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PHYTOCHEMICALS, PHARMACOLOGICAL PROPERTIES AND TRADITIONAL USES OF *GLIRICIDIA SEPIUM* LEAF: A COMPREHENSIVE REVIEW

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ABSTRACT: Herbal therapy has been utilised for a very long time by ancient tribes and civilisations because it uses local herbs, which have less negative effects, to prevent and treat certain illnesses. The exotic plant *Gliricidia sepium* is a member of the Fabaceae family. Gliricidia's generic name means "mouse killer" in Latin, referring to the usage of deadly seeds and bark as a rodenticide. In *Gliricidia sepium*, saponins, flavonoids, terpenes, tannins, glycosides, and volatile oils have been identified as important phytoconstituents from a variety of plant components, including leaves, flowers, fruits, stems, bark, seeds, and roots. *Gliricidia sepium* is said to possess antimicrobial and cytotoxic properties, thrombolytic activity, anti-bacterial activity, anti-inflammatory activity, anti-oxidant activity, wound healing, larvicidal activity, and anthelmintic activity, all of which are particularly significant in the medical sector. An overview of studies conducted on the plant *Gliricidia sepium* is presented in this article. It includes discussions on the taxonomy, classification, common names, vernacular names, description, distribution, phytochemicals, and pharmacological activity.

INTRODUCTION: The use of medicinal plants has a long history and is common in both developed and developing nations. The World Health Organization's research states that 80% of the world's population mostly rely on conventional treatments that use plant extracts or their active ingredients [1]. Today's pharmaceutical business still depends heavily on the variety of secondary metabolites found in plants, of which at least 12,000 have been identified; this represents less than 10% of the total [2]. Utilizing natural products is considerd to have safety, efficacy and quality.

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Gliricidia sepium (Leguminosae family) is a medium-sized tree imported to India from the American continent. In Mexico, this tree provides shade for coffee and cocoa farms. It is known as 'Madrecacao' (mother of cocoa). Gliricidia is also employed as a rat poison, as its Latin name suggests. In some parts of Mexico, it is used as a hedge plant, and the blossoms are eaten [3]. In Panama, a decoction of leaves is used to treat utricaria, rash, burns, and erysepalas [4].

Branches of *Gliricidia sepium* are used to lower fevers in both adults and children. Additionally, infections caused by *Neisseria gonorrhoea*, *Trychophyton mentagrophytes*, and *Microsporum canis* have been treated with it [5]. Several components of *Gliricidia sepium*, including leaves, flowers, fruits, stems, seeds, and roots, have been identified as important phytochemical compounds,

including saponins, flavonoids, volatile oils, and other substances. It is well known that *Gliricidia sepium* possesses cytotoxic, antimicrobial, antibacterial, anti-inflammatory, antioxidant, thrombolytic, anti-sickling, wound-healing, larvicidal, and anthelmintic properties that are particularly significant in the medical field [6].

FIG. 1: *GLIRICIDIA SEPIUM*

FIG. 2: *GLIRICIDIA SEPIUM* SEED PODI

FIG. 3: *GLIRICIDIA SEPIUM* FLOWER

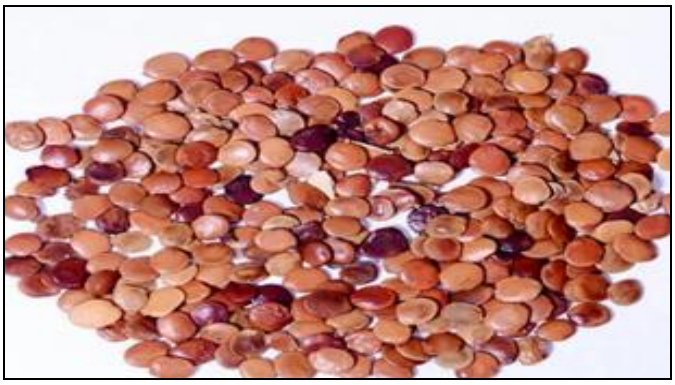

FIG. 4: *GLIRICIDIA SEPIUM* SEED

Taxonomical Classification [7]:

Kingdom: Plantae

Division: Tracheophytes

Phylum: Spermatophytes

Subphylum: Angiosperms

Class: Dicotyledonae

Order: Fabales

Family: Fabaceae

Sub family: Faboideae

Tribe: Robinieae

Genus: Gliricidia

Species: sepium

Synonyms [8]:

- Mexican lilac
- Glory cedar
- Mother of cocoa
- Gliricidialambii Fernald
- Quick stick
- Robinia sepium Jacq.
- *Robinia rosea* Mill.

Vernacular Names [9]:

Africa: Abgookmaniye

Marathi: Giripushpa

Kannada: *Gobbarda mara, Gobbara dgidda*

English: Mexican Lilac, Mother of Cocoa

Spanish: Madre De Cacao

Telugu: Madri

Bengali: Sarangi

Malayalam: Seemakonna

Konkani: Saarayajaad

Malaysia: Bungajepun

Philippines: Balok balok, cacaute, kakauati, kakawate, madre de cacao, madriado, madrecacao

Thailand: Khae farang

Vietnam: Anhdàogía, sátthu, hôngmai

Description [10]:

Size and Forms: Gliricidia is a tiny, thornless, semi-deciduous tree that grows to be 3-15 meters (10-50 feet) tall and has a trunk diameter of up to 30 cm (12 inches) at breast height. If not pruned, the canopy diameter is roughly equal to the height of most provenances. The tree may have one or more trunks and has a diffuse, uneven crown. In agricultural environments, repetitive lopping can significantly alter the size and shape to meet the farmer's objectives.

Flowers: Panicles or racemes are carried at the base of leaves and measure 5–12 cm (2–5 in) in length. Each flower has a corolla of five light-pink or light-purple petals, a five-toothed calyx, and a light green (with a hint of red) colour. With a broad standard, two oblong, curving wings, and two connected petals, the flower has a typical pea-flower shape. A pistil with a red ovary and a whitish style is present, along with ten whitish stamens.

Leaves: When young, the pinnate, alternating leaves are 15–30 cm (6–12 in) long and contain a silky pubescence. A terminal leaflet and seven to seventeen leaf-let pairs are present. The leaflets are lanceolate to elliptical, measuring 3–6 cm (1.2–2.4 in) in length and 1.5–3 cm (0.6–1.2 in) in width. The tips of the leaflets are short to long-pointed, while the bases are rounded to short-pointed.

Fruits: The fruits are flattened pods with three to eight seeds that are 10 to 15 cm (4 to 6 in) long. When fully grown, they are yellow-green, turn yellow, and then turn brown or blackish. Between the ages of one and five, flowering and fruiting start.

Seed: The seeds are flat, round, glossy, and light to dark brown, with a diameter of roughly 10 mm (0.4 in). The range of 4700–11,000 seeds/kg (2100–5000 seeds/lb) varies significantly depending on the source of the seeds. When the pods dry enough that the two parts split apart and curl explosively, the seeds are released, and they can travel up to 25 meters (82 feet) from the mother tree.

Bark: The bark is grey to brown and smooth to slightly cracked.

Rooting Habit: A large, shallow, lateral root system is produced by gliricidia grown from cuttings. Although taproots form in seedlings, it is unknown if these roots persist throughout the plant's life. According to one study, trees grown from seedlings on coastal sands had well-formed lateral roots and poorly developed taproots.

Ethnomedical uses [11]: Literature-based data were used to determine the folklore applications of *G. sepium* (Jacq.) Walp. According to reports, this tree's entire parts leaves, bark, roots, etc. have ethnomedicinal qualities.

TABLE 1: ETHNOMEDICINAL USES OF THE *GLIRICIDIA SEPIUM* (JACQ.) WALP.

Country	Traditional Preparation	Parts used	Medical uses
Panama	Decoction	Leaves	Urticaria, rash, burns, erysipelas
Costa Rica	Decoction	Bark	Bacterial and Protozoal Infection
Guatemala	Decoction	Bark	Bacterial and Protozoal Infection
Philippines	Poultice	Leaves	Wound healing, skin itching or dermatitis
Philippines	Decoction and Poultice	Branches and Leaves	Pruritic ailments, fever, skin infections
Columbia	Decoction	Leaves	Pruritic ailments, fever, body ache

Phytochemicals: *Gliricidia sepium* serves as a reservoir for potent bioactive compounds such as saponins, flavonoids like astragaline, robinine, trifoline, essential oils like coumarins, hydroquinone, myrtenol, maltol. Various phytochemicals like flavones, chalcones, coumarin, o-coumaric acid, melitolic acid, ceryl alcohol, kaempherol glycosides, hydrocarbons, quercetin glycosides, hydrocarbons, quercetin glycosides, canavanin, triterpinoid saponins and rotenoids [12].

The chemical analysis of the leaf oil showed that the major classes of constituents were aliphatics (54.9%) and terpenoids (28.1%) (See **Table 2**, where the percentages of the various classes of constituents of the oils are indicated). Among the

58 aliphatic compounds identified, the major constituents were aldehydes (ca. 30%). Pentadecanal (18.7%) and nonanal (5.1%) were de main ones. Of the twenty-six terpenoids identified, none was found in high concentration. The main ones were pinocarvone (1.5%), myrtenol (1.3%), β-cyclocitral (1.1%), α-pinene (1.0%) and β-caryophyllene (1.0%). These results differ markedly from those reported for the chemical composition of *G. sepium* leaf oil obtained from plants growing at Kerala, south-western India on the Malabar Coast. Kaniampady *et al.* reported that the leaf essential oil was characterized by large amounts of propylene glycol (25.1%), (the authors claimed that it was the first report of propylene glycol obtained from a natural source), coumarin (18.2%), (Z)-3-hexen-1-ol (17.7%) and β-farnesene (14.2%) [23]. The data of the oil samples from Costa Rican leaves do not appear to confirm the presence of that main constituent and afforded only minute amounts of (Z)-3-hexen-1-ol (0.2%) and coumarin (0.8%). The flower oil consists mainly of aliphatics (58.9%) with 67 compounds identified and terpenoids (25.8%) with 35 compounds identified. The major components of the flower oil **Table 1** were hexadecanoic acid (19.7%), myrtenol (7.7%), (E)-nerolidol (5.9%), linoleic acid (3.4%), and heptacosane (3.1%). The flower oil of India contains coumarin (43.1%), hydroquinone (21.6%) and myrtenol (12.7%) [13].

TABLE 2: CHEMICAL COMPOSITION OF THE LEAF ESSENTIAL OIL OF *GLIRICIDIA SEPIUM* [14]

Identified components	Percentage
Propyleneglycol	25.1
Coumarin	18.2
(Z)-3-Hexenol	17.7
β-Farnesene	14.2
(E)-2-Hexenol	6.5
Thymol	3.6
Benzyl alcohol	3.5
Caryophyllene	2.3
α-Farnesene	2.0
2-Pentene-1-ol	≤ 1
Isovanillin	≤1
Isobutyl alcohol	≤1
Phenylethyl alcohol	≤1
Phenol	≤1
Crotonic aldehyde	≤1
5,6-Dihydro-4H-cyclopenta-(6)-furan	≤1

TABLE 3: CHEMICAL COMPOSITION OF THE FLOWER ESSENTIAL OIL OF *GLIRICIDIA SEPIUM* [14]

Identified components	Percentage
Benzyl alcohol	0.35
Nonanol	0.62
Maltol	4.42
3-Nonanol	1.50
2-Octanoic acid	1.26
2-Butyl-2-hexanol	1.46
Octanoic acid	1.53
2-Butyl-3-hexanol	1.03
Myrtenol	12.73
Dihydrocarveol acetate	0.30
Eucarvone	0.88
Geraniol	0.72
Nonanoic acid	0.55
Myrtenal	0.78
Hydroquinone	21.64
p-Mentha-1,8-dien-9-ol	1.83
4-Hydroxy-3-methylacetophenone	0.37
p-Mentha-1,4-dien-2-ol	0.73
p-Mentha-1,4-dien-7-ol	0.71
Decanoic acid	0.31

γ-Nonalactone	1.31
Coumarin	43.07
Allyl tiglate	0.44
Dodecanoic acid	0.64
Tetradecanoic acid	0.46
3Tetradecanoic acid	0.36

TABLE 4: BIOACTIVE COMPOUNDS QUALITATIVELY IDENTIFIED FROM THE LEAF ETHANOLIC EXTRACTS OF *G. SEPIUM* (JACQ.) WALP. [15]

S. no.	Name of Compound	Formula	SIa	Mol. Wt. b	Reported Biological Properties
1	n-Tridecane	$C_{13}H_{28}$	97	184	Antibacterial Antioxidant Antiproliferative against HeLa cells
2	Hexadecane	$C_{16}H_{34}$	95	226	Antibacterial Antifungal Antimicrobial Antioxidant
3	Dodecane, 4,6-dimethyl	$C_{14}H_{30}$	91	198	Antibacterial
4	2,4-Di-t-butylphenol	$C_{14}H_{22}O$	82	206	Antioxidant
5	Fumaric acid, ethyl isobutyl ester	$C_{10}H_{16}0_4$	79	200	No activity reported
6	Hexadecane	$C_{16}H_{34}$	96	226	Antibacterial Antifungal Antimicrobial Antioxidant
7	Heneicosane	$C_{21}H_{44}$	91	296	Antibacterial Anti-inflammatory Antimicrobial Antioxidant
8	Octadecanal	$C_{18}H_{36}O$	89	268	No activity reported
9	Hexadecane	C16H34	94	226	Antibacterial Antifungal Antimicrobial Antioxidant
10	Neophytadiene	$C_{20}H_{38}$	93	278	Anticancer agent Antifungal Anti-inflammatory Antimicrobial Antioxidant
11	Neophytadiene	$C_{20}H_{38}$	89	278	Anticancer agent Antifungal Anti-inflammatory Antimicrobial Antioxidant
12	3,7,11,15-Tetramethyl-2-hexadecen- 1-ol	$C_{20}H_{40}O$	88	296	Antimicrobial, Antidiuretic, Anticancer Antioxidant
13	Eicosane	$C_{20}H_{42}$	88	282	Antibacterial Cytotoxic effects Anti-corrosive agents Anti-fungal Antioxidant Antitumor activity
14	Hexadecanoic acid, ethyl ester	$C_{18}H_{36}O_2$	93	284	Antibacterial Antioxidant
15	Heneicosane	$C_{21}H_{44}$	90	296	Antibacterial Anti-inflammatory Antimicrobial Antioxidant
16	Phytol	$C_{20}H_{40}O$	96	296	Anticancer Anti-inflammatory properties Antimicrobial
17	Lupeol acetate	$C_{32}H_{52}O$	85	468	Anti-snake venom, Antimicrobial, Anti -inflammatory, Antioxidant

Pharmacological Activities:

Anti- inflammatory Activity: Inflammation is a prevalent condition in all age groups, regardless of gender, and using NSAIDS to treat inflammation causes vascular and GI problems. Anti-inflammatory medications on the market provide symptomatic relief with side effects. Nowadays, medicinal plants and their formulations are employed for a variety of illnesses in both ethnomedical traditions and India's traditional medical system. Furthermore, these natural therapies can be employed to treat problems rather than simply masking symptoms. Herbal medications are becoming increasingly important in the treatment of chronic and acute disorders without side effects. *Solanum trilobatum, Plumeria acuminate, Thesium chinense,* Mexican medicinal plant extracts, and crude saponin extracts all

demonstrated anti-inflammatory activity in carrageenan-induced paw oedema. In an *in-vitro* study, the plant extract demonstrated a dose-dependent membrane stabilisation effect by reducing hypotonicity-induced RBC membrane lysis. The RBC membrane is similar to the lysosomal membrane, and its stability implies lysosomal membrane stabilisation. It plays an important function in reducing the pathogenic mechanisms involved in inflammation by increasing the release of activated neutrophils, bactericidal enzymes, and proteases, which cause more tissue inflammation and damage. The anti-inflammatory action of the extract could be attributed to the presence of flavonoids and saponins in the plant.

The aqueous extract of the *Gliricidia sepium* was studied for in vitro anti-inflammatory activity by HRBC membrane stabilization method. The plant extract showed dose dependant anti-inflammatory activity and % protection of HRBC in hypotonic solution. Results were compared with standard diclofenac. Aqueous extract of flowers 250 & 500 mg/kg and standard drug were tested for anti inflammatory activity at different hours in carrageenan induced paw edema model using water plethysmometer. Diclofenac sodium at 10 mg/kg, Aqueous extract administered at a dose of 250 and 500 mg/kg p.o. at 1, 3, 6 and 8 hours significantly [*P<0.05,**P<0.01, ***P<0.001] decreased and increased the volume of paw edema & % protection compared to carrageenan group and diclofenac respectively. Aqueous extract at 250 p.o. at 1, 3, 4 and 8 hours prevented the carrageenan induced paw edema with a percentage inhibition of 5.66±1.21, 35.12±4.36, 51.06±5.90, 69.81±2.93 at 1, 3, 4, 8 hour, respectively., while 14.81±3.37, 43.15±5.51, 57.62±6.07, 78.07±3.19 at dose of 500 mg/kg p.o. at 1, 3, 4, 8 hour, respectively. Diclofenac sodium decreased the carrageenan induced paw edema with a percentag inhibition of 33.66±4.37, 50.21±4.06, 61.73±2.75, 84.04±1.54 at 1, 3, 4, 8 hour, respectively [16].

Wound Healing Property: Pathological processes, whether internal or external, can induce structural and functional damage to certain organs, leading to injuries. Injuries can occur due to sharp or blunt items, temperature changes, chemicals, electric shock, or animal bites. Incision wounds are injuries caused by cutting with a sharp instrument, such a scalpel, during surgery. Clean and aseptic wounds are usually closed with stitches.

Wound healing requires complicated cellular and metabolic reactions, both locally and systemically. Tissue healing occurs during the inflammatory phase. The release of inflammatory mediators, including IL-1β, IL-6, TGF-β, and TNF-α, is enhanced. These cytokines promote inflammation in response to tissue injury, macrophage migration, and other pro-inflammatory stimuli.

Effect of Ointment Containing *G. sepium* Leaves on Inflammatory Cells: The treatment groups' macroscopic observations of the rats' wound healing varied. The wound in the positive control group had not yet closed and seemed to be in the inflammatory phase, which usually lasts two to four days. On day three, the incision wounds in the groups that received ointment containing *G. sepium* leaves from the Philippines or Indonesia started to close or were fully closed.

Effect of Ointment Containing *G. sepium* Leaves on IL-1β Expression: The positive control (T1) group's IL-1β expression was 41.28±9, which was employed as a proxy for normal rat IL-1β expression. Compared to ointment therapy using *G. sepium* leaves from Indonesia, ointment therapy using *G. sepium* leaves from the Philippines improved wound healing. In comparison to the negative control therapy, this was predicated on lower inflammatory cell counts and lower expression of IL-1β and IL-6 [17].

Anti-microbial Activity: The ethanol extract of *Gliricida sepium* leaves was evaluated in this study against a few harmful bacteria and fungi. The existence or lack of an inhibitory zone and diameter, respectively, were used to quantitatively evaluate the extract's antimicrobial activity. *G. sepium* extract showed activity against all gram-ve organisms at 20mg ml^{-1} concentration while at 10 $mgml^{-1}$ and 5 $mgml^{-1}$ concentration showed good and low activity respectively all these concentration showed significant difference ($p > 0.05$). At 5mg ml^{-1} concentration *Klebsiella pneumoniae* was found resistant as concentration increases extract showed significant inhibitory activity.

At a 20 mg ml^{-1} concentration equivalent to a typical antibiotic, the extract demonstrated notable efficacy in gram-positive organisms. These results were consistent with those of Jhon *et al.* (2006) and Abulude and Adebote (2009), who also found that *G. sepium* ethanol extract shown strong antimicrobial activity against *Escherichia coli, Bacillus subtilus,* and *Staphylococcus aureus*. Similarly, 22 Mexican medicinal herbs had antibacterial action against Escherichia coli and Staphylococcus aureus, according to Kakuko *et al.* (2005). Nonetheless, certain tests conducted on various solvents, such as methanol and chloroform extract of *G. sepium* bark, as well as on the essential oils of the plant's leaves and flowers, also demonstrated notable efficacy against various bacterial strains.

None of the fungi exhibited any discernible action at the maximum dose of 20 mg ml^{-1}. At this level, *Fusarium solni, Rhizomucor pusillus, Trichophyton sclerosis, Macrophomnia phaseolina, and Rhizoctonia solani* demonstrated good activity. While Aspergillus effuses demonstrated low activity at 20 mg ml^{-1} and were resistant at 10 and 5 mg ml^{-1}. *G. sepium* had notable activity against *Candida albican* in certain investigations.

Therefore, an effort has been made to ascertain the ethanol extract's minimal inhibitory concentration against gram-positive and -ve bacteria as well as fungi. The MIC value of 1 mg ml^{-1} was discovered in gram-positive bacteria (*Staphylococcus aureus, Streptococcus intermedius, Bacillus pumilus, B. subtilus, and B. cereus*). Against the gram-negative bacteria (*Escherichia coli, Salmonella typhi, Shigella flexneri, Proteus mirabilus,* and *Klebsiella pneumoniae*), the MIC value was determined to be 0.5 $mgml^{-1}$. Against fungi MIC value was $2mgml^{-1}$ except *Aspergillus effuses* which is somewhat resistant. It is acceptable to say that *G. sepium* ethanol extract has more potent antibacterial than antifungal ingredients and can be a good source of chemical compounds [18].

Nematicidal Activity: Worldwide, insect-transmitted diseases continue to be a leading cause of disease and health risks. Every year, more than 700 million individuals are infected by mosquitoes alone. Three million people die from malaria alone every year, including one kid every 30 seconds. There is a risk of mosquito-borne illnesses everywhere in the world, even if they are now more prevalent in tropical and subtropical regions. An infectious female Anopheles mosquito that has already acquired the plasmodia from a malaria patient is typically the sole way for a human to contract malaria. Numerous dangerous illnesses, such as dengue fever and yellow fever, which have lately afflicted Pakistan and nearly reached epidemic proportions, are spread by *Aedes aegypti* mosquitoes.

Measured amounts of plant leaf extract were dissolved in water to create the G/1, G/2, G/3, G/4, and control dilutions. One hundred newly born second stage juveniles of Meloidogyne spp. were moved to several Petri plates in order to assess the nematoidal effect of the plant extract. All dilutions were added in measured amounts, with pure water serving as the only control. Three duplicates of each treatment were made. For forty-five hours, the Petri plates were maintained at room temperature (28±2ºc). By preserving them in distilled water for a full day, the quantity of active and inactive nematodes was verified, and the % mortality was computed.

It has been observed that G/2 dilution is highly significant showing 60% mortality against control and G/3, G/4. Sixty percent mortality of nematodes in above mentioned plant extract can be attributed to the presence of some toxic chemical in them. Although 97% mortality in G/1 dilution, but may be this concentration toxic for plant would be effect on growth yield [19].

Mosquitoes Repellent Activities: Arm-in-cage experiments, in which participants place their repellent-treated arms within a cage containing a predetermined number of unfed mosquitoes, were used to measure the length of protection offered by each product. To ensure that no area was left exposed, 0.2 ml of the ethanol extract from Gliricidia leaves was equally distributed over a hand and a portion of a forearm. After that, the treated hand region was left out for five minutes at half-hour intervals in a cage with fifty unfed *Aedes aegypti* mosquitoes that were four to five days old. The highest effective repellent time was found to be the amount of time that passed between the treatment and the first confirmed bite.

The Gliricidia extract's results were contrasted with those of the conventional repellant, citronella oil. The maximum repellency percentage afforded by the repellent *G. sepium* was 78%, whereas with citronella oil, the repellency percentage was 74% respectively. As a result of the present studies it may be concluded that the ethnolic leaves extract of *Gliricidia sepium* is non-irritating and longer lasting than the standard repellent [20].

Antisickling Activity: A single amino acid alteration (Glu---Val) at the sixth position of the b-globin chains of hemoglobin causes sickle cell disease (SCD), a genetic blood condition. This single amino acid substitution causes a significant reduction in the solubility of the deoxy form of sickle haemoglobin (deoxy-Hb S), causing polymer formation inside the red blood cells. These modified erythrocytes have the ability to block the vasculature through a complicated interaction of adhesion events among blood cells and causing organ damage, hemolytic anemia, pain episodes, and early death. Even though SCD's molecular basis is fully understood, the intricate processes that underlie vasoocclusion (VOC) have not been explained in detail.

The sickling test's basic idea was based on the microscopic observation that red blood cells sickle when subjected to low oxygen tension. This technique involves mixing a drop of blood with a drop of sodium metabisulphite on a sterile glass slide and slipped the cover. Sodium metabisulphite is a reducing agent that speeds up sickling by quickly converting oxyhaemoglobin to reduced hemoglobin. The characteristic sickle-shaped red blood cells will show up in positive results [21].

Larvicidal Activity: Species that act as vectors for this investigation, mosquitoes were chosen. A significant epidemiological vector, mosquitoes are responsible for the spread of numerous viral diseases, such as dengue, chikungunya, and yellow fever. In the current study, mosquito larvae were cultivated and stored in a bottle at room temperature with potato extract that was placed at different points around homes. After being collected, the larvae were brought into the lab and identified at the species level using a standard manual. In order to test for larvicidal activity, the screened larvae were kept at (28 ±2 °C).

With minor adjustments, the WHO standard protocol was followed for the larvicidal bioassay, and results were monitored after 24 and 48 hours. The death rate at the end of 24 hours varied with extract concentration; only 10% to 25% of mortality was noted at 2000 ppm and 3000 ppm concentrations. 60% of the larvae perished at a concentration of 10,000 ppm, but all of the larvae died after 48 hours, regardless of concentration. The current investigation suggests that *Gliricidia sepium* methanol extract would make an excellent larvicidal medication option [22].

Anti-oxidant Activity: With an IC_{50} value of 144 ppm, the ethanolic extracts have demonstrated themselves to be a promising source of antioxidants. The sample's antioxidant capacity in relation to the standard was ascertained using IC_{50}. IC_{50}< 50 ppm indicated a very strong antioxidant, IC_{50}< 50 ppm indicated a strong antioxidant, IC_{50}< 100 ppm indicated a medium antioxidant, and IC_{50}> 150 ppm indicated a weak antioxidant. According to the findings, *G. sepium* (Jacq.) Walp. is a medium antioxidant [23].

Thrombolytic Activity: Using aqueous two-phase systems with polyethylene glycol and sodium phosphate, a cysteine protease with fibrinolytic and fibrinogenolytic activity was extracted, resulting in the promising thrombolytic activity of *Gliricidia sepium*. Another source of the fibrinolytic enzymes is *Gliricidia sepium* [24].

CONCLUSION: The *Gliricidia sepium* plant has valuable phytochemicals used in medicine and other fields. It has promising results in several biological activity tests, including cytotoxicity, anti-microbial, anti-inflammatory, anthelmintic, larvicidal, and antioxidant action. Further research on *Gliricidia sepium* is required to uncover its further secrets.

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