenagogue ^[58] .

Whole plant	Used in rheumatism, skin infections, malarial infection, bronchitis, asthma and reported as tonic, stimulant, emmenagogue, anti-ulcerogenic, anti-inflammatory, abortifacient and purgative [54, 55, 58, 61, 62, 63, 64].
<i>C. sappan</i> L.	
Heartwood	Used in wounds, burning sensation, skin diseases, ulcers, epilepsy, diarrhea, rheumatism, diabetes, convulsion, dysentery, fever, anemia, inflammatory disease, leprosy, biliousness, delirium, strangury, blood complaints, leucorrhoea, dysmenorrhoea, menorrhagia and reported as emmenagogue, sedative, demulcent and haemostatic [65, 66, 67].
Whole plant	Used in jaundice, respiratory ailments, cough, wounds, heart diseases, blood pressure, quenching thirst, dysmenorrhoea, amenorrhoea, blood stasis after delivery and reported as blood purifier [67].
<i>C. spinosa</i> (Molina) Kuntze.	
Whole plant	Used in inflamed tonsils, fever, colds, skin infections, respiratory illness and reported as antitumor [70, 71, 72].
<i>C. spicata</i> Dalz.	
Bark	Used in skin diseases [74].
Roots	Used in pulmonary tuberculosis and pneumonia [74].
Whole	Used in respiratory and cardiovascular diseases [74].
<i>C. volkensii</i> Harms.	
Leaves	Used in malaria [75].
Seeds	Used in stomach ulcers [75].
Root	Used in gonorrhoea and bilharzias [75].

Phytochemistry

<i>C. benthamiana</i> (Baill.) Herend. & Zarucchi.	
Part /Extract	Phytoconstituents
Leave	Gallic acid and its derivatives [5].
Root bark / light petroleum, aqueous	Deoxicaesaldehydric acid, Bentaminine 1 and 2, gallic acid, resveratrol and tannins [4, 5].
<i>C. bonduc</i> (Linn.) Roxb.	
Bark/ ethanol	Sterols, diterpenes, Caesaldehydric acid J, and Homoisoflavonoids [7, 17].
Flower/ ethanol	Flavonoids [15].
Leave/ ethyl acetate	α -(2-hydroxy-2-methylpropyl)- ω -(2-hydroxy-3-methylbut-2-en-1-yl) polymethylene [9].
Root/ hexane and ethyl acetate	Diterpenes and Caesaldehydric acid m, c, f and h, demethylcaesaldehydric acid C, Vouacapen-5, 19-diol, caesalmin d and e-caesalpin [17].
Seed / methanol	Fatty acids, lupeol, lupeol acetate, β -amyrin, α -amyrin, furanoditerpenes, caesalpins, phytosterin, β -sitosterol, homoisoflavonebonducellin, carbohydrates, β -carotene, glycoside-bonducellin, resins, gums, flavonoids, glycosides, saponins, tannins, alkaloids, terpenoids, amino acids and diterpenes [6, 13, 18, 11, 16, 12, 17].
Stem	Diterpenes [17].
Whole plant	Cassane type diterpenoid, lupeol, squalene, trans-resveratrol, quercetin, stigmasterol, astragalol, diterpene hemiketals [8, 14, 17].
<i>C. cacalaco</i> Humb. & Bonpl.	
Pod	Gallic acid, tannic acid [21].
<i>C. coriaria</i> (Jacq.) Willd.	
Leaves and pod /methanol	Carbohydrates, glycosides, amino acid, flavonoids, phenolic compounds, protein, tannin, saponin, gum, mucilage and oil [20].
<i>C. decapetala</i> (Roth) Alston.	
Bark	Homoisoflavonoids, chalcones [24].
Leaves/ methanol and chloroform	Cassane diterpenoid, squalene, lupeol, transresveratrol, astragalol, stigmasterol and quercetin [22, 23, 25].
Root/ methanol	New cassane-type diterpenoid, triterpenoids, phenolics [24, 25].
Whole plant	Sterols, triterpenoids [22].
<i>C. digyna</i> Rottl.	
Root/ petroleum ether	Caesalpinia A, celalocinnine, ellagic acid, gallic acid, bergenin, bonducellin, tannin, intricatinol, friedelin, β -sitosterol, stigmasterol and hexacosanic acid [26, 27, 28].
<i>C. echinata</i> Lam.	
Flower	E- β -ocimene [30].
Leaves	(E)-3-hexan-1-ol [30].
Stem/ ethanol	New cassane diterpenes and lambertianic acid, brazilin, brazilein [30, 31].
Wood	Flavonoids (brazilin and brazilein), lignins, coumarins and tannins [29].
<i>C. ferrea</i> Mart.	
Fruit/ ethyl acetate	Gallic acid, methyl gallate and acetophenone derivatives [34].
Leaves	Flavones [36].
Pod and stem/ ethanol	Gallic acid, ellagic acid, biflavonoid and resveratrol [37].
Stem, bark and leaves/ hydroalcohol	Flavonoids, tannins, saponins, steroids, coumarins and phenolic compounds [32, 35].
Stem	Pauferrol A, B and C [36].
<i>C. gilliesii</i> (Hook.) Dietr.	
Flower/dichloromethane	Sterol, daucosterol and flavonoids [38].
<i>C. major</i> (Medik.) Dandy & Exell	
Root	Caesaldehydric acids a, b, c, d and e [39].
Seed kernels/methanol	Cassane diterpenoid [39].
<i>C. melanadenia</i> (Rose) Standl.	

Aerial parts/ hexane	Flavonoids, licosides and terpens ^[40] .
<i>C. mimosoides</i> Lamk.	
Aerial parts/ ethyl acetate	Quercetin ^[2] .
Root/ acetone and dichloromethan	Diterpenoids, mimosol A- G ^[2, 41] .
Whole plant/ ethanol	Quercetin, ethyl gallate and gallic acid ^[42] .
<i>C. minax</i> Hance.	
Seed/ acetone, chloroform	Caesalminaxins A-L, caesalmines A-G, stigmaterol, macrocaesalmin ^[43, 44, 45, 46] .
Whole plant	Caesalmines A-G, spirocaesalmin, macrocaesalmin, neo-caesalpins AA-AE, neo-caesalpins J-N, neo-caesalpins S-U, sicutiniranes G-I ^[45] .
<i>C. paraguariensis</i> Burk.	
Aerial parts/ dichloromethane, methanol	Caesalpinol, bilobetin; stigmast-5-en-3- β -6'-palmitoylglucopyranoside; stigmast-5-en-3- β -6'-stearoylglucopyranoside, lupeol, betulinic acid, 3-O-(E)-hydroxycinnamoyl betulinic acid, oleanolic acid, 3-O-(E)-hydroxycinnamoyl oleanolic acid; stigmast-5-en-3- β -glucopyranoside ^[47] .
Bark/ ethanol and aqueous	Ellagic acid and its derivatives ^[48, 49] .
<i>C. platyloba</i> S.Watson.	
Leaves/ dichloromethane	Cassane diterpenes ^[50] .
<i>C. pulcherrima</i> (Linn.) Swartz.	
Aerial parts/acetone	Flavonoids, bonducellin, tannins ^[51, 57, 58] .
Bark	β -sitosterol, leucodelphinidin, ellagitannins, quercimeritrin, sebacic acid, pulcherrimin, rutin., flavonoids, glycosides, steroids, phenols, diterpenoids, triterpenoids ^[52, 54] .
Fruit	Myricitroside, tannins, benzoic acid, gallic acid ^[53] .
Flower	Gallic acid, β -sitosterol, lupeol, lupeol acetate, quercetin, myricetin, rutin, myricitroside, tannins, benzoic acid, flavonoids ^[52, 53, 62] .
Leaves/ dichloromethane	Myricetin glycoside, pentahydroxyflavanol, isovouacapenol a,b,c,d, myricitroside, tannins, benzoic acid, gallic acid, cyaniding-3,5-diglucoside, hydrocyanic acid, cassane, caesalpin, dibenzoate ^[52, 53, 57, 62] .
Root	Diterpene benzoates, furanoditerpenoids; 8, 9, 11, 14-didehydrovoucapen-5 α -ol, isovouacapenol C, pulcherrimin A, cassane, caesalpin ^[52, 57, 62] .
Seed	Galatomannan ^[52] .
Stem	Pulcherralpin, pulcherrimin, 6-methoxypulcherrimin, bonducellin, 8-methoxybonducellin, peltogynoids, bhonducellin, cassane, caesalpin, dibenzoate, tannins, flavonoids ^[52, 55, 57, 62] .
Whole plant	2,6-Dimethoxybenzoquinone and 4'-methoxyisoliquiritigenin, diterpenoids, peltogynoids, flavanoids, furanoditerpenoids, ellagitannins, homoisoflavonoids, galatomannan, pulcherrimins A-D, diterpene dibenzoates, steroids, phenols, carotenoids, glycosides, myricetin, quercetin, terpenoids, sitosterol ^[52, 58, 61, 64] .
<i>C. sappan</i> L.	
Heartwood/methanol	Neosappanone A, naphthoquinone derivatives, phenols, sappanchalcone, caesalpin J, caesalpin P, protosappanin a,b and e, homoisoflavonoids, sterol, brazilin, Sappanol, episappanol; 3'-deoxy sappanol, 3'-O-methylsappanol, 3'-methylepisappanol, 3'-O-methylbrazilin, sappanon β , 3-deoxysappanone β , 3'-deoxysappanone β , dibenzoxocin derivative, 10-O-methyl-protosappanin β , 4,4'-dihydroxy-2'-methoxychalcone, 8-methoxy-bonducellin, quercetin, rhamnetic, ombuin, Monohydroxybrazilin, benzyl dihydrobenzofuran derivatives, brazilide A, 4-O-methylepisappanol, methoxychalcone, isoliquiritigenin ether-2-methyl, 4-O-methylsappanol, and pluchoic acid ^[65, 66, 68, 69] .
Lignum	Monohydroxybrazilin and benzyl dihydrobenzofuran derivatives ^[66] .
Leaves	Essential oil ^[66] .
Pod	Tannins ^[66] .
Seed	Protein and fixed oil ^[66] .
Stem	Tetraacetyl-brazilin and protosappanin ^[66] .
Wood/ ethyl acetate	Sappanchalcon, β -amyrin, amino acids, lactose, galactose, 2-deoxyribose, glucose, caesalpin j, brazilin and brazilin ^[66] .
<i>C. spinosa</i> (Molina) Kuntze.	
Fruit	Gallotannin ^[70] .
Leave/ ethanol	Caespinosin A-E and Isonoe-caesalpin H ^[73] .
Pod	Tannin, galltannic, gallic acid, gallotannins, gum ^[71, 72] .
Seed	Gum and tannin ^[71, 72] .
Twigs	Caespinosin A-E and Isonoe-caesalpin H ^[73] .
<i>C. spicata</i> Dalz.	
Root	Vakerin ^[74] .

Pharmacology

<i>C. benthamiana</i> (Baill.) Herend. & Zarucchi.	
Part /Extract	Pharmacological activities
Leave	Antibacterial ^[5] .
Root bark/ light petroleum, aqueous	Anti-bacterial, antioxidant, vasorelaxant and aphrodisiac ^[4, 5] .
<i>C. bonduc</i> (Linn.) Roxb.	
Bark/ ethanol	Inhibition of Glutathione S-Transferase, antihelminthic, anticancer, antimalarial, antihyperglycemic, anti-inflammatory, antirheumatic, antipyretic, antidiuretic, anti-anaphylactic, antidiarrheal, anti-estrogenic, antibacterial, antiameobic, anticonvulsant, antiameobic, nematocidal, abortifacient, antiasthmatic and antiviral ^[7, 19] .
Flower/ ethanol	Analgesic and antipyretic ^[15] .

Leaves/ hydroalcohol, ethyl acetate and ethanol	Antipsoriatic, antioxidant and antimicrobial [9, 10, 19].
Seed/ ethanol and methanol	Antibacterial, antipyretic, analgesic, antidiabetic, anti-inflammatory, anthelmintic, antiperiodic, anticancer, antimalarial, antirheumatic, antidiuretic, anti-anaphylactic, anti-diarrheal, anti-estrogenic, anticonvulsant, antiameobic, nematocidal, abortifacient, antiasthmatic, antiviral,, antioxidant, antifilarial and immunomodulatory [13, 18, 8, 19, 11, 16].
Whole plant	Antiproliferative, anthelmintic,, antitumor, antibacterial, anti-diarrheal, anti-implantation, insecticidal, cytotoxic and antioxidant [14, 8, 17].
<i>C. cacalaco Humb. & Bonpl.</i>	
Pod/water-methanol (8:2)	Antimutagenic, antimicrobial and antioxidant [21].
<i>C. coriaria (Jacq.) Willd.</i>	
Leaves and pod/ aqueous, ethanol and methanol	Anti-bacterial [20].
<i>C. decapetala (Roth) Alston.</i>	
Branches and leaves/ n-hexane and methanol	Analgesic, anti-inflammatory and antipyretic [23].
Whole plant	Anti-tumor, anti-fertility and antioxidant [23].
Wood and pericarp / methanol	Antioxidant [22].
<i>C. digyna Rottl.</i>	
Root/ hydroalcohol and methanol	Antitubercular, antioxidant, radioprotective, antidiabetic and antihypertensive [26, 27, 28].
Whole plant	Antifatigue, antiulcerogenic, hepatoprotective, antiviral, antidiabetic, antiarrhythmic, antioxidant and antiarthritic [26, 27].
<i>C. echinata Lam.</i>	
Stem/ ethanol	Leishmanicidal [30, 31].
Wood/ ethanol	Antioxidant and antiangiogenic [29].
<i>C. ferrea Mart.</i>	
Fruit/ aqueous	Analgesic, anti-inflammatory, antihypertensive, antidiabetic, cancer chemopreventive, antiulcerogenic and antibacterial [33, 34, 36].
Leaves/ hydroalcohol	Antidiabetic and antioxidant [36].
Stem bark/ aqueous	Analgesic, anti-inflammatory, antihypertensive, antidiabetic, cancer chemopreventive, antiulcerogenic and antibacterial [36].
Whole plant/ aqueous	Anti-gastric ulcer, antimicrobial, anti-inflammatory, analgesic, larvicidal, cancer chemopreventive and antihypertensive [32, 33, 34, 35].
<i>C. gilliesii (Hook.) Dietr.</i>	
Leaves, pod and flower	Cytotoxic and antioxidant [38].
<i>C. melanadenia (Rose) Standl.</i>	
Aerial parts/ hexane	Antimicrobial [40].
<i>C. mimosoides Lamk.</i>	
Flower/methanol	Antimicrobial and antioxidant [2].
Fruit/methanol	Antimicrobial and antioxidant [2].
Leave /methanol	Anti arthritic, analgesic, antimicrobial and antioxidant [2].
Root/methanol	Anti-inflammatory, antimicrobial and antioxidant [2, 41].
Shoot / methanol, ethanol	Antioxidant and antimicrobial [2, 42].
Stem	Antimicrobial and antioxidant [2].
Whole plant	Antimicrobial, antioxidant, anti-inflammatory, anticancer, anticholinesterase and neuroprotective [41, 42].
<i>C. minax Hance.</i>	
Seed/ acetone, ethanol	Cytotoxic, anti-inflammatory and antiviral [43, 44, 45, 46].
Whole plant	Anti-inflammatory, antibacterial and anticancer [46].
<i>C. paraguariensis Burk.</i>	
Aerial parts/ dichloromethane and methanol	Antibacterial [47].
Bark/ ethanol and aqueous	Antibacterial, antioxidant and anti-inflammatory [48, 49].
<i>C. pulcherrima (Linn.) Swartz.</i>	
Aerial parts/ acetone	Antimicrobial and anti-inflammatory [51, 58].
Bark/hydroalcoholic and aqueous	Antiulcer, anthelmintic, antimicrobial and cytotoxic [54, 55].
Fruit/ethanol	Antimicrobial [61].
Flower/petroleum ether, ethyl acetate, methanol, aqueous, ethanol	Antioxidant, antimicrobial, antidiabetic and antiwrinkle [53, 57, 60, 63].
Leaves/ dichloromethane, ethanol	Antimicrobial, anticonvulsant and antifertility [52, 56, 59].
Root	Cytotoxic [52].
Stem	Antitumor [52].
Wood/methanol and aqueous	Antioxidant and cytotoxic [62].
Whole plant/ethanol	Antiarthritic, antiviral, anti-inflammatory and antibacterial [57, 64].
<i>C. sappan L.</i>	
Heartwood/ ethyl acetate, methanol, water, ethanol, petroleum ether, diethyl ether	Antihyperuricemia, antioxidative, hypoglycemic, cytotoxic, hepatoprotective, antimicrobial, anti-inflammatory, analgesic, antifungal, immunosuppressive, acaricidal, cytoprotective and neuroprotective effect [65, 66, 68, 69].
Leave/ methanol and ethyl acetate	Antimicrobial [67].
Whole plant/chloroform, n-hexane, ethyl	Anticancer, anti-inflammatory, antiplatelet, antimicrobial, vasorelaxing effect and antiproliferative

acetate, dichloromethane and methanol aqueous, n-butanol and methanol-water(1:1)	[66].
Wood	Antidiabetic [66].
<i>C. spinosa</i> (Molina) Kuntze.	
Fruit/ethanol	Antimicrobial [70].
Pod/ethanol, chloroform, ethyl acetate and aqueous	Antimicrobial, antioxidant and antitumor [70, 72].
Whole plant	Astringent, antibacterial, antifungal, antiviral, anti-inflammatory, antiseptic, anti-diarrheal and antioxidant [70, 71].
<i>C. spicata</i> Dalz.	
Root	Antibacterial [74].
Whole plant	Antiseptic [74].
<i>C. volkensii</i> Harms.	
Leaves/ petroleum ether and aqueous	Antimalarial [75].

Conclusion

The present review discusses the ethnopharmacognosy, phytochemistry and pharmacology aspects of genus *Caesalpinia*. Pharmacological evaluation carried out on different crude extracts and pure compounds provided pragmatic documents for its traditional uses and have revealed this genus to be a valuable source for medicinally importance molecules. Expansion of research work would provide more chances for discovery of new bioactive compounds from the genus *Caesalpinia*. Validating the correlations of the ethno medicinal uses, bioactive compounds and pharmacological activities is of special importance and is still the primary task for future research.

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