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DALBERGIA SISSOO (INDIAN ROSE WOOD-SHISHAM): ETHNOBOTANY, PHYTOCHEMISTRY AND PHARMACOLOGY

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ABSTRACT

Dalbergia sissoo Roxb. ex DC belongs to the family *Fabaceae* of the genus *Dalbergia* containing 300 species. *Dalbergia sissoo* is a medium to large-sized tree of height of approximately 25 m with a greyish yellow trunk having thin bark. The wood also has remarkable characteristics in terms of termite and abrasion resistance. As a result, it can be used for furniture, decoration, processing, and carving. *Dalbergia sissoo* (North Indian Rosewood or Shisham) is a fast-growing deciduous tree native to the Himalayan foothills but found in the Western Ghats of India primarily as an introduced, cultivated species. It is primarily used for its high-quality timber, as fuel wood, and traditionally for medicinal properties. In ancient and traditional medicine, plant has shown promise in traditional medicine for treating infections, cardiovascular diseases, and skin issues. *Dalbergia sissoo* is known for its biomodulatory properties which include wound healing, anti-inflammatory, antioxidant, antimicrobial, antidiabetic, antibacterial, neuroprotective, and anti-osteogenic activity. The oil has been used to treat ulcers and skin conditions when applied topically. The bark extracts have been used to treat blood disorders, dyspepsia, dysentery, leukoderma, anal disorders, and skin disorders. The wood in powdered form is used as a cooling agent and expectorant for leprosy, scabies, stomach issues, and blood disorders. Phytochemical investigations have reported that *Dalbergia sissoo* exhibits a vast phytoconstituent profile. The leaf extracts showed the presence of flavonoids (biochanin A, genistein, caviunin-7-O-glucoside, and biochanin-7-O-glucoside), phenols, glycosides, and lipids. The stem, bark, and heartwood extracts include compounds such as dalbergin, dalbergichromene, isodalbergin, nordalbergin, tectorigenin, and 4-phenylchromene.

Keywords: *Dalbergia Sissoo,* High-Quality Timber, Leprosy, Rose Wood, Skin Disease, Shisham, Western Ghats

1 INTRODUCTION

Dalbergia sissoo Roxb., mainly known as Indian rosewood (shisham), belongs to the *Fabaceae* family, is native to the Indian subcontinent and Southern Iran [1-15-98-120]. *Dalbergia sissoo* (Indian Rosewood or Shisham) is a fast-growing deciduous tree native to the Himalayan foothills but found in the Western Ghats of India primarily as an introduced, cultivated species[1-15-98-126]. It thrives in the region's tropical climate but differs ecologically from the Ghats'

endemic *Dalbergia latifolia* (Indian Rosewood). *Dalbergia sissoo* (Indian Rose wood) is a commercially exploited timber tree also known for its varied phytochemical constituents holding significant importance in folk medicines with documented biological properties [1-15-98-126]. It is a perennial tree that grows in both natural and man-made forests on the Indian subcontinent in tropical or subtropical temperatures.

Dalbergia sissoo has a yellowish-brown wood with a fragrant scent, is tough and crack-resistant. The wood also has remarkable characteristics in terms of termite and abrasion resistance. As a result, it can be used for furniture, decoration, processing, and carving [1-99-125]. The tree has numerous reputed therapeutic benefits in addition to being utilized as wood for excellent furniture, and it has been traditionally used for a variety of illnesses[1-100-125]. It is primarily used for its high-quality timber, as fuel wood, and traditionally for medicinal properties [1-15-98-120]. Vanshita, and Bajpai (2023) [2] reviewed that in ancient and traditional medicine, *Dalbergia sissoo* is known for its bio-modulatory properties which include wound healing, anti-inflammatory, antioxidant, antimicrobial, antidiabetic, antibacterial, neuroprotective, and anti-osteogenic activity [1-25–27-126]. The genus, *Dalbergia*, consists of 300 species out of which nearly 25 species occur in India. Many species of *Dalbergia* are important timber trees, valued for their decorative and fragrant wood, rich in aromatic oils [1-27–57-126]. *Dalbergia sissoo* is a medium to large tree of about 25 meters high with grey yellow trunk, 2-3 meters in diameter[1-15-98-120]. Leaves are leathery, pinnately compound, leaflets are alternate[1-28–37-120]. They are broad, ovate, acuminate, glabrescent, petiolate with fine pointed tip [1-7-89-126]. Flowers are whitish to pink, fragrant nearly sessile, they are 5-8 mm long racemes 2.5 - 3.7 cm long in short axillary panicles. It's crown is oval in shape[1-27-126]. Pods are oblong, flat, thin, strap like 4-8 cm long and 1 cm in wide with 1-4 seeds. Seeds are 4-5 mm kidney shaped, thin and flat, light brown[1-126]. They have long taproot and numerous surface roots which produce suckers. The sapwood is white to pale brown is dark brown in color. The flowering period is March-May[1-25–27-126].

The medicinal properties of *Dalbergia sissoo* revealed that its parts, mainly the leaf, bark, roots, and wood, were used in treating skin disorders, chronic wounds, inflammatory conditions, and skin infections [1-28-45-100]. The oil has been used to treat ulcers and skin conditions when applied topically. The bark extracts have been used to treat blood disorders, dyspepsia, dysentery, leukoderma, anal disorders, and skin disorders [1-29-97-120]. The wood in powdered form is used as a cooling agent and expectorant for leprosy, scabies, stomach issues, and blood disorders[1-30,31-120]. The leaf extracts showed antipyretic, anti-inflammatory, and antioxidant properties and were used in the treatment of cancer, diabetes, gonorrhea, osteoporosis, and syphilis. The seeds are used for treating burning sensations and scabies [1-30,31-120]. Phytochemical investigations have reported that *D. sissoo* exhibits a vast phytoconstituent profile. The leaf extracts showed the presence of flavonoids (biochanin A, genistein, caviunin-7-O-glucoside, and biochanin-7-O-glucoside), phenols, glycosides, and lipids [1-30,31-120]. The stem, bark, and heartwood extracts include compounds such as dalbergin, dalbergichromene, isodalbergin, nordalbergin, tectorigenin, and 4-phenylchromene [1-30,31-120]. The extracts of mature pods are reported to have glycosides like tectoridin and isocaviudin [1-25-30-31-121].

Dalbergia sissoo is found as wild and cultivated tree in the Western Ghat region of Karnataka, Kerala and Tamil Nadu States of India. India's Western Ghats, also known as the Sahyadri mountains, are a stunning and environmentally vital terrain that run over 1,600 kilometers along the country's western coast [127-196-239]. Medicinal plants play a crucial role in the Western Ghats, both ecologically and culturally. This vast mountain range is one of the richest tropical forest zones in the world due to its tremendous diversity of flora and fauna in addition to its spectacular beauty [127-196-239]. The Western Ghats populations' traditional medical practices frequently center on using plant-based treatments[127-196]. The Western Ghats of Karnataka is one of the mega biodiversities of the world. The Karnataka state is endowed with great diversity of climate, topography and soil [127-196]. Karnataka is endowed with most magnificent forests in the country ranging from majestic evergreen forests of the Western Ghats to the scrub jungles of the plains[127-196]. The Western Ghats of Karnataka are one of the 25 global priority hotspots for conservation and one of the two on the Indian subcontinent. Several economically important species such as Sandalwood, Rosewood, Teak, White cedar grow naturally in these forests[127-196]. People use medicinal plant species for sustenance of their traditional healthcare system both logistically as well as economically. But an inclination towards modern technology and over extraction of many of these plants have resulted in considerable depletion of the population of such species and some have become extinct [127-196]. These medicinal plants have been used as traditional medicine due to their high medicinal value and plays a major role in the lives of people. Many traditional remedies for ailments and diseases rely on the use of these medicinal plants [127-196-239]. Many indigenous communities residing in the Western Ghats have a rich traditional knowledge of medicinal plants and their therapeutic properties[127-196].

2 *DALBERGIA SISSOO*: BOTANY

Dalbergia sissoo Roxb. ex DC belongs to the family *Fabaceae* of the genus *Dalbergia* containing 300 species is a medium to large-sized tree of height of approximately 25 m with a greyish yellow trunk having thin bark [1-11-67]. The trees 2–3 m wide crown is widely dispersed, and its stem and trunk are crooked. The leaves are compound and broad, grouped in an alternating, pinnate arrangement. The leaflets are petiolate, ellipsoidal and about 2.5–3.5 cm in width or around

three to five leaflets seem to be present in an alternative pattern [1-14-126]. Flowers range in color from white to pale yellowish to pinkish, are 2.5–3.7 cm long, and are arranged in an axillary. Flowers have sepals and petals that are 4–5 mm and 6–8 mm in size, respectively[1-14-126]. *Dalbergia sissoo* fruit is spherical and light brown in colour. The seeds have a kidney-shaped form, and are flat, flattened, thin and light brown in color. The *Dalbergia sissoo* plant produces oblong, 4–8 cm long, 1 cm wide and one to four seeds per pod pods. While the adult branches sustain the large, oval-shaped crown, the young shoots are drooping [1-15-98]. *Dalbergia sissoo* survives well in tropical or sub-tropical conditions[1-15-98-120]. The ideal average yearly temperature needed for its best growth spans between 18°C and 24°C, although in January it may tolerate the temperature of 10–15°C with frequent frost [1-15-98-126]. However, it can withstand temperatures as low as 4°C and as high as 50°C in its native areas in Indo-Pakistan[1-16-120]. *Dalbergia sissoo* trees however are better suited to areas with annual rainfall between 1000 and 1700 mm[1-15-98-120]. The well-drained, porous, moderate soil with a pH range of neutral to acidic is what Dalbergia sissoo prefers to grow in alluvial, sandy and sandy loam soils are the best for tree growth, while clay and waterlogged soils produce poor results. The ideal pH range is 5–7.7, and it has relatively low resistance to high salt concentrations [1-15-98-120].

The leaves, young shoots and green pods are used as good fodder for livestock and gazing animals; April to May is the best time for the production of high quality fodder[1-15-98-125]. The dry weight of leaves of *D. sissoo* contains up to 24.1% crude protein, 4.9% fat, 26.1% crude fiber and 12.0% ash [1-15-98-125]. *Dalbergia sissoo* provides numerous services to environment and agro-forestry. It is used as a wind break and shelter belt and as a shade tree in intercropping of orchards, mango, tea and coffee plantations[1-15-98-120]. The root system has suckers, it is commonly used for soil-erosion control and soil stabilization along stream and river banks[1-15-98-125]. It is widely used as plant for nitrogen fixation and reforestation. Due to its fragrant flowers and shade, it is planted along the road side and in gardens as an ornamental plant [1-20-125] .

3 *DALBERGIA SISSOO*: PHARMACOLOGY

In the developing world, the over-reliance on chemically synthesized drugs has raised serious concerns such as drug resistance, higher cost, adverse side effects, and ecological footprint[1-46-125]. Therefore, the global shift towards the use of natural products has gained attention for treating health conditions as they are known for their safety, efficacy, and broad health benefits with minimum side effects [1-46-125]. Medicinal plants have been extensively studied for their bioactive compounds and medicinal uses. *Dalbergia sissoo*, belonging to the *Fabaceae* family, has shown promise in traditional medicine for treating infections, cardiovascular diseases, and skin issues [1-46-125]. Vanshita, and Bajpai (2023) [2] reviewed that *Ayurveda* describes the bark and wood as bitter, hot and acrid used as aphrodisiac abortifacient expectorant, antihelmintic, antipyretic and diseases of the blood, leucoderma, dysentery[2-126]. *Dalbergia sissoo* oil is used to treat buming and scabies[1-46-125]. A decoction of the leaves are given in acute stage of gonorrhea. Its use in removing pus in urine, as alleviates profuse menstruation[1-46-125]. To cure boils and pimples. The leaves extract has been reported to have antipyretic, antihelmintic and analgesic properties of pharmacology[1-46-125]. *Dalbergia sissoo* is reported to be a stimulant used in folk medicine and remedies. It is a folk remedy for gonorrhea and skin ailments[1-46-125]. *Ayurvedics* prescribe the leafy juice for eye ailments, the woody bark paste as anthelmintic, antipyretic and analgesic[1-46-125]. The wood is also used in India for boils, leprosy and nausea[1-46-125]. The alcohol extract of green branches of aerial parts showed an inhibitory effect on the mobility of rabbit duodenum, pronounced bronchodilation, as well as significant anti-inflammatory antipyretic, analgesic and estrogen-like activities. An aqueous extract of wood has been used for the treatment of gonorrhea in Arabic countries [1-46-125]. In one of the study reported by Jyotsana and Gupta (2025) [1], the successful establishment of *D. sissoo* callus cultures from a leaf explant and further subculture up to three stages[1-46-125]. However, further *in vitro* and *in vivo* investigations are required in future studies to validate their possible role as anti-tyrosinase inhibitors [1-46-125]. The present findings by Jyotsana and Gupta (2025) [1] recommend the utilization of *D. sissoo* leaf callus cultures as a controlled and sustainable platform for the production of diverse phytochemicals with potential applications as skin therapeutics[1-46-125]. Compounds obtained from *D. sissoo* like an isoflavone, biochanin is a potent chemotherapeutic cancer preventive agent[1-35-98-125]. Also reported the estrogenic activity from the fresh flowers of *D. sissoo*. Querection was also isolated in a low yield research is still need to prove these effects [1-23-98]. The species of *Dalbergia* has been reported to have isoflavones, norartocarpotin, stigmasterol and neoflavonoids [1-19-125].

Among the many healing plants recognized as far, *D. sissoo* has demonstrated to have exceptional medicinal promise for treating different illnesses/diseases including microbial infections, diabetes, ulcer, spermatogenesis, skin disorders, diarrhoea, osteoporosis, etc[1-12-125]. Different parts of plant have been used for the treatment of a variety of disorders. Due to the alcoholic component, *D. sissoo* leaf extract possesses noticeable antipyretic and mild analgesic properties [1-19-125]. In numerous models of inflammation, the alcoholic leaf extract of *D. sissoo* significantly reduces inflammation without having any negative effects on the gastrointestinal mucosa[1-120]. *D. sissoo* leaves are used by rural residents of Nepal and India to treat animals with generalized diarrhoea. Leaf extract has also been used in treating gonorrhoea, syphilis, dysentery and heart issues in Jordan[1-19-125]. The antioxidant activity of *D. sissoo* leaf extract was almost two times more than that of other regularly used antioxidants like vitamin E or Selenium[1-21-126]. The

juice from the leaves is effective as an anthelmintic, improves blood quality and treats eye and nasal conditions[1-19-126]. It is useful for digestive issues, syphilis, scorching urine, scabies and burning sensations throughout the body[1-22-126]. When the components of *D. sissoo* leaf extract were examined for osteogenic activity, it was discovered that the compounds genstein, pratensein, biochanin A, biochanin 7-O-glucoside and caviunin 7-O-[- D-apiofuranosyl-(16)-D-glucopyranoside] (CAFG) produced osteogenic activity[1-8, 23-126]. It is reported that wood and bark have abortifacient, expectorant, anthelmintic, aphrodisiac, antipyretic and refrigerant properties. Antioxidant-rich *D. sissoo* bark helps to treat inflammatory conditions[1-24-126]. The wood and bark are also used in *Ayurveda* to treat anal problems, blood disorders, burning feelings, diarrhoea, dyspepsia, leucoderma and skin problems. For cleansing wounds, the bark's decoction is used. The wood and bark are also said to be aphrodisiacs, induce abortions and promote appetite[1-125]. The roots can be used to induce labor and cure gonorrhoea, hernia and abdominal pain. Herpes, vitiligo and fever can all be treated with heartwood. Skin conditions are treated with oil extracted from the seeds [1-113-126].

Dalbergia sissoo is one of the fast-growing multipurpose trees distributed in various tropical and subtropical regions of Asia and Africa. Its leaves are used by rural residents of India and Nepal to treat animals with non-specific diarrhoea. Different parts of tree, including the roots, barks, leaves, wood and seeds, are used to treat a variety of illnesses, including syphilis, expectorant, aphrodisiac, eye and nose disorders, nausea, dysentery, stomach difficulties and a variety of skin and blood ailments[1-126]. According to reports, *D. sissoo* is a stimulant used in home remedies and folk medicine. It is a traditional treatment for skin conditions and gonorrhoea [1-27-125]. A finely grounded paste made from 8 to 10 D. sissoo leaves and 25 g of palm candy given in the morning reduces heavy menstruation. Painful urination as well as boils and pimples can be treated with a 50–100 ml infusion of the leaves given three times per day1-27-125]. Taking 10–15 cc of the juice (from the leaves) three times a day aids in treating jaundice and removing pus from the urine1-27-125]. The leaves were warmed and tied to the breast, and taking the decoction of leaves reduces swelling of the breast [1-118-126]. Gonorrhoea can be treated with 3–6 gm of powdered bark or a decoction of the leaves. In leprosy, the bark and leaf decoction is given[1-118-126]. Decoction is prepared by boiling 10 g of *D. sissoo* bark in 500 g of water until the liquid is reduced by half. Leprosy treatment involves combining bark juice with water and taking it every morning for 40 days. Blue itching, skin burning and scabies can be treated with *D. sissoo* oil. The roots give an astringent used to cure infections and inflammations. The roots can also be utilized to treat hernia, abdominal pain, gonorrhoea and also in abortion. Traditional healers in the Bastar region of India reported that Shisham is an effective blood purifier and leprosy therapy[1-118-126].

4 *DALBERGIA SISSOO*:PHYTOCHEMISTRY

Dalbergia is quite a large genus belonging to the family *Fabaceae* with about 300 species and about 25 species found in India. The numerous species of the genus have yielded a variety of phytoconstituents, including flavonoids, isoflavonoids, steroids, glycosides, quinines, etc [1-69-125]. *Dalbergia sissoo* Roxb. ex DC (D. sissoo) is a multipurpose tree of this genus. It is a deciduous rosewood tree vernacularly called as Shisham consisting of small to medium-sized shrubs, trees or lianas[1-79-125]. *D. sissoo* is a rich source of flavonoids, phenolic compounds, saponins, phytosterols, tannins, steroids, carbohydrates, proteins and alkaloids [1-11-125]. Recent research has focused on its intriguing biological properties, which include antimicrobial, antiparasitic antidiabetic, antioxidant, antipyretic, antiulcer, antispermatogenic, antinociceptive, antidiarrhoeal, neuroprotective, cardioprotective and osteogenic activities [1-11-125].

According to Vanshita, and Bajpai (2023) [2], Flavonoids are the most prominent class of secondary metabolites in this species. Numerous flavone and isoflavone glycosides, chalcones and retinoids have been identified in different plant parts. The investigation of the chemical components of *D. sissoo* led to the extraction and identification of five main flavonoids, which were then classified by HPLC analysis as a chalcone, 2, 3-dimethoxy-4'-γ, γ-dimethylallyloxy-2' hydroxylchalcone, isoflavones i.e. Biochanin A, and 7-γ,γ-dimethylallyloxy-5-hydroxy-4'-methoxyisoflavone, flavone i.e. 7-hydroxy-6 methoxyflavone, and a retinoid namely dehydroamorphigenin [1-11-125]. The stem bark and flowers contain Tectorigenin, Chalcones (Isoliquiritigenin and Isoslipurposide) were extracted from the heartwood of this plant [1-29-126]. The presence of Naringenin in the trunk exudates of *D. sissoo*, and two compounds such as Dalbergin. Dalbergiphenol were isolated from the heartwood extract[1-29-126]. The study of chemical constituents of leaves extract of *D. sissoo* has resulted in the isolation and identification of various flavonoids, characterized as Pratensein, Genstein, Genistein 8-C-β-D-glucopyranoside, Kampferol-3-O-rutinoside, Quercetin 3-O-rutinoside, quercetin 3-O- b-D-glucopyranoside, caviunin 7-O-b-D-glucopyranoside, biochanin A 7-O-[β-D-apiofur- anosyl-(1→6)-β-D-glucopyranoside] and Biochanin A 7-O-[b-D- apiofuranosyl-(1→5)-β-D-apiofuranosyl-(1→6)- β-D-glucopyrano- side], Dalbergichromene was isolated from the stem bark and heartwood of this plant[1-29-126]. A novel isoflavonoid, Caviunin 7-O-[β-D-apiofuranosyl-(1-6)-β-D-glucopyranoside (CAFG) (22) was obtained from the heartwood extract of *D. sissoo*[1-29-126]. Quantitative and qualitative analysis revealed the presence of major isoflavone glycosides from the leaves extract of *D. sissoo* such as sissotrin, Isocaviudin, Tectoridin, Caviunin-7-O-glucoside, and Biochanin-7- O-glucoside [1-29-126]. These flavonoids possessed significant osteogenic effects[1-29-126]. The saturated fatty acids obtained include palmitic acid (10.130%), stearic acid (2.862%), arachidic acid, linoleic acid (22.350%), linolenic acid

and oleic acid (10.232 %) [1-29-126]. Ansari et al., (2000) [72] has done chemical investigations in isolating two sesquiterpene derivatives i.e. nerolidol, and bisabolene, and were simultaneously estimated using gas chromatography/mass spectrometry (GC/MS) [1-29-126]. Nerolidol possessed antibacterial, antimicrobial and anti-oxidant properties[1-29-126]. From the leaves, 14% of pure polysaccharides were obtained which contains 15.7% of glucuronic acid[1-29-126]. Findings have led to the extraction and identification of D-galactose, D-glucose, D-rhamnose, 3-O-methyl-L-rhamnose, D-glucuronic acid, 2,3,4,6-tetra-O-methyl-D-glucose, 2,3-di-O-methyl-D-galactose,2,4,6-tri-O-methyl-D-galactose,2-O-methyl-L-rhamnose by using gel permeation chromatography, gas liquid chromatography and paper chromatography[1-29-126]. Some components from aerial parts of *D. sissoo* were analyzed by using gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS). The analysis showed the presence of norartocarpetin[1-29-126]. Few steroids are also present in the aerial parts such as β–amyrin, β –sitosterol and stigmasterol [1-29-126]. Phytochemical compounds including phenolic compounds, alkaloids, saponins, steroids and flavonoids possessed significant antioxidant property[1-29-126]. The leaves of *D. sissoo* were found to have nutraceutical components such as crude fibres (26.1%), protein (24.1%) and fat (4.9%) [1-29-126]. The antioxidant property of these compounds were evaluated using 2, 2-diphenyl-1-picryhydrazyl (DPPH), nitric oxide and hydrogen peroxide-free radical scavenging activity [1-29-126].

D. sisso plant extracts also showed the anti-osteoporotic effect and anthelmintic activity. The acaricidal action of aqueous and ethanolic leaf extract of *D. sissoo* was investigated using an adult immersion test, gastroprotective effect, neuroprotective effect, cardio-protective effect, and immuno-modulatory effect [1-29-126].The pharmacological effects D. sissoo has a broad range of pharmacological effects such as anti-oxidant effects, analgesic and anti-inflammatory effects, anti-diarrhoeal effects, anti-diabetic effects, osteogenic effects, and Anti-spermatogenic effect etc[1-29-126]. Several studies on toxicological studies of *D. sissoo* have been conducted. At doses between 50 and 3000 mg/kg in an acute toxicity trial, every rat lived and showed no signs of toxicity or abnormalities. For 7 days following oral delivery, no aberrant symptoms or changes in behavior or body weight were noticed. However, it can be said that methanolic leaves extract of *D. sissoo* has a low toxic potential and also the LD50 is greater than 3000 mg/kg[1-47-126]. Therefore, acute toxicity studies on the extract did not show any toxic effects in the rats or cause any deaths[1-47-126].

5 CONCLUSION

Dalbergia sissoo Roxb. ex DC is an important medicinal plant native to tropical and sub-tropical areas belonging to *Fabaceae* family of genus *Dalbergia* commonly called as Sheesham. The tree has numerous reputed therapeutic benefits in addition to being utilized as wood for excellent furniture, and it has been traditionally used for a variety of illnesse. It is a source of multiple bioactive metabolites that have the potential to be used as promising candidates for drug development in the near future. Extracts of different parts of *D. sissoo* have antioxidant action due to the presence of polyphenol, particularly flavonoids. Plants have been utilized as a source of medications with strong therapeutic potential in treating diseases and fighting a variety of pathogenic infections since the dawn of time. Different ancient medical systems, including *Ayurvedic*, Chinese, Unani medicine, have extensively employed the healing properties of medicinal. Using herbs as an alternative treatment is becoming prevalent and gaining worldwide demand and popularity. Moreover, more advanced experimental investigations would be added, which might aid in the discovery of more potential drugs from natural source.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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