



## Review

# Current state of knowledge on the traditional uses, phytochemistry, and pharmacology of the genus *Hymenaea*



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## ARTICLE INFO

*Chemical compounds cited in this article:*

δ-Amorphene (PubChem CID: 12306059)  
 Arachidic acid (PubChem CID: 10467)  
 Aromadendrene (PubChem CID: 11095734)  
 allo-Aromadendrene (PubChem CID: 10899740)  
 Astilbin (PubChem CID: 119258)  
 Behenic acid (PubChem CID: 8215)  
 α-trans-Bergamotene (PubChem CID: 86608)  
 Bicyclogermacrene (PubChem CID: 5315347)  
 (-)-(1'S,2S)-α-Bisabolol (PubChem CID: 1549992)  
 β-Bourbonene (PubChem CID: 62566)  
 α-Cadinene (PubChem CID: 12306048)  
 δ-Cadinene (PubChem CID: 441005)  
 γ-Cadinene (PubChem CID: 92313)  
 trans-Cadina-1,4-diene (PubChem CID: 6430869)  
 α-Calacorene (PubChem CID: 12302243)  
 trans-Calamenene (PubChem CID: 6429022)  
 Calarene (PubChem CID: 15560278)  
 Campesterol (PubChem CID: 173183)  
 Camphoric acid (PubChem CID: 219463)  
 Caprylic acid (PubChem CID: 379)  
 (Z)-Caryophyllene (PubChem CID: 5322111)  
 (-)-(E)-Caryophyllene (PubChem CID: 5354499)  
 (-)-(E)-Caryophyllene oxide (PubChem CID: 1742210)  
 α-Copaene (PubChem CID: 92042749)  
 β-Copaene (PubChem CID: 21722369)  
 Copalic acid (PubChem CID: 11162521)  
 α-Cubebene (PubChem CID 86609)  
 1-*epi*-Cubenol (PubChem CID: 519857)  
 Cyclosativene (PubChem CID: 16212927)  
 Cyperene (PubChem CID: 12308843)  
 (Z)-9-Eicosenoic acid (PubChem CID: 5312523)  
 β-Elemene (PubChem CID: 6918391)  
 δ-Elemene (PubChem CID: 89316)  
 Engelitin (PubChem CID: 6453452)

## ABSTRACT

**Ethnopharmacological relevance:** Plants of the genus *Hymenaea* (Fabaceae) are used in South American and Asian traditional medicines to treat a multitude of disorders, like cough, diarrhea, dysentery, intestinal colic, pulmonary weakness, asthma, anemia, sore throat, and for the treatment of kidney problems, viral related disorders, chronic cystitis, bronchitis, and bladder infections. Some *Hymenaea* species are also used as vermifuge, and for the treatment of arthritis, and inflammation conditions. This review deals with updated information on the traditional uses, phytochemistry and pharmacology of ethnomedicinally important *Hymenaea* species in order to provide an input for the future research prospects.

**Methods:** Literature available in various recognized databases including Google Scholar, PubMed, SciFinder, Scopus, Springer, Wiley, ACS, Scielo and Web of Science, as well as from theses, dissertations, books, reports, and other relevant websites ([www.theplantlist.org](http://www.theplantlist.org)), are surveyed, analysed, and included in this review. Herein, the literature related to chemical constituents and pharmacological activities were searched in November 2016.

**Results:** The literature provided information on ethnopharmacological uses of the South American and African species of the genus *Hymenaea* (e.g., *H. courbaril*, *H. stigonocarpa*, *H. onblogifolia*, *H. martiana*, *H. parvifolia* (South America) and *H. verrucosa* (African species)) for the treatment of multi-factorial diseases. From these plant species, more than 130 compounds, including fatty acids, flavonoids, terpenoids and steroids, phthalides, phenolic acids, procyanidins and coumarins were identified. Experimental evidences confirmed that the *Hymenaea* spp. could be used in treating inflammatory disorders, asthma, diarrhea, and some microbial infections. However, reports on the toxicity of *Hymenaea* species remain scarce.

**Conclusion:** Plants of this genus have offered bioactive samples, both from crude extracts and pure compounds, thus substantiating their effectiveness in traditional medicine. However, intensive investigations of all the species of *Hymenaea* spp. relating to phytochemical and pharmacological properties, especially their mechanism of action, safety and efficacy could be the future intropsection.

**Abbreviations:** CNS, Central nervous system; DI, Diameter of inhibition; DPPH, 2,2-Diphenyl-1-picrylhydrazyl; EC<sub>50</sub>, Half maximal effective concentration; HPLC, High-performance liquid chromatography; IC<sub>50</sub>, Half maximal inhibitory concentration; MIC, Minimum inhibitory concentration; MTT, 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazoliumbromide; NS, Not specified; ORAC<sub>FL</sub>, Oxygen radical absorbance capacity; TCID<sub>50</sub>, 50% tissue culture infectious dose per millilitre; TNBS, Trinitrobenzenesulfonic acid

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Eperuic acid (PubChem CID: 12309485)  
 (-)-Epicatechin (PubChem CID: 72276)  
 Erucic acid (PubChem CID: 5281116)  
 Eucryfin (PubChem CID: 5488575)  
 (*Z*)- $\beta$ -Farnesene (PubChem CID: 5281517)  
 Fisetin (PubChem CID: 5281614)  
 Fisetinediol (PubChem CID: 442397)  
 Fustin (PubChem CID: 5317435)  
 Germacrene B (PubChem CID: 9281519)  
 Germacrene D (PubChem CID: 5317570)  
 Globulol (PubChem CID: 12304985)  
 Guamaic acid (PubChem CID: 101297672)  
 $\alpha$ -Himachalene (PubChem CID: 11830551)  
 $\alpha$ -Humulene (PubChem CID: 5281520)  
 $\beta$ -Humulene (PubChem CID: 5318102)  
 Humulene epoxide II (PubChem CID: 10704181)  
 4-Hydroxybenzoic acid (PubChem CID: 135)  
 Ipomopsin (PubChem CID: 5491777)  
 Isoozic acid (PubChem CID: 100983062)  
 (-)-Kolavenic acid (PubChem CID: 6441458)  
 Lauric acid (PubChem CID: 3893)  
 Levomenol (PubChem CID: 442343)  
 Linoleic acid (PubChem CID: 5820450)  
 Linolenic acid (PubChem CID: 5280934)  
 Margaric acid (PubChem CID: 10465)  
 7-Methoxy catechin (PubChem CID: 44257125)  
 (-)-Methyl (-)-copalate (PubChem CID: 13858180)  
 Methyl (-)-kolavenate (PubChem CID: 13918497)  
*cis*-Muurolo-3,5-diene (PubChem CID: 6429206)  
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 (-)-Ozic acid (PubChem CID: 12303813)  
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 Pentadecanoic acid (PubChem CID: 13849)  
 Quercetin (PubChem CID: 5280343)  
 Quesnoin (PubChem CID: 101837763)  
 Selina-4(14),7-diene (PubChem CID: 524199)  
 $\alpha$ -Selinene (PubChem CID: 10856614)  
 $\beta$ -Selinene (PubChem CID: 442393)  
 Selin-11-en-4- $\alpha$ -ol (PubChem CID: 15560330)  
 7-epi-Sesquithujene (PubChem CID: 56927990)  
 $\gamma$ -Sitosterol (PubChem CID: 457801)  
 Spathulenol (PubChem CID: 92231)  
 Stearic acid (PubChem CID: 5281)  
 Stigmasterol (PubChem CID: 5280794)  
 Taxifolin (PubChem CID: 439533)  
 $\alpha$ -Ylangene (PubChem CID: 442409)  
 Zanzibaric acid (PubChem CID: 101289556)

**Keywords:**

*Hymenaea* spp.  
 Ethnomedicine  
 Phytochemistry  
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 Toxicology  
 Pharmacopeia

## 1. Introduction

For centuries, plants have been widely used as food and for medicinal purposes in several cultures (Street and Prinsloo, 2013). In the last few years, interest in medicinal plants has increased worldwide (Ekor, 2014).

Because of the immense diversity of flora around the world and because of cultural factors, the use of medicinal plants in the form of crude extracts, infusions, or plasters has experienced a revival as a common approach for the treatment of several diseases (Samuelsson, 2004; Samuelsson and Bohlin, 2004; Marques and Farah, 2009).

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