

Pharmacological Evidence from Plants of Genus Jacaranda

Mariana Barreto Serra^{1,2*}, Wermerson Assunção Barroso⁴, Flávio Freitas Soares Filho³, Selma do Nascimento Silva³, Antônio Carlos Romão Borges³, Matheus Brandão Campos³, Roberta Sabrine Duarte Gondim², Ramon Guimarães Souza⁶, Ademilton Costa Alves⁵, Iracelle Carvalho Abreu³ and Marilene Oliveira Rocha Borges³



¹Clinical Medicine Department, University of São Paulo, Brazil

²Department of Pharmacy, Graduate Program in Health Sciences, Federal University of Maranhão, Campus do Bacanga, Av. Dos Portugueses, s/n, Bacanga, São Luís, MA, 65080-040, Brazil

³Physiological Sciences Department, Federal University of Maranhão, Brazil

⁴Department of Biomedicine, CEUMA University (UNICEUMA), Brazil

⁵Department of Pharmacy, CEUMA University (UNICEUMA), Brazil

⁶Amorim II Basic Health Unit, Conjunto Consolata, s/n, Amorim, Zé Doca, MA, 65365-000, Brazil

*Corresponding author: Mariana Barreto Serra. Clinical Medicine Department, University of São Paulo, São Paulo 01246-903, Brazil

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ABSTRACT

Jacaranda, a member of Bignoniaceae family, contains 49 species around the world that are native to Central and South America and the Caribbean. Very few additional data are available on the pharmacological evidences from genus Jacaranda. The following article gives a critical assessment of the literature to date, aims to show that the pharmaceutical potential of this genus has been underestimated, and deserves closer attention.

Keywords: Genus Jararanda; Bigonaceae; Secondary Metabolites; Savanna Biome

Mini Review

The Bignoniaceae is especially common in the tropics of South America and occurs in habitats consisting of mainly woody trees, shrubs, lianas and, rarely, herbaceous plants. Many woody representatives of Bignoniaceae are well known for their use in the timber industry (e.g. *Tabebuia*, *Cybistax*, *Paratecoma*, *Stereospermum*, *Parmentiera*, *Jacaranda*, *Catalpa*) or as ornamentals (e.g. *Jacaranda*, *Catalpa*, *Spathodea*) [1]. Bignoniaceae Juss., a dicot family that contains, according to respective taxonomic treatments, 700–800 species grouped in 100–125 genera mainly distributed within tropical floras of the world, with lesser representation in temperate regions [2,3]. Chemical constituents recognized in the

family are naphthoquinones of the lapachol type, iridoid glucosides, alkaloids, flavones, triterpenes, polyphenols, tannins and seed oils [2,4]. *Jacaranda*, a member of Bignoniaceae family, contains 49 species around the world that are native to Central and South America and the Caribbean. The majority of *Jacaranda* are trees ranging from 1 to 45 meters tall, but they can also be found as shrubs and subshrubs. Genus *Jacaranda* consists mainly of shrubs and trees with opposite bipinnate leaves; terminal, axillary or cauliflorous, paniculate inflorescence. Fruits are oblong flattened capsules with numerous, winged, hyaline or brownish seeds [1,5,6]. Previously have reviewed the ethnobotanical, pharmacological and phytochemical aspects of genus *Jacaranda*. In this review we intend

to show an overall aspect of genus *Jacaranda*, as a continuation to the previous work, which will serve as a source of information for researchers from various species of the genus *Jacaranda* [1,7].

Species of Genus *Jacaranda*

Jacaranda oxyphylla

Jacaranda Oxyphylla CHAM. is an shrub found in the Brazilian Cerrado, commonly known as “caroba-de-São-Paulo” and used on the popular medicine to treat microbial infections [8-10], Pereira et al., 2016 [8,11] made a phytochemical screening and proved the presence of terpenoids, that are potentially active chemicals substances. In the same study, the plant showed antiedematogenic, antimicrobial and antiacetylcholinesterase activity.

Jacaranda Mimosaeifolia or *J. Mimosifolia*

Jacaranda mimosaeifolia is widely distributed in tropical and subtropical areas of the world, traditionally used to heal wounds, ulcers, as well as astringents and in the treatment of diarrhea and dysentery [12]. Previous phytochemical studies revealed that triterpenes [13], flavonoids, acetosides [14], quinines [15], derived phenylpropanoid [16], Fatty acid and anthocyanins [17] are constituents of *J. mimosaeifolia*. Antimicrobial activity of *J. mimosifolia* against *Bacillus cereus*, *Escherichia coli*, *Staphylococcus aureus* [12,18] and anticandida has also been described [19]. The other study showed hypotensive activities in rats [20].

Jacaranda Acutifolia

Jacaranda acutifolia is widely distributed in Central America, where is used as an ornamental tree. It presents in its constitution secondary metabolites of the class of flavonoids [21] and tannins [22]. In 20014, Singab et al., found that the species has antimicrobial activity [22].

Jacaranda Ulei

Jacaranda ulei Bureau has been popularly used in the treatment of rheumatic diseases, backache, skin disorders, urinary tract disorders and dysentery [23,24]. Its constitution is integrated by secondary metabolites of the class of phenolic compounds that can be related to the antioxidant potential of the plant [25], but so far pharmacological studies have not been conducted.

Jacaranda Decurrens

The specie *Jacaranda decurrens* CHAM. has the scientific synonym *Jacaranda pteroides* Manso, receiving common names as “carobinha e caroba” [23]. In Brasil, It's na endemic plant of Brazilian cerrado in the states of Goiás, Mato Grosso, Maranhão e São Paulo [26]. It has its leaves used on the treatment of high blood pressure, as a purifying blood, in infectious processes and liver disorders [27,28].

The hydro-alcoholic extract of the leaves of carobinha presented antioxidant activity similar to the rutin standard, revealing to have

potential sequestering of H⁺ cations [29]. It was also demonstrated anti-inflammatory activity in induced model of paw edema in rats, similar to dexamethasone standard [30]. In recent study, our research group observed healing activity of the hydro-alcoholic extract of the species leaves [31]. Study with the hydro-alcoholic extract of plant leaves showed that the triterpene and the ursolic acid have high activities: antimicrobial, antiviral, hepatoprotective, immunoregulatory and inhibitory of human cancer cells [32,33]. However, few pharmacological studies about the plant *J. decurrens* CHAM. were found on the literature, although phytochemical analysis performed with the specie indicates the presence of flavonoids, flavones, triterpene, oleanolic acid and ursolic acid [34] that can be related with its therapeutic potential.

Jacaranda Puberula

Jacaranda puberula CHAM., also known as “caroba” and “carobinha” in Brazil, is a midsize tree (4-7 m) native to Brazil, where is largely distributed in the states of Rio de Janeiro and Rio Grande do Sul and Mata Atlântica. There are studies reporting the use of extracts of the leaves of this tree for the treatment of burns [35,36], but has not been found scientific evidences about this.

Jacaranda Caroba (Vell.) A. DC

Jacaranda caroba is popularly known as caroba, caroba muuda, carobinhag, camboatág, camboatá-pequenog, cambotég, carobado-campog, caroba-miúdag, carobado-carrascog [37]. *Jacaranda caroba* has been traditionally employed as a bitter or astringent, as diuretic and against syphilis, applied externally during baths in the treatment of infections and as a cathartic remedy. The application of the macerated leaves in alcohol (cachaça) in cicatrization and internal ingestion to treat ulcers is widely practiced [37,38].

The phytochemical assay of the *J. caroba* detected the presence of iridoids, triterpenes and steroids, as well as coumarins, flavonoids and alkaloids absent. Ursolic acid, α -amyrin and a mixture of ursolic acid and oleanolic were isolated [38,39]. *Jacaranda caroba* (Vell.) A. DC was analyzed by HPLC-DAD-ESI/MS and revealed the presence of four dicaffeoyl acid derivatives and nine flavonoids including quercetin, kaempferol and isorhamnetin derivatives. Isorhamnetin-3-O-rhamnoside-7,4'-di-O-glucoside and quercetin-3-O-(2-pentosyl) hexoside were the main metabolites in both the aqueous and hydromethanolic extracts and qualitative and quantitative differences were found between the extracts. The aqueous extract was richer in dicaffeoyl acid derivatives [39].

The ethanolic extract of *Jacaranda caroba* (IC₅₀ of 13.22 μ g/mL) was potent against stationary-phase promastigotes of *Leishmania amazonensis* [40]. Aqueous and hydromethanol leaves extracts of *Jacaranda caroba* (Vell.) A. DC proved to be strong radicals' scavengers and effective monoamine-oxidase A inhibitors, but showed weak protection against cholinesterases activity [39]. *Jacaranda caroba* (Bignoniaceae) presented strong toxicity to THP-1 monocytic cells line [41].

Jacaranda Obtusifolia

Commonly known in Colombia as Gualanday, the *Jacaranda obtusifolia* can be found in Venezuela as: *clavellina montanosa*, *clavellina*, *clavellino*, *guarupa*, *rabo de iguana*, *uadam-kayu*, *sanjose*, *casabe*, *uadacamayu*, *patico*; besides Venezuela, *Jacaranda* is used in Guyana to promote wound healing and in Colombia to treat syphilis [42]. A study described the bioassay-guided isolation, structure elucidation and anticancer evaluation of five flavonoids (-)-liquiritigenin (1), (-)-neoliquiritin (2), isoliquiritigenin (3), isoliquiritin (4) and formononetin (5) from the twigs of *Jacaranda obtusifolia* H. B. K. ssp. *rhombifolia* (G. F. W. Meijer) Gentry. The structures were elucidated based on H-1, C-13 NMR, comprehensive 2D NMR, MS analyses and comparison with previously reported spectral data. Compounds 1 and 3 were demonstrated to be inhibitory in vitro against NCI-H187 (small cell lung cancer) with IC50 values of 30.1 and 16.6 $\mu\text{g mL}^{-1}$, respectively. The isolates were non-cytotoxic to Vero cells (African green monkey kidney) [43].

Jacaranda Cuspidifolia

Consider a medium-size tree with height of 3 to 10 meters, the *Jacaranda cuspidifolia* Mart. is known as *jacarandá*, *caroba*, *caiuá*, *pau-de-colher*, *pau-santo*, *carobeira* and *bolacheira* in Brazil. The phytochemistry prospection of the plant extract of *Jacaranda cuspidifolia* detected the presence of tannins, flavonoids, terpenes, coumarins and steroids [44]. Lupeol, ursolic acid and oleanolic are the principal isolated terpenoids and that present inhibitory growing activity of *Micobacterium* [42]. This specie presents insecticides properties being used the root for the treatment of scabies. It's a blood purifier and used in bacterial infections as syphilis and gonorrhoea. The wood, bark and leaf are used in the fight against the fever [44]. A study investigated in vitro leishmanicidal activity from 16 different Brazilian medicinal plants, between them the ethanolic extract of *J. cuspidifolia* leaves. Extracts of *J. cuspidifolia* presented higher selectivity index, with high leishmanicidal activity and low cytotoxicity in the mammalian cells. The capacity in treated infected macrophages using the extracts and/or fractions of *J. cuspidifolia* was also analyzed, and reductions of 97.16% in the parasite burden, were observed [40].

Jacaranda Caucana

J. caucana was first described in 1917 by Pittier. It was found in the Cauca Department of Colombia, hence its name. Further studies by Gentry divided the species into four subspecies: *calycina*, *caucana*, *glabrata*, and *sandwithiana*. In Panama, only the former has been described [5]. The only phytochemical studies were done by Ogura et al., who reported cytotoxic activities of *J. caucana* due to the presence of *jacaranone*, a quinonid compound [45-47]. Were isolated and characterized some compounds as glycoside and *neolignan* [48], metabolites known for their antioxidant and

radical-scavenging activities [48].

Jacaranda Copaia

Studies realized in the Amazon describe the popular use of the plant in the treatment of skin infections, through sap application of barks and leaves. Moreover, Indians "Andoque" in the Colombian Amazon prepare a decoction of crushed leaves until a consistency of the honey type to apply topically this medication to promote healing [49]. Another study report popular use of the plant in the treatment of gastrointestinal disorders, diarrhea treatment, leishmaniasis treatment in South America and cancer prevention [50]. There were no pharmacological studies demonstrating the plant action for any of the reported activities.

Conclusion

Despite the diversity of species that make up the *Jacaranda* genus, and ethnopharmacological studies highlight the use of parts of these plants for therapeutic purposes, there are still few chemical and pharmacological papers that seek to clarify the secondary metabolites present in the species and their respective biological activities.

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Conflict of Interesting

The authors declare no conflict of interest.

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Mariana Barreto Serra. Biomed J Sci & Tech Res



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