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# Pharmacological and Phytochemical Investigation of *Chloroxylon swietenia* DC.

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## A B S T R A C T

The phytochemical, antibacterial, and antioxidant properties of the extracts of *Chloroxylon swietenia* leaves were investigated. Initially preliminary phytochemical analysis revealed the presence of tannins, phenols, glycosides, flavonoids, saponins, terpenoids, alkaloids anthroquinones and coumarins. The GC-MS analysis of the methanolic leaf extract of *C. swieteni* revealed the presence of 21 phytoconstituents. Using disc diffusion method, various extracts waere examined for their ability against gram-positive and gram-negative pathogenic bacteria and amoxicilin was used as standard control. At a greater concentration of 100 mg/mL, the extracts exhibited considerable antibacterial and antioxidant activity.

***Key words*:** *Chloroxylon swietenia,* Preliminary phytochemical, Antibacterial activity, Antioxidant activity

In recent years, there has been an increasing understanding regarding the significance of medicinal plants. This is encouraging because the plant kingdom is a treasure store of potential medications, and there has been a growing understanding regarding the significance of medicinal plants in last few decades. Medications derived from plants are not only easily accessible, but they are also somewhat affordable, risk-free, and effective, with just a small number of occurrences of ill effects. When looking at the current search for therapeutically effective new drugs such as anticancer drugs [1] and antimicrobial drugs [2], and anti-hepatotoxic compounds, the most obvious choice is to look at the plants that have been selected for medicinal use over the course of thousands of years. This is because looking at these plants is the most obvious choice because they are the ones that have been used for thousands of years. A wide range of diseases have been successfully treated with the help of these plants. According to the World Health Organization (WHO), the greatest area to look for a wide array of medications would be medicinal plants. This is the recommendation that has been made by the WHO. Around 80% of individuals living in developed countries make use of traditional medicines. However, research into such plants is required in order to have a better understanding of the characteristics, safety, and efficacy of the plants in question [3]. Tannins, alkaloids, carbohydrates, terpenoids, steroids, and flavonoids are some examples of the organic chemicals that medicinal plants contain and which are responsible for the specific physiological effect have on the human body. Other organic chemicals that medicinal plants contain include flavonoids, terpenoids, and carbohydrates [4].

These compounds are created by the primary and the secondary metabolism of living plant that have been employed in phytomedicines. Several plants bark, leaves, flowers, roots, fruits, and seeds, as well as the seeds, can be used to extract the compounds [5]. It is desirable to acquire knowledge of the chemical components of plants will be beneficial in the development of more complex chemical substances. This knowledge can be obtained by screening plants [6].

A tropical aromatic tree that is found in dry deciduous woods, *C. swietenia* DC. is a member of the Meliaceae family of plants [7-8]. It is a deciduous tree that may reach heights of 9-15 metres, has a girth of 1.0-1.2 metres, has a spreading crown, and can have a bole that is up to 3 metres in length. It is an endemic to both India and Sri Lanka, is variously called as Yellowwood, East Indian satinwood, and Ceylon satinwood [9]. The bark of this tree is used as an astringent, and the leaves are applied to worm infested wounds of animals and fungal infections of the skin, as well as for the treatment of inflammation-related disorders such as pain and rheumatism. This tree has been used for a very long time in the traditional medical practices of the native peoples. Tribal people who live in the Bastar District in Madhya Pradesh apply a paste made of the leaves and root in equal parts to the forehead as a salve or eat a paste made of the leaves and root inside to cease headache

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pain [10]. The smoke produced by burning the leaves is used to drive ticks out of stables, and the decoction of the leaves can be used as a lotion to treat ulcers and to cure abrasions on the skin. The leaves have a significant mosquito larvicidal effect and are also put to use as an insect repellent [11].

In traditional medicine, this plant is used to treat a variety of ailments, including cuts, burns, wounds, rheumatism, eye infections, snakebites, and so on [12]. It has been reported that various extracts of *Chloroxylon swietenia* have antimicrobial activity [13], antibacterial and antihelminthic [14] properties; hepatoprotective, antioxidant [15] larvicidal [16] anti-inflammatory [17] and analgesic [18]. The investigation of the lipid profile and the ocular oxidative stress of *C. swietenia* on Streptozotocin nicotinamide-induced diabetic rats [19] was studied in the aerial sections of the plant. The purpose of the current study is to screen phytochemical profile, which will help in the identification of a new candidate for drug design.

## MATERIALS AND METHODS

The leaves of *Chloroxylon swietenia* DC. was collected from Arimalam, Pudukkottai District, Tamil Nadu and subsequently identified. A voucher specimen has been placed at the Postgraduate Department of Botany at the J. J. College of Arts and Science (Autonomous), located in Pudukkottai, Tamil Nadu for the authenticity of the leaves had been established, they were gathered, allowed to air-dry at room temperature until complete dry, and then ground into a powder using electric blender. Fine powder was derived using a sieve, it was placed in an airtight container for further purposes. Using a Soxhlet apparatus, the dried, roughly powdered leaves were subjected to a series of extractions using petroleum ether, chloroform, acetone, ethanol, and water. The potential existence of phytoconstituents in each and every extract was investigated. Preliminary phytochemical evaluations of a pant of extracts were carried out in accordance with the prescribed protocols [20-21].

*Antibacterial activity*

The *in-vitro* antibacterial activity of *Chloroxylon swietenia* leaves extract (petroleum ether, chloroform, acetone, ethanol and water) at different concentrations of 25, 50 and 100 mg/ml were studied by the agar Disc diffusion method, against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia* and *Pseudomonas aerugenosa* organisms obtained from stock cultures of Doctor's Diagnosis lab, Thillai Nagar, Tiruchirappalli, Tamil Nadu, India. Before each antimicrobial test, stock cultures were kept on nutrient agar medium at a temperature of 40°C. Subcultures were then grown in nutrient broth at a temperature of 37°C. A comparison was made between the antibacterial activity of all of the extracts and Amoxicilin used as standard control. The zone of inhibitions was measured [22].

*Antioxidant activity*

*DPPH assay*: The potential of the natural antioxidants found in the plant extract to scavenge the stable free radical DPPH was evaluated using the methodology developed by Shimada *et al*. [23]. 2 ml aliquot of DPPH methanol solution with a concentration of 25µg/l was introduced to a 0.5 ml sample solution that had varying concentrations. After giving the combination a vigourous shake, it was left at room temperature and in the dark for a period of thirty minutes. After that, the spectrophotometer was used to determine the absorbance at a wavelength of 517 nm. L-ascorbic acid was used as control.

## RESULTS AND DISCUSSION

*Preliminary phytochemical*

The preliminary screening of phytochemicals is absolutely necessary in order to determine the active compounds that are present in the crude plant extract. In the present study, it has been performed qualitative and preliminary chemical tests on five distinct *Chloroxylon swietenia* extracts and compiled the results in (Table 1). Extracts of *Chloroxylon swietenia* were used for qualitative analysis of the secondary metabolites (petroleum ether, chloroform, acetone, ethanol and water). The presence of the preliminary phytochemicals such as tannin, saponin, flavonoids, terpenoids, phenols, and coumarin was confirmed in each of the five extracts. In all of the studies, the alkaloids were only present in the extracts of ethanol and distilled water. Except for acetone and ethanol, glycosides were to be used to confirm their existence. With the exception of the aqueous extract of *Chloroxylon swietenia*, the steroids were found to be conformed in practically all of the extract.

Table 1 Preliminary phytochemical investigation on different extracts of *Chloroxylon swietenia* leaf

| Phytochemical constituents | Name of the extracts | | | | |
|---|---|---|---|---|---|
| | Petroleum ether | Chloroform | Acetone | Ethanol | Distilled water |
| Tannin | + | + | + | + | + |
| Saponin | + | + | + | + | + |
| Flavonoids | + | + | + | + | + |
| Steroids | + | + | + | + | - |
| Terpenoids | + | + | + | + | + |
| Phenol | + | + | + | + | + |
| Alkaloid | - | - | - | + | + |
| Anthraquinones | + | + | + | + | - |
| Coumarin | + | + | + | + | + |
| Glycoside | + | + | - | - | + |

+ Present; - Absent

*GC-MS analysis*

The medicinal plants are exhibiting foundation of various secondary metabolites determined by GCMS spectra analysis [24]. The present study has been found helpful in the identification of many constituents present in the *Chloroxylon swietenia* leaf extract. Most of the identified compounds possess various known medicinal properties, whereas some of the compounds obtained in this work have not beet report earlier. In *Chloroxylon swietenia* leaf extract have 21 phytochemicals which gas chromatogram is given (Fig 1). Among these compounds some of the known bioactive compounds with their name, molecular weight and formula, are represented in (Table 2). The bioactivity of these compounds

are Bicyclo[3.1.1]Hept-2-Ene, 2,6,6-Trimethyl-; Cycloheptasiloxane, Tetradecamethyl-; 1,6-Cyclodecadiene, 1-Methyl-5-Methylene-8-(1-Methylethyl)-, [S-(E,E)]-; 1,3,6,10-Dodecatetraene, 3,7,11-trimethyl-, (Z,E)-; 1,6,10-Dodecatrien-3-Ol, 3,7,11-Trimethyl-; Neophytadiene; Hexadecanoic Acid, Methyl Ester; 9- Ester Octadecenoic Acid, Methyl; 9-Octadecenoic acid, methyl ester, (E)-; Phytol; 2,4(1H,3H)-Phenanthrenedione, 4a,9,10,10a-Tetrahydro-7-Methoxy-1,1,4a-Trimethyl-8-(1-Methylethyl)-; Chalepin; Stigmastanol; Cyclononasiloxane, Octadecamethyl-; Rutamarin; Squalene; Ergost-5-En-3-Ol, (3.Beta.)-; 1-Aminononadecane, N-trifluoroacetyl- and Stigmasta-5,22-dien-3-ol, (3.beta.,22e)-.

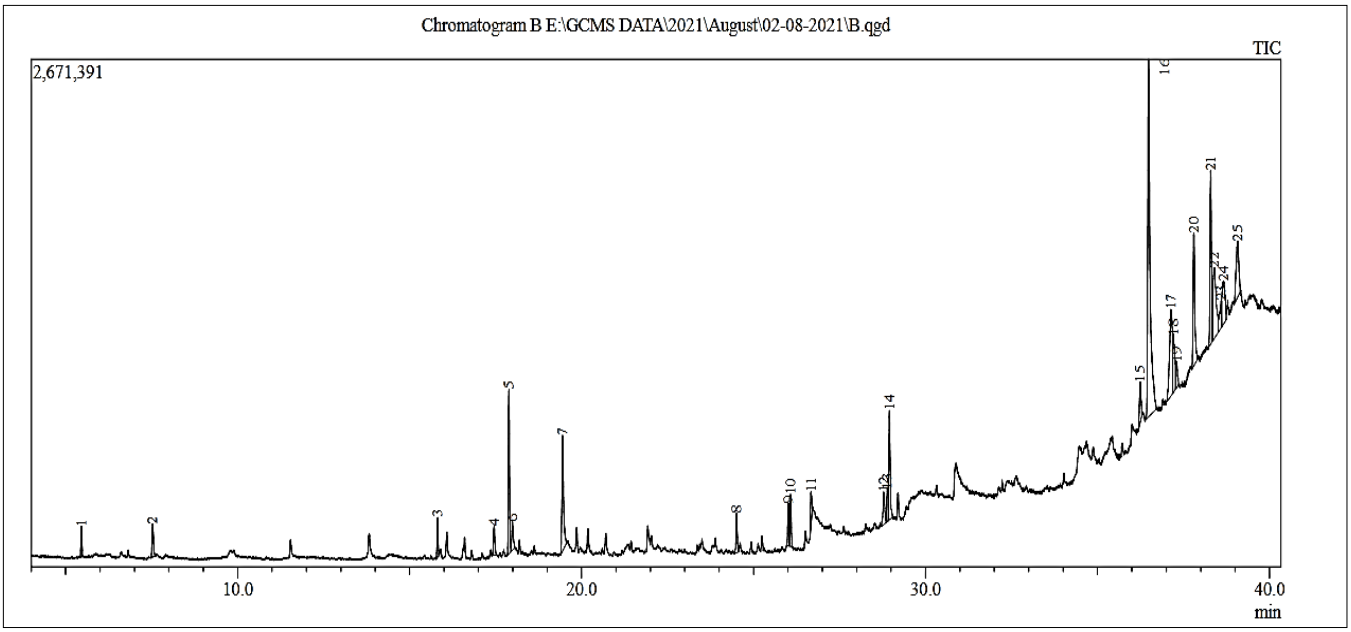


Fig 1 Gas chromatogram mass spectrum study methanolic extract *C. swietenia* leaf

Table 2 Phyto-chemical profile of *Chloroxylon swietenia* using GCMS analysis

| Peak | Retention time | Area % | Name | Molecular formula | Molecular weight |
|---|---|---|---|---|---|
| 1 | 5.46 | 0.99 | Bicyclo[3.1.1]Hept-2-Ene, 2,6,6-Trimethyl- | $C_{10}H_{16}$ | 136.23 |
| 2 | 17.457 | 1.18 | Cycloheptasiloxane, Tetradecamethyl- | $C_{14}H_{42}O_7Si_7$ | 519.07 |
| 3 | 17.888 | 5.7 | 1,6-Cyclodecadiene, 1-Methyl-5-Methylene-8-(1-Methylethyl)-, [S-(E,E)]- | $C_{15}H_{24}$ | 204.35 |
| 4 | 17.991 | 1.27 | 1,3,6,10-Dodecatetraene, 3,7,11-trimethyl-, (Z,E)- | $C_{15}H_{24}$ | 204.35 |
| 5 | 19.445 | 5.72 | 1,6,10-Dodecatrien-3-Ol, 3,7,11-Trimethyl- | $C_{15}H_{26}O$ | 222.37 |
| 6 | 24.506 | 1.43 | Neophytadiene | $C_{20}H_{38}$ | 278.5 |
| 7 | 26.012 | 1.59 | Hexadecanoic Acid, Methyl Ester | $C_{17}H_{34}O_2$ | 270.5 |
| 8 | 26.08 | 1.74 | Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, methyl ester | | |
| 9 | 26.671 | 1.29 | n-Hexadecanoic acid | $C_{16}H_{32}O_2$ | 256.42 |
| 10 | 28.787 | 1.62 | 9- Ester Octadecenoic Acid, Methyl | $C_{19}H_{36}O_2$ | 296.5 |
| 11 | 28.885 | 1.33 | 9-Octadecenoic acid, methyl ester, (E)- | $C_{19}H_{36}O_2$ | 296.5 |
| 12 | 28.951 | 4.44 | Phytol | $C_{20}H_{40}O$ | 296.5 |
| 13 | 36.243 | 2.03 | 2,4(1H,3H)-Phenanthrenedione, 4a,9,10,10a-Tetrahydro-7-Methoxy-1,1,4a-Trimethyl-8-(1-Methylethyl)- | $C_{21}H_{28}O_3$ | 328.4 |
| 14 | 36.483 | 24.71 | Chalepin | $C_{19}H_{22}O_4$ | 314.4 |
| 15 | 37.136 | 7.28 | Stigmastanol | $C_{29}H_{52}O$ | 416.7 |
| 16 | 37.305 | 1.42 | Cyclononasiloxane, Octadecamethyl- | $C_{18}H_{54}O_9Si_9$ | 667.4 |
| 17 | 37.799 | 6.57 | Rutamarin | $C_{21}H_{24}O_5$ | 356.4 |
| 18 | 38.289 | 8.07 | Squalene | $C_{30}H_{50}$ | 410.7 |
| 19 | 38.395 | 6.55 | Ergost-5-En-3-Ol, (3.Beta.)- | $C_{28}H_{48}O$ | 400.7 |
| 20 | 38.59 | 1.59 | 1-Aminononadecane, N-trifluoroacetyl- | $C_{21}H_{40}F_3NO$ | 379.5 |
| 21 | 39.076 | 4.46 | Stigmasta-5,22-dien-3-ol, (3.beta.,22e)- | $C_{29}H_{48}O$ | 412.7 |

*Antibacterial activity*

The antibacterial activity of each of the extracts has been demonstrated against each and every bacterium. *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* were the species that the petroleum ether, chloroform, acetone, ethanol and Distilled water extract was shown to have the most significant effect on respectively. On the distilled water extract did not exhibit any significant effect against any of the organisms tested. When compared to amoxicillin, the extracts of petroleum ether and chloroform showed only a small amount of efficacy against both gram-positive and gram-negative bacteria. Developing innovative

antimicrobial drugs that can kill resistant diseases is one way to battle resistant organisms. The fast spread of antibiotic resistance and the growing interest in natural products have put medicinal plants back in the spotlight as a source for active anti-microbial compounds and maybe new classes of antibiotics. In keeping with the usage of therapeutic plants, our work was based on microbe isolation from oral cancer patients and antibacterial activity of medicinal plants against these clinical isolates [25].

*DPPH assay*

The DPPH assay has attracted great attention in recent years for its use in natural antioxidant research. One of the reasons is that this procedure is not complicated and it has a high level of sensitivity. DPPH is one of the few organic nitrogen radicals that are reliable and readily available for commercial use [26]. The elimination of DPPH in test samples is directly correlated to the magnitude of the antioxidant effect. Monitoring DPPH levels with a UV spectrophotometer has lately emerged as the approach that is applied the most frequently and extensively due to its ease of use and precision. At a wavelength of 517nm, DPPH exhibits a significant absorption maximum. In general, the ability of the plant extracts to scavenge DPPH radicals is dependent on the concentration, and a lower $IC_{50}$ value suggests stronger protective action. In the current experiment, the $IC_{50}$ value was determined to be lower for the methanolic extract than it was for the aqueous extract. The outcome was very similar to what one would expect from regular gallic acid. The $IC_{50}$ values for methanol, aqueous extracts, and standard gallic acid were determined to be 23.16, 33.06, 54.06, 62.05, and 74.06 mg/ml, respectively. The standard gallic acid had an $IC_{50}$ value of 56.9 mg/ml.

Table 3 Antibacterial activity of different extracts of *C. swietenia* leaf

| Extracts | Conc. (mg/mL) | Zone of inhibition (diameter in mm) | | | |
|---|---|---|---|---|---|
| | | *Staphylococcus aureus* | *Escherichia coli* | *Klebsiella pneumoniae* | *Pseudomonas aerugenosa* |
| Acetone | 25 | 11.9±3.21 | 11±1.21 | 13±1.32 | 16±2.31 |
| | 50 | 18.5±4.25 | 12.6±3.32 | 15±2.14 | 18.5±1.31 |
| | 100 | 19.6±1.12 | 23±1.21 | 20.7±1.12 | 22.6±1.32 |
| Chloroform | 25 | 9.9±6.11 | 11±1.25 | 9.7±1.32 | 13±3.19 |
| | 50 | 11.3±7.21 | 13±1.23 | 14±1.41 | 15±1.32 |
| | 100 | 17.5±2.21 | 14.6±2.12 | 17±2.12 | 21.8±1.25 |
| Petroleum ether | 25 | 13±2.02 | 12±1.21 | 20±1.25 | 16±1.20 |
| | 50 | 12±4.03 | 19±3.12 | 23.7±2.12 | 22±1.21 |
| | 100 | 15±1.01 | 28±3.14 | 28.4±1.21 | 28.8±3.48 |
| Ethanol | 25 | 8.7±4.15 | 9±1.13 | 10±1.23 | 12.3±1.21 |
| | 50 | 10.8±5.21 | 14.2±2.13 | 16±3.21 | 13.9±1.31 |
| | 100 | 15.8±3.31 | 22.5±3.14 | 18.4±2.31 | 22.5±1.14 |
| Distilled water | 25 | 4.3±4.15 | 6±1.23 | 4±1.13 | 3.3±1.14 |
| | 50 | 4.8±1.71 | 7±1.43 | 6±4.21 | 4.9±2.31 |
| | 100 | 6.8±3.21 | 7.5±3.34 | 7.4±2.11 | 5.5±1.24 |
| Amoxicillin | 10 | 30±3.2 | 31.5±1.1 | 29.7±4.4 | 32±2.2 |

Mean ± S.D

Table 4 DPPH assay of *Chloroxylon swietenia* leaf extracts of methanol and aqueous

| Concentration | Methanol | Aqueous | Gallic acid |
|---|---|---|---|
| 20 | 24 | 14 | 23.16 |
| 40 | 41 | 28 | 33.06 |
| 60 | 65 | 41 | 54.06 |
| 80 | 71 | 50 | 62.05 |
| 100 | 86 | 58 | 74.06 |
| 120 | 92 | 66 | 98.78 |
| $IC_{50}$(µg/ml) | More than 120µg/ml $IC_{25}$ is 86.21µg/ml | | 56.9 |

## CONCLUSION

The leaf extracts of *Chloroxylon swietenia* have been found to contain phytochemical components, which supports the new active compound investigation. The findings of the GC-MS investigation revealed the existence of 21 different chemicals. It has been demonstrated that each of the five distinct extracts of the leaves had both antibacterial and antioxidant activities. Additional research on the molecular mechanism and the isolation of the molecule responsible for this effect may lead to a new candidate for use in the pharmaceutical sector.

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