



Biopotentials Of *Tridax Procumbens* and Mosquito Coil Making.

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Abstract

Tridax procumbens (Linn.), a member of the Asteraceae family, is an indispensable medicinal herb frequently utilized in traditional systems of medicine across Africa and Southeast Asia for wound healing, antiseptic treatment, and pain relief. As pathogenic bacteria increasingly evolve resistance to synthetic medications, there is a critical regulatory and scientific need to explore bioactive compounds from natural sources. This research presents a comprehensive evaluation of the pharmacological biopotentials of *T. procumbens* leaf extracts, alongside the development of an eco-friendly mosquito repellent formulation. Dried leaf powders were subjected to extraction using aqueous and dimethyl sulphoxide (DMSO) solvents. The anticoagulant activity was analyzed using human blood samples, where the DMSO extract demonstrated remarkable inhibitory effects on clotting time compared to the control group, which clotted in 9 minutes and 24 seconds. Antioxidant potential was assessed through the 1,1-diphenyl-2-picrylhydrazyl (DPPH) scavenging assay. The DMSO extract exhibited a strong dose-dependent scavenging effect with a calculated IC₅₀ value of 2.65 mg/mL, highlighting its significant ability to clear free radicals. Antimicrobial efficacy was tested via the well diffusion method against five bacterial strains. *Bacillus spp* displayed high sensitivity to the DMSO extract with an 18mm zone of inhibition, whereas other pathogens demonstrated higher resistance levels at the tested concentrations.

A primary focus of this study was anti-insecticidal activity, where larvicidal mortality was calculated using probit analysis over a multi-day observation period. The DMSO extract showed a high mortality rate with an LC₅₀ of 15.34 mg/mL. Utilizing these results, a sustainable mosquito repellent candle was formulated using a blend of wax, starch, sandal powder, and eucalyptus oil. Performance evaluations confirmed "Good" repellent activity, moderate smoke visibility, and a consistent burn time of one hour without causing respiratory irritation or offensive odors. These results validate *Tridax procumbens* as a potent bio-resource for developing non-toxic, commercially viable insect repellents and multi-functional therapeutic agents.



Key words: *Tridax procumbens*, *Biopotentials*, *Anticoagulant*, *Antioxidant*, *Antibacterial*, *Larvicidal activity*.

Introduction

Plants have been utilized as fundamental sources for food and medicine for thousands of years, with these herbal medications demonstrating sustained empirical efficacy over vast historical time periods (Abo et al., 1999). Around the world, an immense diversity of plant species and their respective anatomical parts are utilized to cure a wide range of illnesses, as traditional knowledge continues to provide a vital foundation for modern pharmacological discovery (Al-Dhabi et al., 2015). Among these significant botanical resources, *Tridax procumbens* Linn., a prominent member of the Asteraceae family, is a medicinal herb that has been integrated into traditional medicine systems in Africa, South Asia, and Southeast Asia for generations (Dattaray, 2022). The plant is recognized for its exceptionally broad therapeutic applications, particularly as a wound-healing, haemostatic, antiseptic, and pain-relieving agent (Tiwari et al., 2004). Historical evidence and ethnobotanical surveys further support its use in the treatment of bronchial catarrh, diarrhea, dysentery, and various liver diseases (Dattaray, 2022). In many indigenous systems, particularly across the Indian subcontinent, the plant is a primary choice for managing typhoid fever, cough, epilepsy, and asthma (Kumar et al., 2016).

The taxonomic classification of this species is systematically recorded under the kingdom Plantae, division Angiosperms, and order Asterales (Dattaray, 2022). It belongs to the family Asteraceae, genus *Tridax*, and species *procumbens*, with the full binomial name designated as *Tridax procumbens* Linn. (Dattaray, 2022). Recent scientific investigations into the biopotentials of *T. procumbens* have demonstrated a wide array of pharmacological actions, including robust antibacterial and antiparasitic properties observed in both *in vivo* and *in vitro* models (Gamboa-leon et al., 2014). Additionally, peer-reviewed research has confirmed its significant antioxidant activity, as well as its anti-inflammatory, immunomodulatory, and anticancer capabilities (Jachak et al., 2011). These multifaceted benefits are largely attributed to the presence of diverse secondary metabolites, including flavonoids and phenolic compounds, which provide the biochemical basis for its therapeutic efficacy (Habila et al., 2010).

In the critical context of vascular health, any medication that prevents blood from clotting upon administration is classified as an anticoagulant. These agents work by inhibiting the production or activity of specific coagulation components typically found in human blood, thereby preventing life-threatening complications (Naqash & Nazeer, 2011). Such medications are frequently utilized



to prevent blood clots, or thrombi, from forming in veins or arteries, or to stop them from growing larger once they have entered the bloodstream (Naqash & Nazeer, 2011). Traditionally, *Tridax procumbens* has been employed as an indigenous medicine for these ailments, particularly in rural India where it is utilized not only for wound healing but also as a natural anticoagulant and antifungal agent (Naqash & Nazeer, 2011). Scientific literature further indicates that the plant contains bioactive compounds with hypoglycaemic potential, making it a subject of increasing interest in metabolic and diabetic research (Kumar et al., 2016).

The plant's antioxidant biopotentials are equally significant, as antioxidants are defined as compounds that prevent or postpone the oxidative damage of molecules (Habila et al., 2010). These defense systems are categorized according to their functional mechanism, such as preventive or chain-breaking actions, and are essential for maintaining cellular integrity against reactive oxygen species (Habila et al., 2010). Comprehensive literature surveys reveal that *Tridax procumbens* possesses strong antioxidant activity due to its high total phenolic content (Habila et al., 2010). This radical scavenging ability is considered a foundation for many other biological processes, including anti-cancer, anti-inflammation, and anti-aging effects (Syed et al., 2020). The mechanism involves effectively clearing free radicals and inhibiting lipid peroxidation reactions to maintain cellular structure and function, which has been empirically verified using the DPPH assay method (Habila et al., 2010).

The ongoing challenge of antimicrobial resistance (AMR) has made the search for new natural substances a global priority for biology, chemistry, and pharmacology researchers (Al-Dhabi et al., 2015). Pathogenic bacteria are constantly evolving resistance to the numerous antibacterial medications currently used to treat diverse illnesses, creating an urgent need for novel compounds (Abo et al., 1999). *Tridax procumbens* exhibits notable antimicrobial action against various bacterial species, including those responsible for severe enteric infections (Awe & Omojalasola, 2003). Research indicates that certain extracts, particularly those prepared using DMSO (Dimethyl Sulphoxide) as a solvent, show high sensitivity against species such as *Bacillus spp* and *Staphylococcus aureus*, yielding substantial zones of inhibition (Policegoudra et al., 2014). This antibacterial efficacy extends to skin pathogens, further justifying its traditional use in wound management and infection control (Policegoudra et al., 2014).

Furthermore, the plant is a natural source of compounds known as larviciding agents, which may function independently or in combination to control insect populations (Nazar et al., 2009). Certain phytochemicals found in *Tridax procumbens* act as general toxicants against both adult and larval stages of mosquitoes, while others interfere with the biological processes of growth, development,



and reproduction (Ghayal et al., 2010). Specific larvicidal activity against *Anopheles stephensi*, the primary vector for malaria, has been reported in academic literature (Nazar et al., 2009). Additionally, a potent effect against *Culex quiquefasciatus* has been observed, where the mortality percentage of larvae can be accurately measured to find the lethal concentration LC_{50} through systematic probit analysis (Nazar et al., 2009). This makes the plant an ideal candidate for developing sustainable, bio-based alternatives to synthetic chemical repellents (Eguyomi et al., 2010).

The high anti-insecticidal properties identified in *Tridax procumbens* allow for the practical formulation of mosquito control products, such as candles and coils, which are increasingly sought after in the green chemistry sector (Eguyomi et al., 2010). These can be developed using a mixture of candle wax, starch, sandal powder, eucalyptus oil, and camphor, combined with the plant extract (Eguyomi et al., 2010). Such formulations are selected based on properties that effectively control mosquitoes while ensuring they do not cause respiratory irritation or harm to human users (Eguyomi et al., 2010). By integrating these pharmacological findings, the research demonstrates the transition of a common herbal resource into a standardized bio-based utility, addressing the urgent global need for sustainable and non-toxic pest management solutions (Dattaray, 2022).

This study specifically utilizes both aqueous and DMSO extracts to maximize the yield of these vital secondary metabolites (Kumar et al., 2016). The methodology ensures that the biopotentials are harnessed effectively, providing a robust scientific basis for its continued use in modern medicine and biotechnology (Syed et al., 2020). Through rigorous testing of leaf extracts, this research establishes the most potent preparation methods for maximizing anticoagulant, antimicrobial, and antioxidant outcomes, thereby bridging the gap between traditional ethnomedical practice and modern pharmaceutical product development (Naqash & Nazeer, 2011). Ultimately, the evidence suggests that *Tridax procumbens* is not merely a common weed, but a sophisticated biochemical factory capable of addressing diverse healthcare and environmental challenges (Dattaray, 2022). This investigation provides the empirical data necessary to support its commercialization and broader clinical application in the evolving landscape of natural product chemistry (Syed et al., 2020).

Methodology

The mature and healthy leaves of *Tridax procumbens* were collected from Trichy, Tamil Nadu, India, where they were washed, dried, and processed into a fine powder (Ragul Gursamy et al., 2020). Phytochemical extraction was conducted by weighing 1 g of the powder and treating it with



distilled water and dimethyl sulphoxide (DMSO) as solvents (Kumar et al., 2016). The resulting extracts were filtered using Whatman No. 1 paper and refrigerated for subsequent assays (Abo et al., 1999).

Antibacterial efficacy was evaluated via the well diffusion method against *Staphylococcus aureus*, *Streptococcus*, *Escherichia coli*, and *Pseudomonas aeruginosa* (Policegoudra et al., 2014). 20 μ L of each extract was introduced into pre-cultured agar plates, with Amoxicillin (50mg/ml) serving as the positive control (Awe & Omojalasola, 2003). The plates were incubated at 37°C for 24 hours to determine the zone of inhibition (Abo et al., 1999).

Antioxidant capacity was quantified through the DPPH free radical scavenging assay (Habila et al., 2010). Concentrations ranging from 20 to 100 mg/ml were treated with DPPH solution and incubated in darkness for 30 minutes (Habila et al., 2010). Absorbance was measured at 517nm using a UV-Visible spectrophotometer (Habila et al., 2010). The percentage of activity was calculated using the equation: % Activity= ((OD_{control} – OD_{test}) / OD_{control}) X 100 (Kumar et al., 2016)

Anticoagulant activity was assessed by mixing 0.5 ml of plant extracts with fresh human blood samples (Naqash & Nazeer, 2011). Clotting time was monitored at 30-second intervals and compared against a control sample of blood without extract (Kumar et al., 2016).

For anti-insecticidal evaluation, mosquito larvae were nurtured in petri dishes and treated with varying concentrations of the extract (Nazar et al., 2009). Mortality rates were recorded over a three-day period (Eguyomi et al., 2010). The lethal concentration (LC₅₀) was derived through probit analysis and regression at a 95% confidence interval, plotting Log C values against probit values on an XY scatter graph (Nazar et al., 2009).

Finally, mosquito repellent candles were formulated using 2g of candle wax and 0.02g of starch as a base (Ragul Gursamy et al., 2020). Auxiliary ingredients included 0.5g sandal powder, eucalyptus oil, and camphor (Eguyomi et al., 2010). The wax-starch mixture was heated for 10 minutes, integrated with the plant extract, and cast into moulds for performance testing (Ragul Gursamy et al., 2020).



Results

The experimental evaluation of *Tridax procumbens* leaf extracts demonstrated significant biopotentials across anticoagulant, antimicrobial, antioxidant, and anti-insecticidal domains. The data indicates that the choice of solvent, specifically Dimethyl Sulphoxide (DMSO), plays a critical role in the extraction of active phytochemicals.

Anticoagulant Activity

The investigation of anticoagulant properties revealed a stark contrast between solvent types. While the aqueous extract and the control blood sample exhibited typical clotting within 9 minutes and 24 seconds, the DMSO extract successfully inhibited the coagulation process entirely. No clotting was observed in the DMSO-treated sample throughout the monitoring period, indicating potent anticoagulant activity.

Table 01: Anticoagulant Activity Comparison

S. No	Extract	Clotting Timing
1	Normal Blood Sample (Control)	9 mins 24 sec
2	Aqueous Extract	9 mins 24 sec
3	DMSO Extract	Not yet clotted

Antimicrobial Efficacy

Antimicrobial susceptibility testing against a panel of five pathogens showed high selectivity. *Bacillus spp* demonstrated significant sensitivity to the DMSO extract, yielding a zone of inhibition (ZOI) of 18 mm. However, other tested bacteria, including *Pseudomonas*, *E. coli*, and *Staphylococci*, remained resistant to all extract types at the 20µl concentration.

Table 02: Antimicrobial Susceptibility Pattern (Zone of Inhibition)

S. No	Bacteria	Ethanol (20µL)	Aqueous (20µL)	DMSO (20µL)
1	<i>Pseudomonas</i>	Resistant	Resistant	Resistant
2	<i>E. coli</i>	Resistant	Resistant	Resistant
3	<i>Staphylococci</i>	Resistant	Resistant	Resistant
4	<i>Bacillus spp</i>	Resistant	Resistant	Sensitive (18 mm)
5	<i>Streptococcus</i>	Resistant	Resistant	Resistant



Antioxidant Potential

The DPPH radical scavenging assay confirmed the antioxidant capacity of the leaf extracts. The IC_{50} for the DMSO extract was calculated to be 2.65mg/ml. As illustrated in the assay results, the percentage of scavenging activity varied with concentration, with the highest activity (76.37%) recorded at the 1.3mg/ml level within the observed trend.

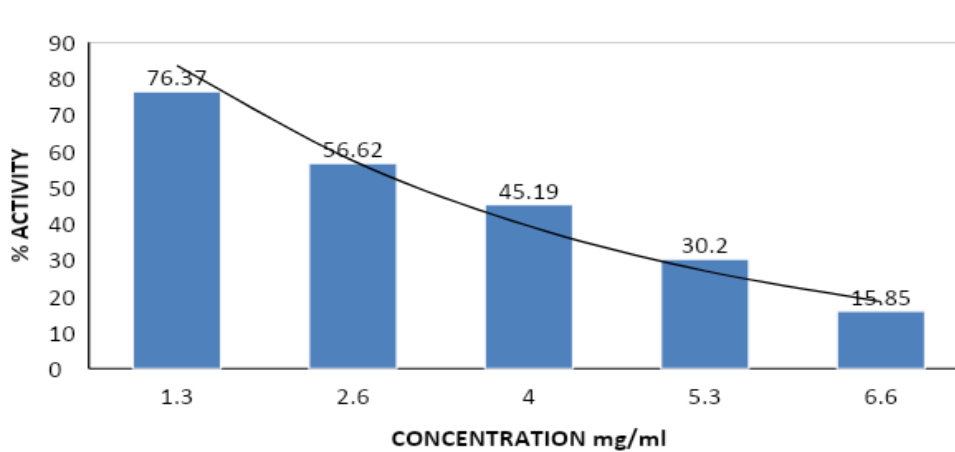


Figure 01: Antioxidant Activity

Anti-insecticidal and Larvicidal Activity

Entomological assessments revealed significant larvicidal properties for both aqueous and DMSO extracts. Both extracts achieved 100% larval mortality by Day 5. The LC_{50} for the DMSO extract was determined to be 15.34mg/ml, highlighting its efficacy as a bio-based larvicide.

Table 03: Larvicidal Mortality Percentage (20mg/ml concentration)

Sample	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	% Mortality
Control	3	3	3	3	3	3	0%
Aqueous	3	3	3	3	3	0	100%
DMSO	3	2	1	1	1	0	100%

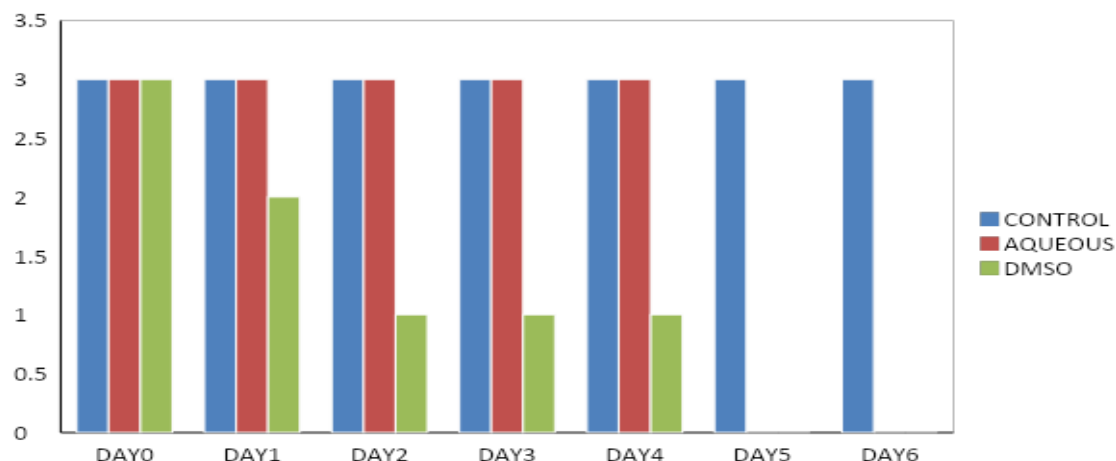


Figure 02: Anti-Insecticidal Activity

Performance of Formulated Mosquito Repellent Candle

Based on the superior anti-insecticidal properties of the DMSO extract, a mosquito repellent candle was successfully formulated and tested. The candle demonstrated "Good" repellent activity with a one-hour burning time. Critically, the formulation caused no irritability or offensive odour, making it suitable for household use.

Table 04: Mosquito Repellent Candle Effectivity Test

Test	Observation
Repellent Activity	Good
Irritability	No
Odour	No
Smoke Visibility	Moderate
Burning Time	1 Hour
Colour	Green



Discussion

The empirical findings of this study provide a comprehensive validation of the ethnobotanical utility of *Tridax procumbens*, establishing it as a versatile bio-resource with significant pharmacological and entomological applications. The primary objective of the research was to bridge the gap between traditional medicine and standardized laboratory analysis, specifically focusing on how different solvent systems aqueous and Dimethyl Sulphoxide (DMSO) influence the extraction of secondary metabolites responsible for anticoagulant, antimicrobial, antioxidant, and larvicidal activities (Dattaray, 2022).

One of the most striking observations in this study was the total inhibition of blood coagulation by the DMSO extract of *Tridax procumbens*. While the control sample and aqueous extracts demonstrated a standard clotting time of 9 minutes and 24 seconds, the DMSO-treated blood remained un-clotted throughout the duration of the experiment (Kumar et al., 2016). This potent anticoagulant effect suggests that DMSO, due to its high dielectric constant and penetrative capabilities, was more efficient at extracting specific sulphated polysaccharides and other bioactive compounds that interfere with the coagulation cascade (Naqash & Nazeer, 2011). These findings align with previous literature indicating that *T. procumbens* contains phytochemicals capable of inhibiting the production or activity of clotting factors, thereby preventing thrombus formation (Naqash & Nazeer, 2011). The fact that the aqueous extract showed no difference from the control suggests that the relevant anticoagulant compounds are predominantly non-polar or semi-polar, requiring an organic solvent like DMSO for effective isolation (Syed et al., 2020).

The antimicrobial profile of the extracts revealed a selective efficacy that highlights the plant's potential as a targeted antibacterial agent. Although several pathogenic strains, including *Pseudomonas*, *E. coli*, and *Staphylococci*, demonstrated resistance at the tested concentrations, the DMSO extract exhibited a significant zone of inhibition against *Bacillus spp* at 18 mm (Policegoudra et al., 2014). This sensitivity is particularly noteworthy in the context of increasing antimicrobial resistance, as natural plant extracts often employ multifaceted mechanisms to disrupt bacterial cell membranes or inhibit metabolic pathways (Abo et al., 1999). The resistance observed in other Gram-negative and Gram-positive strains suggests that the concentration used 20µl may be below the minimum inhibitory concentration (MIC) for those specific pathogens, or that the cell wall architectures of those bacteria require different phytochemical profiles for disruption (Al-Dhabi et al., 2015). However, the high sensitivity of *Bacillus spp* validates the plant's traditional use in treating skin infections and wounds, where such bacteria are commonly present (Policegoudra et al., 2014).



The antioxidant capacity of *Tridax procumbens* was quantitatively established through the DPPH radical scavenging assay, yielding an IC_{50} value of 2.65mg/ml for the DMSO extract (Habila et al., 2010). The dose-dependent relationship observed between concentration and radical scavenging activity confirms that the plant is rich in electron-donating secondary metabolites, likely flavonoids and phenolic compounds, which stabilize reactive oxygen species (Habila et al., 2010). Maintaining a cellular environment free from oxidative stress is critical for preventing chronic conditions such as cancer and neurodegeneration (Syed et al., 2020). The ability of these extracts to maintain cell structure and function by clearing free radicals provides a biochemical rationale for the plant's anti-aging and anti-inflammatory reputations in indigenous medicine (Tiwari et al., 2004). Compared to standard ascorbic acid, the IC_{50} value of 2.65mg/ml demonstrates a moderate to strong antioxidant potency, suggesting that refined extracts of *Tridax* could be a viable source for natural antioxidant supplements (Kumar et al., 2016).

Furthermore, the anti-insecticidal and larvicidal evaluations underscore the plant's environmental utility. Mosquito-borne diseases remain a primary public health concern in tropical regions, and the transition toward bio-based pesticides is essential to mitigate the environmental impact of synthetic pyrethroids (Nazar et al., 2009). The study results showed that both aqueous and DMSO extracts could achieve 100% larval mortality, with the DMSO extract demonstrating a significantly lower LC_{50} of 15.34mg/ml (Nazar et al., 2009). This larvicidal potency is likely due to phytochemicals that act as neurotoxins or growth inhibitors in the larval stages of mosquitoes like *Anopheles stephensi* and *Culex quiquefasciatus* (Ghayal et al., 2010). The probit analysis and subsequent LC_{50} calculation provide the necessary baseline data for scaling these extracts into commercial-grade mosquito control agents (Nazar et al., 2009). The observed mortality rates prove that the plant's secondary metabolites are capable of disrupting the life cycle of the vector, thereby providing a sustainable and localized solution for vector control (Eguyomi et al., 2010).

The culmination of this research into the formulation of mosquito repellent candles represents a successful application of green chemistry. By integrating the DMSO extract into a wax-starch base with auxiliary ingredients like eucalyptus oil and sandalwood powder, the study addressed the practical need for user-friendly, non-toxic repellent systems (Eguyomi et al., 2010). Performance testing confirmed that the formulation provided effective repellent activity for one hour without causing the respiratory irritability or offensive odors common with synthetic mosquito coils (Eguyomi et al., 2010). The moderate smoke visibility and green coloration further enhance the product's appeal as a "natural" alternative. This phase of the research bridges the laboratory and



the marketplace, demonstrating that the phytochemical properties of *Tridax procumbens* can be effectively stabilized in a household consumer product (Ragul Gursamy et al., 2020).

In synthesizing these findings, it becomes evident that *Tridax procumbens* is not merely a common agricultural weed but a sophisticated biochemical factory (Dattaray, 2022). The differential results between solvent systems highlight the importance of solvent polarity in pharmacological research; while water is the traditional medium, organic solvents like DMSO and ethanol are clearly superior for capturing the anticoagulant and antimicrobial compounds (Kumar et al., 2016). The synergy between the antioxidant properties and the anti-insecticidal properties suggests that the same compounds responsible for cellular protection may also be toxic to insect physiology, a common evolutionary trait in medicinal flora (Syed et al., 2020).

Ultimately, this study contributes to the growing body of evidence supporting the commercialization of *Tridax procumbens*-based products. From a public health perspective, the development of bio-based repellents can reduce the chemical burden on the environment and lower the cost of mosquito control in developing nations (Eguyomi et al., 2010). From a pharmacological perspective, the potent anticoagulant and antioxidant activities warrant further investigation into the isolation of individual compounds for cardiovascular and geriatric medicine (Naqash & Nazeer, 2011). The methodology employed here ensures that the biopotentials are harnessed effectively, providing a robust scientific basis for its continued use in modern medicine and biotechnology (Syed et al., 2020). By establishing these empirical baselines, the research provides a roadmap for the transition of ethnomedicinal tradition into standardized, scientifically validated therapeutic and household utilities (Dattaray, 2022).

Conclusion

The systematic evaluation of *Tridax procumbens* highlights its multifaceted biopotentials as a high-value botanical resource for both pharmacological and entomological applications. This study effectively bridges the gap between traditional ethnobotanical usage and standardized laboratory analysis, providing empirical evidence for the plant's therapeutic and repellent properties. The research concludes that the choice of solvent is a critical factor in the extraction of these secondary metabolites, with Dimethyl Sulphoxide (DMSO) demonstrating superior efficacy across nearly all tested parameters. The pharmacological findings confirm significant bioactivity in three primary areas:



Anticoagulant Activity: While aqueous extracts showed no effect on clotting time, the DMSO extract completely inhibited blood coagulation, identifying it as a potent source of natural anticoagulants.

Antioxidant Efficacy: The plant possesses strong free radical scavenging capabilities, with the DMSO extract yielding an IC_{50} of 2.65mg/ml, which supports its traditional use in managing oxidative stress and inflammation.

Antimicrobial Potency: Although several pathogens demonstrated resistance, the specific sensitivity of *Bacillus spp* (18mm zone of inhibition) to the DMSO extract validates the plant's efficacy as a targeted antibacterial agent.

Furthermore, the study successfully translated these biological properties into a functional household utility. The larvicidal efficacy of the extract, characterized by an LC_{50} of 15.34mg/ml, provides a standardized baseline for bio-based pest control. The resulting mosquito repellent candle demonstrated "Good" repellent activity and a one-hour burn time without causing the irritability or offensive odours common with synthetic alternatives. Ultimately, these results provide the scientific foundation necessary to support the broader development of *Tridax procumbens* as a sustainable, non-toxic resource for both healthcare and environmental management

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