# A Review of the Botanical, Ethnomedicinal Uses, and Phytochemistry of *Dalbergia (Fabaceae)*Species


## ABSTRACT

Secondary metabolites found in plants are recognized to have medicinal qualities and are utilized in both mainstream and traditional medicine. More than 80% of people on the planet use medicinal plants to treat a variety of illnesses, including fever, malaria, stomachaches, and ulcers. One significant family of flowering plants with therapeutic qualities is the Fabaceae, sometimes referred to as the *Leguminoceae*. The *fabaceae* subfamily *Faboideae* of the pea family includes the large genus *Dalbergia*, which has over 300 species. It is a tiny to medium-sized trees, bushes, and lianas are found in tropical parts of Central and South America, Africa, Madagascar, and Southern Asia. Many species of *Dalbergia*are commonly utilized in diverse communities around the world to treat a variety of diseases. Phytoconstituents commonly found in *Dalbergia* species, includes isoflavonoids, neoflavonoids, glycosides, cinnamylphenols, quinones, and furans.However, only a limited number of *Dalbergia* species have been subjected to pharmacological research to validate their traditional uses. Additionally, only a few compounds have been identified based on their phytochemical constituents. Despite the existence of over 300 *Dalbergia* species worldwide, only a small fraction has been studied in detail. Therefore there is need for more scientific research on *Leguminoceae*species especially *Dalbergia* due to tremendous medicinal phytochemicals present in the specie, and can be used to cure multiple diseases affecting global population.



**Key word:** *Dalbergia, Fabaceae,* phytochemistry, Botanical, medicinal, Africa


## INTRODUCTION

Plant-based secondary metabolites are used as food additives, bio-pesticides, flavorings, fragrances, colors, agrochemicals, and pharmaceuticals. Higher plants are the source of two-thirds of all new chemicals found annually (Elshafie et al., 2023; Al-Snafi, 2017). Plants have always been a part of medical research, from the beginning of human civilization to the current era of synthetic drugs. Around the world, herbal medicines are used in conventional disease treatment practices (Chaachouay and Zidane, 2024).

Nature contains a wide variety of medicinal plants that can help treat a range of illnesses (Saurabh et al., 2012). Despite the availability of several effective synthetic drugs, herbal medicine is a triumph of popular therapeutic diversity. The use of plant-based health products

has increased dramatically in both developed and developing nations in recent years, which has resulted in a global explosion of herbal goods (Srivastav et al., 2011). Numerous products with high activity profiles have been produced as a result of the extraction and characterization of different active phyto-compounds from these green factories (Bijauliya et al., 2020). Natural prescription drugs made from plant sources are becoming more and more well-liked worldwide due to their accessibility, affordability, non-toxicity, and lack of synthetic ingredients. Flavonoids and phenolic chemicals are found in many plants with antioxidant properties (Lakshmi *et al.*, 2014).

The genus *Dalbergia* contains 300 species, 37 of which are found in Africa and just a small number in Nigeria. According to Vasudeva et al. (2009), several *Dalbergia* species are important timber trees that are valued for their beautiful and often fragrant wood that is rich in aromatic oils. *Dalbergia* is a genus name honoring the 18th-century Swedish brothers Nils and Carl Dalberg (Sudhakar et al., 2013).

Plants in the genus *DalbergiaFabaceae* are rich in isoflavones and neoflavones. Several *Dalbergia* species have been reported to possess medicinal properties (Chalo et al., 2023; Radha et al., 2015). They are used in the treatment of diarrhea, leucoderma, dyspepsia, dysentery, syphilis, gonorrhea, stomach ache, leprosy, eye illnesses, scabies, pain, and ringworm in traditional systems of medicine all throughout the world (Kazembe *et al.*, 2012; Saha*et al.*, 2013).

300 species are found in the genus *Dalbergia*, 37 are found in Africa, and just a few are found in Nigeria. A number of *Dalbergia* species are significant timber trees that are prized for their exquisite, frequently scented wood that is abundant in aromatic oils (Vasudeva et al., 2009). The Swedish brothers Nils and Carl Dalberg, who lived in the 18th century, are honored by the genus name *Dalbergia* (Sudhakar et al., 2013). Neoflavones and isoflavones are abundant in plants belonging to the genus Dalbergia *Fabaceae*. It has been claimed that a number of *Dalbergia* species have therapeutic qualities (Radha et al., 2015).

**Botanical Aspect of *DalbergiaFabaceae***

Small to medium-sized trees, shrubs, and lianas in the broad genus *Dalbergia* are members of the pea family's *Fabaceae* subfamily *Faboideae*. The genus is widely distributed and indigenous to tropical parts of Madagascar, Africa, southern Asia, and Central and South America (Rahaingoson et al., 2022). In the genus *Dalbergia*, the leaves of small to medium-sized

trees, shrubs, climbers, and lianas are leathery, alternate, and compound. According to Chopra et al., (1980), the leaflets are glabrous, alternating, and sometimes sub-opposite. Kidney-shaped seeds have a light brown color and are thin and flat. It is rather typical for the roots to nodulate. According to Saha et al., (2013), a number of species are cultivated for their colored wood, which is used in the furniture business.

With 730 genera and more than 19,400 species, the *Leguminosae* family also referred to as the *Fabaceae*is one of the largest families of flowering plants (Abdelsalam et al., 2022; Stevens, 2008). The *Faboideae* subfamily, which has 274 ILDIS-accepted species worldwide, especially in tropical and subtropical regions, includes the genus *Dalbergia* (Mamta et al., 2014). Due to their beautiful and aromatic wood, most *Dalbergia* species make good timber trees (Chopra et al., 1980).

***Dalbergia sissoo***

This tree, which may grow to a height of around 25 meters, is medium to large, with a grey-yellow trunk, longitudinal crack, and downcast twig. Approximately five alternate leaflets on leathery, pinnately complex leaves. The petiole of the leaf stalk is about 15 cm long, and each leaflet is about 6 cm long with a finely pointed tip. Pale to pink, fragrant, nearly sessile, and up to 1.5 cm long, the flowers are grouped in dense clusters that are 5–10 cm long. Pods are light brown, oblong, flat, thin, and strap-like; they are 4–8 cm long and 1–8 cm wide (Chalo et al., 2023). According to Sudhakar et al., (2013), they have one to five flat, bean-shaped seeds that are 8 to 10 mm long.

They have several suckers on the surface roots and a long taproot. Large upper branches support a spreading crown, while juvenile shoots are downy and drooping. Established stems have light brown to dark grey bark that is up to 2.5 cm (0.98 inches) thick and sheds in narrow strips. The plant fixes nitrogen from the atmosphere using bacteria that are present in nodules in the root system (Britannica, 2016). The leaf litter that builds up and breaks down contributes to soil fertility by providing the soil with more nitrogen, potassium, iron, manganese, and organic carbon. Both seeds and root suckers are employed in the process of proliferation. Several parts of the plant are used to make medicines (Sudhakar et al., 2013).

***Dalbergia saxatilis***

It can grow as little as 2 to 3 meters in height, but it can also be a robust climbing shrub with stems up to 20 meters long (Burkill, 1985). The stem's diameter around the base can reach up to

5 cm, but it can potentially reach up to 15 cm. Some of the branches are very convoluted since they have been transformed into woody spine hooks. The wood and local medicinal uses are the main reasons for collecting the plant in the wild. It is sometimes used as a leafy vegetable and is occasionally sold in local markets (Tropical, 2022).

***Spinosa Dalbergia***

Tiny trees or shrubs with spines at the tips of their branches, they can grow up to 3–6 meters tall. Small, purplish-white, bisexual, and zygomorphic flowers with a campanulate calyx, a free ovary, an incurved style, a capitate stigma, a papilionaceous corolla, papilionaceous petals, monadelphous stamens, and minute anthers. One-seeded fruits with flat, falcate, brownish pods (PROTA, 2017).

***Dalbergia latifolia***

The tree features clusters of tiny white flowers, pinnately complex leaves, and grey bark that peels into long fibers. Young seedlings of *Dalbergialatifolia* have a strong taproot and hardly any secondary roots. At first, seedlings develop slowly. Nodules created by symbiosis with nitrogen-fixing bacteria have already been seen on seedling roots. Although growth rates are reported to vary widely, young trees also grow slowly. *Dalbergialatifolia* trees are often surrounded by many root suckers. Seedlings of *Dalbergialatifolia* may withstand some shade, but the plant needs moderate light. In open spaces, it has a tendency to develop twisted and branchy (PROTA, 2017).

***Dalbergia melanoxylon***

The bark surface is white to pale grey or greyish brown, thin, smooth, but can become rough and fissured or flaking, and the inner leaves are arranged in a spiral pattern. It is a deciduous, spiny shrub or small tree that can grow up to 12(–20) m tall, frequently multiple-stemmed, and heavily branched. The bole is typically short, branchless for up to 2(–3.5) m, often gnarled and fluted, reaching up to 50(–100) cm in diameter(PROTA, 2017). A terminal or axillary panicle that is 2–12 cm long, has many flowers, is short-hairy to almost glabrous, and branches laxly. The calyx is campanulate, 2–3(–4) mm long, with lobes shorter than tube, bottom lobe longest, and upper lobe fused; the corolla is white, with obovate standard and clawed wings and a keel; the flowers are bisexual, papilionaceous, and 4–6 mm long, nearly sessile; and the stamens are typically 9, fused into a tube, but free in upper part; ovary superior (PROTA, 2017).

**Ethnomedicinal Properties of *DalbergiaFabaceae***

The ethnomedical usage of several *Dalbegia* genus members have been recognized and published. Numerous species are frequently used to cure a range of illnesses in varied populations throughout (Ninh, 2017). *Dalbergiasissoo*Roxb. Fabaceae is used as an antipyretic, expectorant, anthelmintic, aphrodisiac, and abortifacient. Additionally, it is recommended for syphilis, leucoderma, ulcers, and dyspepsia (Lakshmi et al., 2014).

Sissoo oil, which is made from the seeds, is used to treat scabies, skin burning, and blue irritation. To ease heavy menstruation, a finely ground paste of the leaves mixed with palm candy is administered in the morning (Wróblewski et al., 2024). The leaves can be brewed three times a day to cure boils, acne, and painful micturition. The leaf juice is used to clear the urine of pus and treat jaundice. Breast edema can be lessened by using the leaf decoction. Powdered bark or leaf decoction is used to cure leprosy and gonorrhea. When combined with milk and water, sissoo nectar can be used to treat fevers of any kind (Sudhakar et al., 2013).

In India, particularly in rural regions, traditional medicine practitioners use the leaves of *Dalbergia* species to treat diarrhea (Vineeta et al., 2022; Mulla et al., 2011; Mohanty et al., 1998). The leaves of *Dalbergiasaxatilis* are powdered and burned to repel insects (Namadina et al., 2019; Okwute et al., 2009). In traditional medicine, the leaves, bark, and roots of *Dalbergiasaxatilis* are utilized to treat various ailments, including cough, smallpox, skin lesions, bronchial disorders, and toothaches (Saha et al., 2013; Hassan et al., 2016).

*Dalbergiaspinosa*Roxb is traditionally used to treat a range of conditions, such as fever, pain, skin infections, and urinary tract infections (Senthamarai et al., 2003). Additionally, to counteract the effects of alcohol, a teaspoon of *DalbergiaspinosaRoxb*root powder is dissolved inwater (Jung et al., 2023; Senthamarai et al., 2003).The fruits of *Dalbergia* species are traditionally used as an antipyretic and tonic. The leaves and stem bark serve as febrifuges and anthelmintics (Naskar, 2004; Saha et al., 2013).

The stem bark of *Dalbergialatifolia* contains tannins, which are used in the treatment of leprosy, obesity, and intestinal worms (Kirtikar and Basu, 2005; Khalid et al., 2011). Additionally, the bark is utilized to alleviate body pain, while the whole plant is used to treat diarrhea, dyspepsia, stomach ailments, as an anthelmintic, and as a bitter tonic (Ghani, 1999; Khare, 2007; Saha et al., 2013). In Senegal, the stem and root bark of *Dalbergiamelanoxylon* are combined with baobab or tamarind fruits to relieve diarrhea.

The smoke from burning its roots is inhaled to treat colds, bronchitis, and headaches. In Sudan, inhaling the smoke from burned stems helps ease rheumatism (Kamanula et al., 2018). An infusion of the roots is also used as an anthelmintic and aphrodisiac to treat gonorrhea, stomachaches, and abdominal pain. The bark decoction of *Dalbergiaspinosa* is applied to treat wounds, while leaf decoctions are used to alleviate joint pain, and leaf sap is used to treat inflammation of the mouth and throat (Joshiet al., 2023; Bolza et al., 1972; Neuwinger et al., 2000; Saha et al., 2013).

**Phytochemistry of *Dalbergia***

Several phytoconstituents have been identified from *Dalbergia* species, including isoflavonoids, neoflavonoids, glycosides, cinnamylphenols, quinones, and furans (Saha *et al.*, 2013). The separation of betulinic acid (**1**) from the root wood of *Dalbergia saxatilis* was reported by Okwute and Isyaka (2014).

Fatty acid esters, sterols, and phenols have been found in the bark and leaves of *Dalbergia saxatilis*(Okwute *et al.*, 2009), 4-phenyl coumarin (**2**) like dalbergin (**3**) (Ahluwalia and Seshadri, 1957), methyl dalbergin (**4**), allyl quinone (**5**) like dalbergenone (**6**) (Ahluwalia and Seshadri, 1963), 4-phenylchromone (**7**) like dalbergichromene (**8**) (Mukerjee *et al.*, 1971; Lakshmi *et al.*, 2014), isodalbergin (**9**) (Mukerjee *et al.*, 1971; Saha *et al.*, 2013).

Bijauliya*et al.* (2020) isolatedquercetin(**10**) from *Dalbergia sissoo*ethanolic leaf extracts. Genstein(**11**), biochanin A(**12**), biochanin A 7-O-glucoside(**13**), pratensein(**14**), Caviunin 7-*O*-[*β*-D-apiofuranosyl-(1→6)-*β*-D-glucopyranoside](**15**) was identified in the leaves of *Dalbergiasissoo* by Dixit *et al.*, (2012).

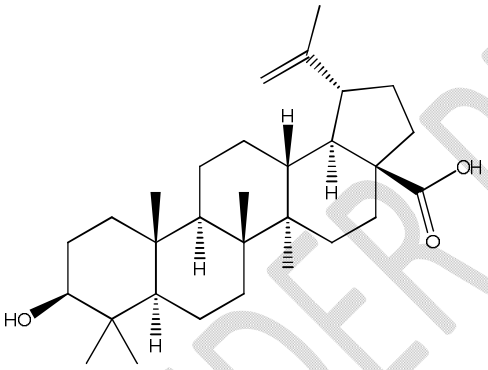
From the leaves of *Dalbergiasissoo*, Farag*et al.*, (2001) isolated Biochanin A 7-*O*-[β-D-apiofuranosyl-(1→5)-β-D-apiofuranosyl-(1→6)-β-D-glucopyranoside](**16**), biochanin A 7-O-apiosyl-(1→6)-glucoside(**17**).7-Methyltectorigenin 4'-*O*-[β-D-apiofuranosyl-(1→6)-β-D-glucopyranoside](**18**), dalbergichromene(**8**), and nordalbergin(**19**) were isolated from the stembark/heartwood of *Dalbergia sissoo* (Sharma *et al.*, 1980).

Radha*et al.*, (2015) isolated 5-hydroxy-6-methoxy-3',4-methylenedioxy-7-[(6-O-D-apiofuranosyl-D-glucopyranosyl)oxy] isoflavone(**20**), as well as dalspinin(**21**), dalspinosin(**22**), and caviunin(**23**), from the ethanol extract of *Dalbergia spinosa* roots.The leaves and stembark of *Dalbergia spinosa* were found to contain 7-O-Methyltectorigenin 4'-O-galactoside(**24**), prunasin(**25**), and Prunetin 4'-O-galactoside(**26**) according toNarayanan *et al.*, (1988).

From the heartwood of *Dalbergia tonkinensis*Prain's methanol extract, Son *et al.*, (2017) identified carboxyethylflavanones [(2S)-8-Carboxyethylnaringenin] (**27**) and [(2S)-6,8-Dicarboxyethylpinocembrin](**28**).Buteaspermanol(**29**), homoferreirin(**30**), dalbergin(**3**), and medicarpin(**31**), Linalool(**32**), β-damascenone(**33**), β-ionone(**34**), geranyl acetone(**35**), and α–ionone(**36**) were discovered in the volatile oil of *Dalbergia frutescens* leaves (Mendes *et al.*, 2014), as well as formononetin(**37**) from the bark (Mendes *et al.*, 2014).

From *Dalbergia latifolia* seeds, Shyam and Chibber (1978) extracted 12a-hydroxyrotenoid, dalbinol(**38**), and sisafolin coumarin(**39**). Rastogi and Mehrotra (1993), found dalbergichromene(**8**), lupeol(**40**), latifolin(**41**), and dalbergin(**3**) in the tree's bark, as well as latinone(**42**), a substituted phenanthrene-1, 4-quinone(**43**), neoflavonoid(**44**) in the tree's heartwood (Thurlough*et al.*, 1981; Khalid *et al.*, 2011). The heartwood of *Dalbergia melanoxylon* was found to contain 2,3-Dihydrobenzofuran(**45**) and melanoxin(**46**), according to (Chalo*et al.*, 2023).

**Structures**

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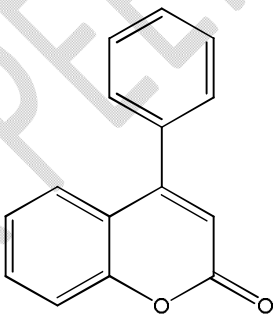


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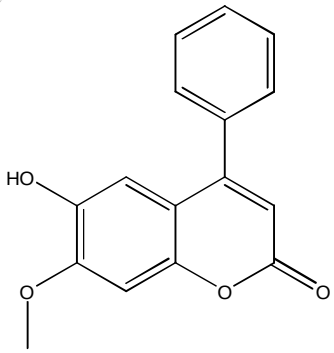


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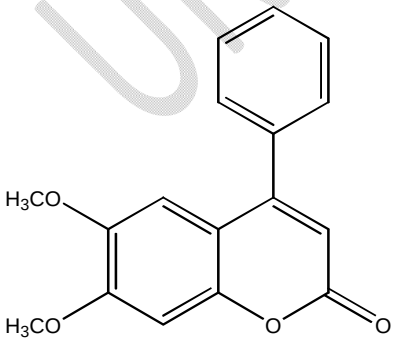


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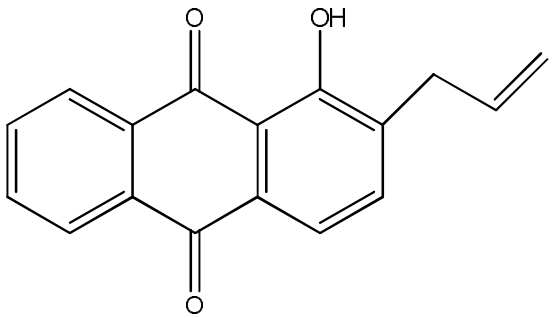


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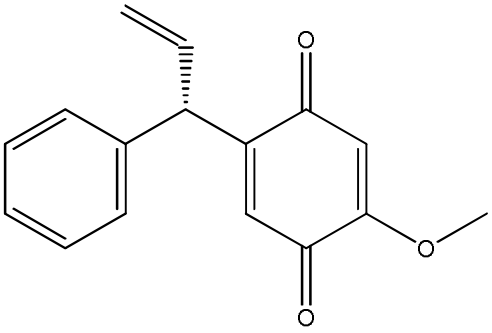


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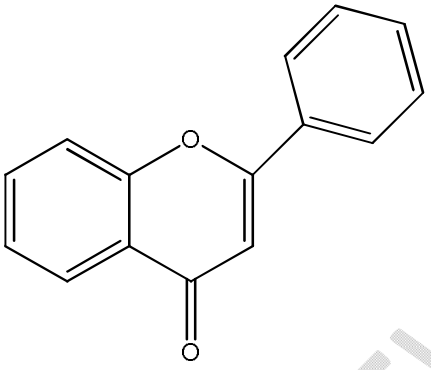


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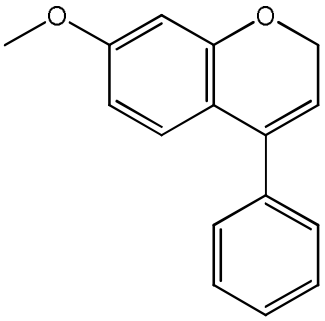


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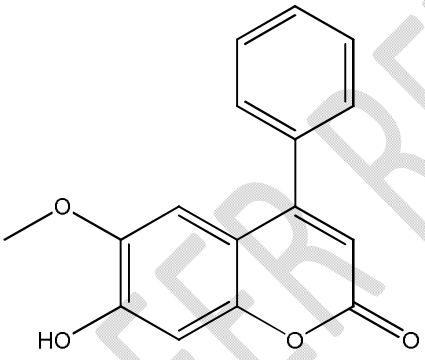


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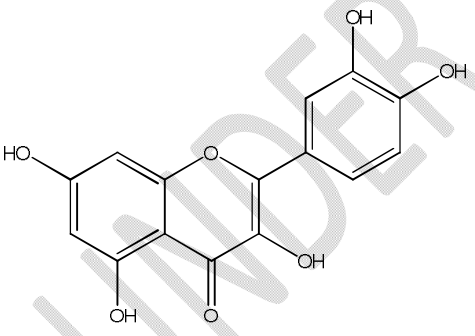


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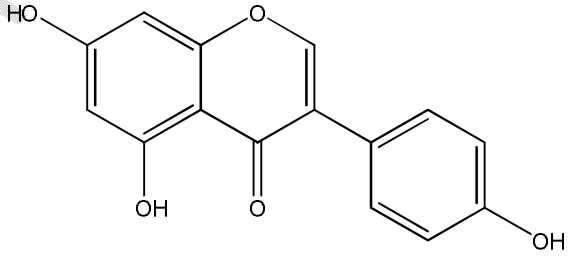


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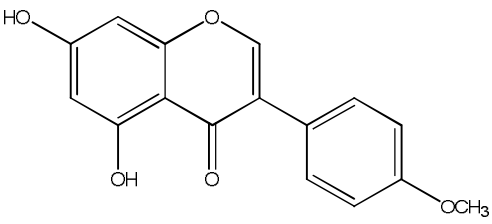


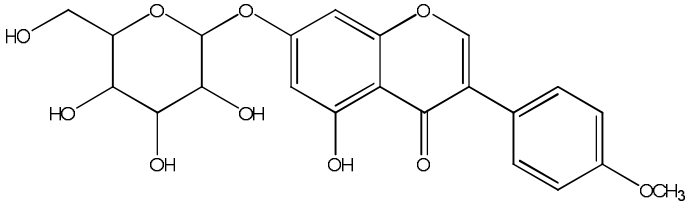

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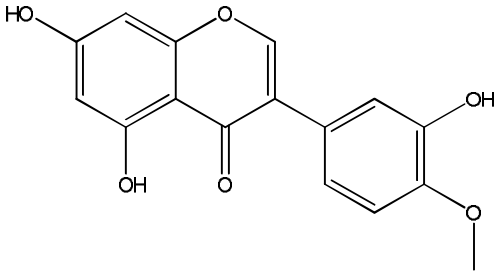

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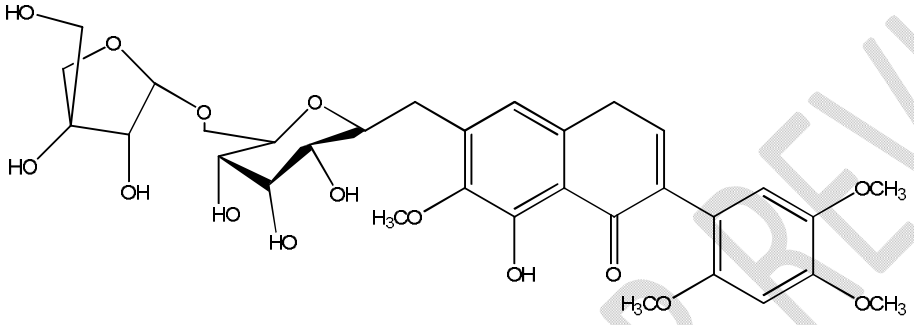

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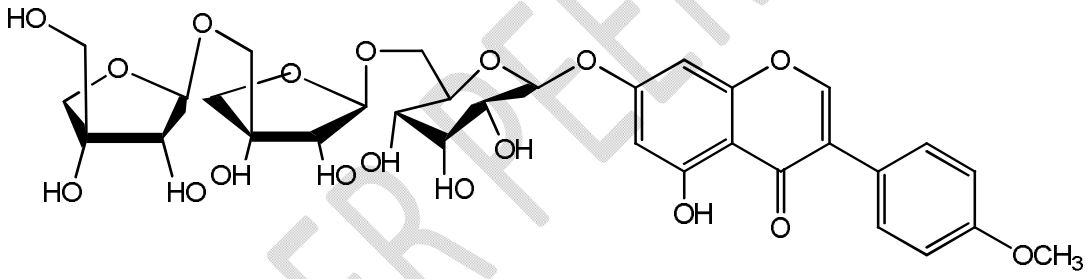

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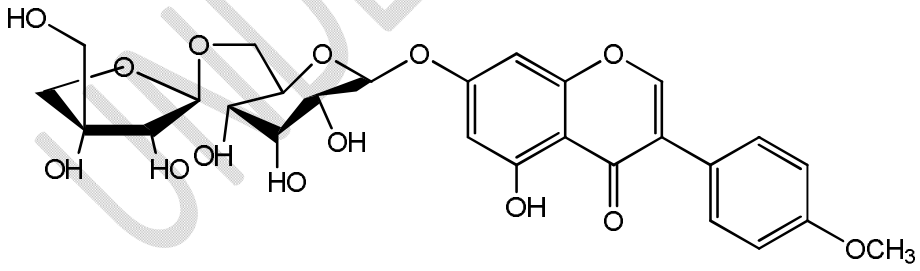

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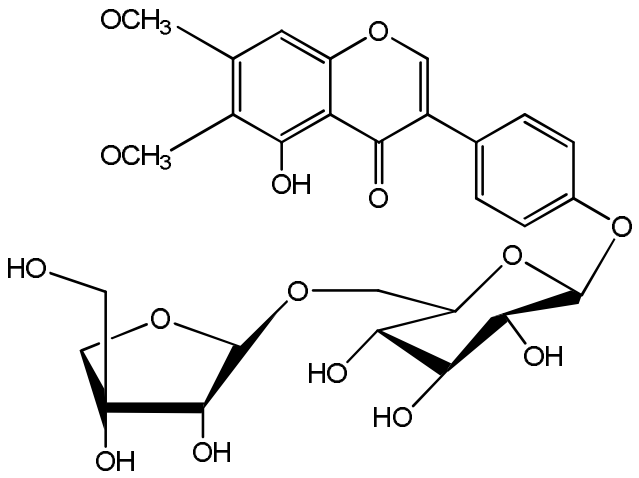

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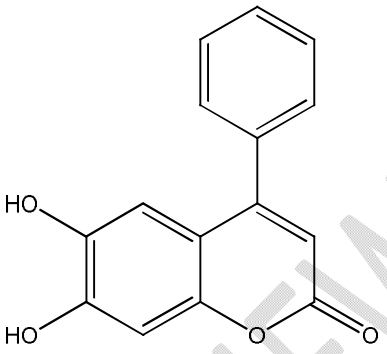

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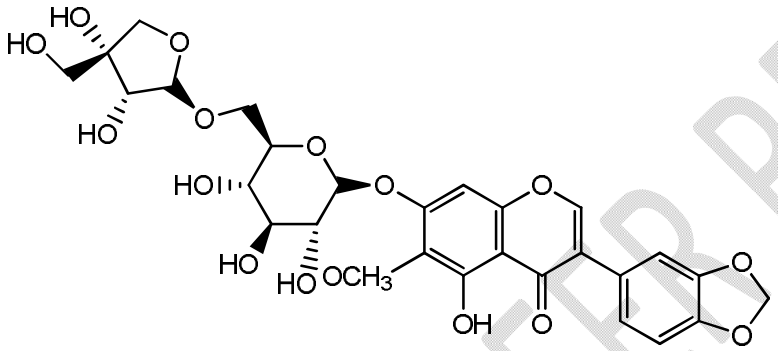

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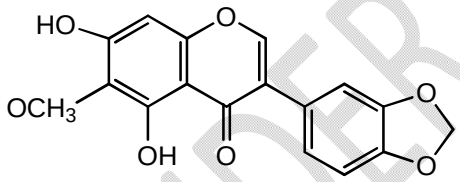

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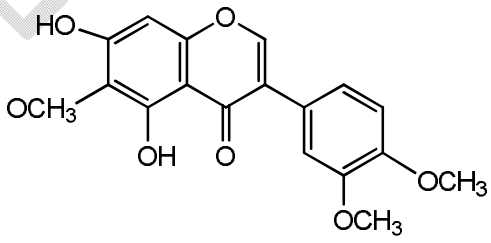

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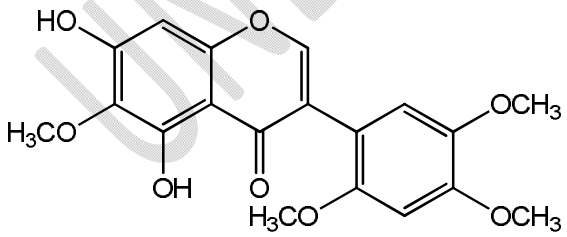

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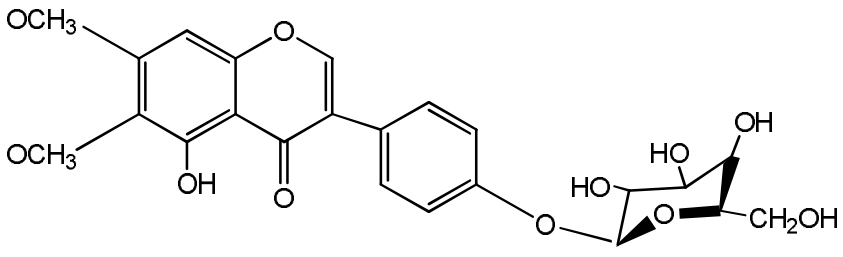

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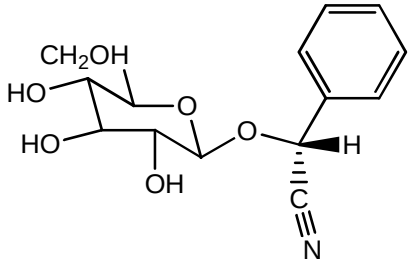

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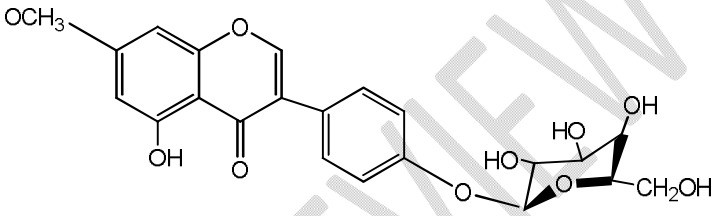

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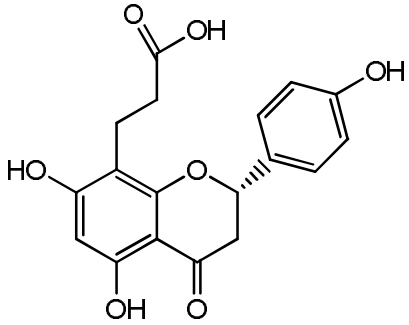

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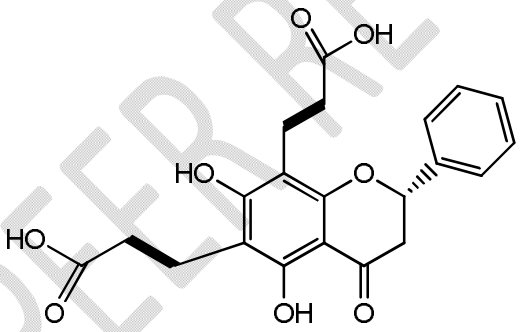

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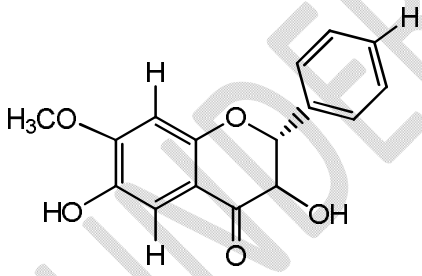

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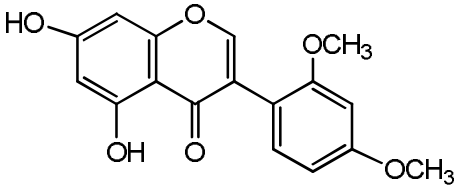

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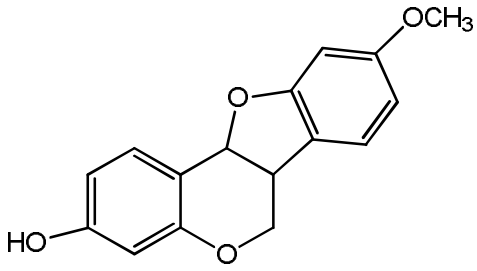

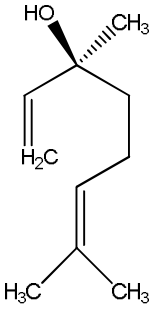

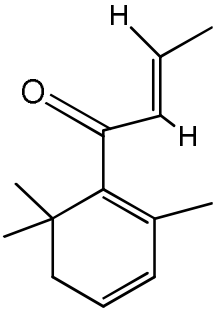

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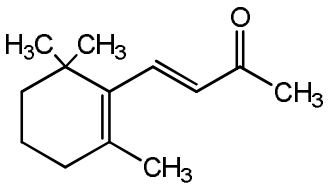

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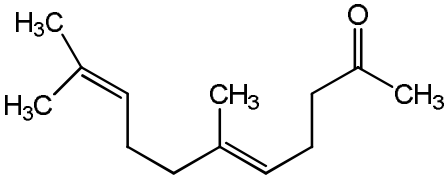

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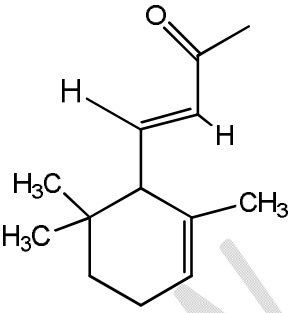

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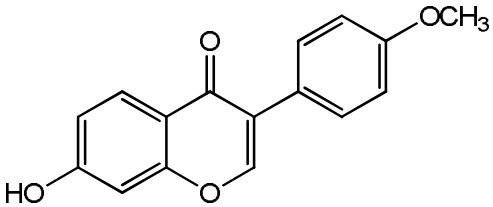

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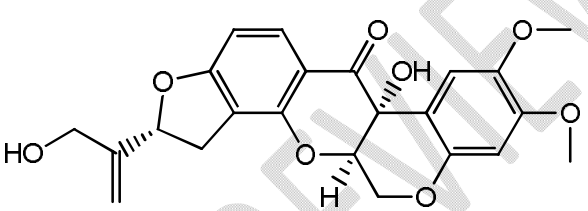

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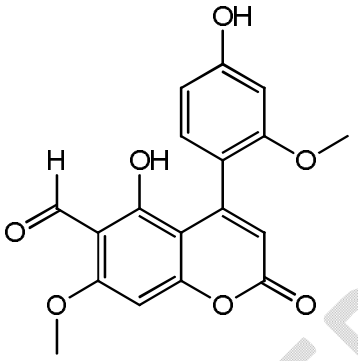

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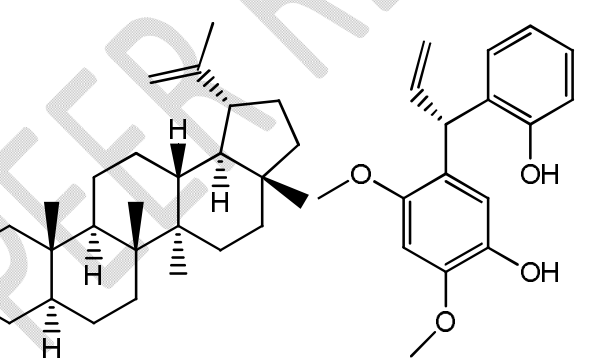

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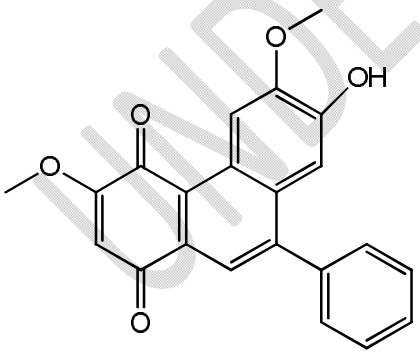

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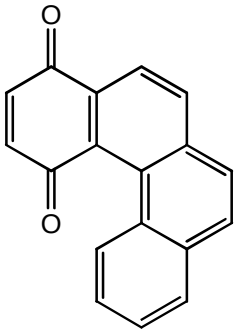

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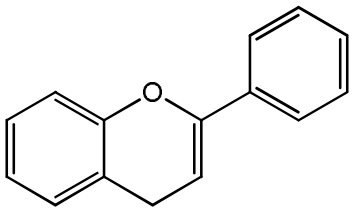

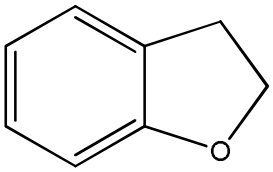

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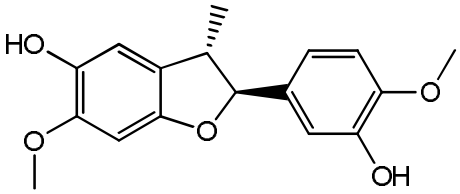

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## CONCLUSION

Several species of *Dalbergia* are known for their medicinal properties and are used in traditional medicine systems across the globe to treat a wide range of conditions, including diarrhea, leucoderma, dyspepsia, dysentery, syphilis, gonorrhea, stomach aches, leprosy, eye disorders, scabies, pain, and ringworm. However, only a limited number of *Dalbergia* species have been subjected to pharmacological research to validate their traditional uses. Additionally, only a few compounds have been identified based on their phytochemical constituents. Despite the existence of over 300 *Dalbergia* species worldwide, only a small fraction has been studied in detail.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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