



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Mosquito Repellents Herbal Plants

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ABSTRACT:

Herbal mosquito repellents are a promising alternative to synthetic chemicals. Various studies have identified several plant-based ingredients with mosquito-repelling properties. While herbal plants can be valuable in treating malaria, it's crucial to prioritize evidence-based treatments and consult with healthcare professionals for proper diagnosis and treatment. Artemisia annua (Sweet Wormwood): Contains artemisinin, a compound used in modern antimalarial medications. The growth and spread of resistance to all first-line antimalarial drugs used in the treatment of malaria today has caused many problems in eradicating malaria in various countries in the world. Researchers have begun to look for candidates for new antimalarial drug compounds derived from natural products that have been scientifically proven to have antimalarial activity. This is done to replace antimalarial drugs that are currently experiencing resistance. Some active compounds that have been successfully isolated from various plants, including curcumin, kaempferol, piperine, andrographolide, α -mangostin, catechin, luteolin and betulinic acid, have been scientifically tested to have antimalarial activity with different mechanisms of action. The development and dissemination of resistance to all first-line antimalarial medications now used to treat malaria has made it difficult to eradicate the disease in many nations worldwide. Scientists are now searching for potential novel antimalarial medication molecules made from natural sources that possess antimalarial properties that have been demonstrated by science. This is done in order to substitute antimalarial medications that are encountering opposition at the moment. A few potent substances that have been

KEY WORDS: Malaria, Antimalarial, Curcumin, Kaempferol, Piperine, Andrographolide, α -Mango's tin,

INTRODUCTION:

Malaria remains a global health problem 229 million malaria cases worldwide Over 400,000 people have died from malaria One per year Many malaria cases are Caused by the development of various disorders Regarding the extinction of malaria, including resistance Malaria - From parasites to antimalarial methods available Medicine increased mosquito immunity Discovering chemicals and side effects from these anti-malarial medicines. Growth And broad resistance to the first row Anti-malarial mikament in treatment Malaria prevention is causing much now Malaria prevention program issues Studies to obtain both new Anti-plasmodical families Synthetic drugs and people who have become more natural Ingredients Studying active connections from nature Materials, especially medicinal plants Traditionally used by the community for

treatment Malaria in various endemic regions around the world. The goal is to find new antimalarial clumps It has a mild side effect of being less toxic They do not harm the patients. 6

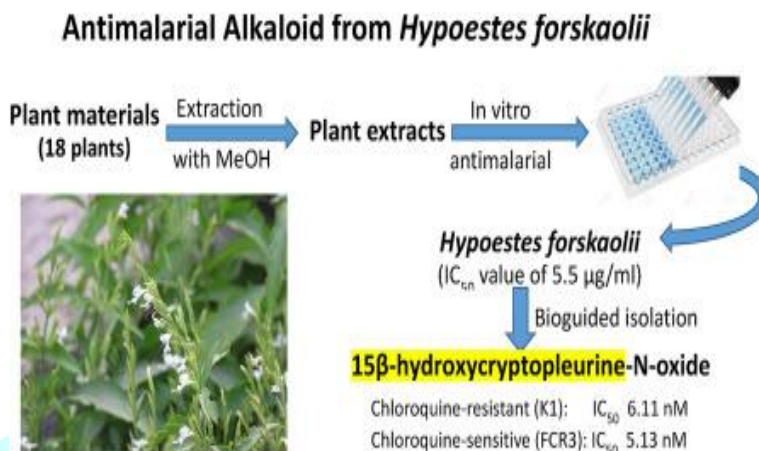


Fig No. 1 Isolation of Herbal Plant

Activity of several medicinal plant isolates.

1. *Azadirachta indica* (Neem): Neem extracts have shown antimalarial activity against Plasmodium species.
2. *Cryptolepis sanguinolenta*: Traditionally used in West Africa to treat malaria, its extracts have demonstrated antimalarial activity.
3. *Alstonia scholaris*: Some studies suggest its extracts have antimalarial properties.

Here are some other examples of herbal plants with antimalarial properties: Additional Antimalarial Herbal Plants:

6. *Andrographis paniculata* (Kalmegh): Traditionally used in Ayurvedic medicine to treat fever and malaria.
7. *Momordica charantia* (Bitter Melon): Some studies suggest its extracts have antimalarial activity.
8. *Tinospora cordifolia* (Giloy): Used in Ayurvedic medicine to treat various ailments, including fever and malaria.
9. *Swertia chirata* (Chirata): Traditionally used to treat fever and malaria in some parts of the world.
10. *Cassia occidentalis*: Some studies have reported antimalarial activity in its extracts.

SOME VARIOUS HERBAL PLANTS AGAINST ANTIMALARIAL ACTIVITY

1) CURCUMIN:



Fig 2. Curcumin

Curcumin, a compound found in turmeric, has shown potential antimalarial activity. Studies suggest it works by

Inhibiting parasite growth: Curcumin has been shown to reduce Plasmodium viability and inhibit parasite transmission at the trophozoite stage.

Modulating inflammatory response: Curcumin regulates immune response and inflammation levels within the body, which can help prevent severe malaria.

Targeting specific proteins: Curcumin interacts with proteins like PfATP6, PfGCN5 HAT, and PfTrxR, which are involved in parasite survival and growth.

Mechanisms of Action:

Inhibition of NF- κ B: Curcumin suppresses NF- κ B activation, reducing pro-inflammatory **Cytokine**

Induction of ROS: Curcumin induces reactive oxygen species (ROS) production, damaging parasite cells.

Binding to parasite proteins: Curcumin interacts with proteins like PfATP6 and PfGCN5 HAT, inhibiting parasite growth and survival.

2) CLOVE:

Clove, specifically its essential oil, has shown potential antimalarial activity. However, I couldn't find direct studies on clove's antimalarial properties. Instead, I found information on allicin, a compound found in garlic, which has demonstrated antimalarial activity. Allicin works by inhibiting cysteine proteases: Essential for parasite survival and growth.

Preventing sporozoite invasion: Reducing malaria infection in mice.

Targeting multiple life stages: Effective against both preerythrocytic and erythrocytic stages Some studies suggest that compounds like allicin may be useful in developing new antimalarial drugs. If you're looking for information on clove specifically, further research might be needed to determine its efficacy against malaria.



Fig 3. Clove

Potential Antimalarial Compounds:

Allicin: Found in garlic, shows promise as an antimalarial agent

Cysteine protease inhibitors: May target multiple life stages of the parasite. 3

3) LEMONGRASS



Fig. 4. Lemon grass

Lemongrass essential oil (LEO) has shown potential bioactive properties, but its antimalarial activity is not well-documented. However, LEO's antimicrobial and antioxidant properties could contribute to its potential effectiveness against various diseases. Key Components of Lemongrass Essential Oil:

Citral: A mixture of geranial and neral, known for its antimicrobial and anticancer properties

Geraniol: Exhibits antimicrobial and anticancer activities

Citronellal: Has antimicrobial and antifungal properties.

Potential Mechanisms:

Antimicrobial activity: LEO components can disrupt microbial membranes, inhibit growth, and induce cell death

Antioxidant activity: LEO may neutralize reactive oxygen species, potentially protecting against oxidative stress While there's limited research on lemongrass oil's antimalarial activity, its bioactive compounds could be useful in developing new treatments. Further studies are needed to explore its efficacy and mechanisms against malarial. 4

4) SANDALWOOD



Fig. 5. Sandalwood

Sandalwood's antimalarial activity isn't extensively studied, but essential oils, including sandalwood, have shown potential in treating malaria. A study on 60 essential oils identified 15 with inhibitory activity against Plasmodium early mosquito stages. While sandalwood wasn't specifically highlighted, compounds like eugenol, eucalyptol, and limonene were identified as potential transmission-blocking agents.

Key Findings:

Eugenol: Shows strong inhibitory effect on zygote formation, with potential antimalarial properties.

α -citral: Exhibits inhibitory capacity on zygote development.

α -pinene: Affects ookinete maturation.

Potential Mechanism:

Natural remedies: Essential oils might offer alternative treatments for malaria.

Transmission-blocking: Targeting mosquito stages could help control malaria spread.

Further Research:

More studies are needed to explore sandalwood's efficacy and mechanisms against malaria. Researchers are investigating essential oil combinations and their potential synergistic effects. 2

5) MORINGA



Fig 6. Moringa Oleifera

Moringa oleifera has shown potential antimalarial activity, with various studies confirming its efficacy against malaria-causing parasites. Here's a breakdown of its antimalarial properties.

Antimalarial Activity

In vivo studies: Moringa oleifera extracts have demonstrated antimalarial activity in rodents infected with Plasmodium parasites, including *P. berghei*, *P. falciparum*, *P. yoelii*, and *P. chabaudi*.

Extracts and preparations: Various extracts, including acetone, hexane, methanol, and aqueous extracts, have shown antimalarial activity, as well as pellets and oils obtained from the plant.

Plant parts: Leaves are the most commonly used part for antimalarial purposes, but seeds, roots, flowers, and stems are also utilized. 5

Potential Mechanisms

Flavonoids: *Moringa oleifera* contains flavonoids like apigenin, kaempferol, rutin, and quercetin, which have shown antimalarial activity in previous studies.

Antioxidant activity: Flavonoids in *Moringa oleifera* may help scavenge free radicals and reduce oxidative stress, potentially contributing to its antimalarial effects.

Toxicity and Safety

Preclinical tests: Most studies have found *Moringa oleifera* extracts to be safe and non-toxic in preclinical tests, although one study reported mild toxicity at high doses of seed oil.

Ethnomedicinal Uses

Traditional medicine: *Moringa oleifera* is widely used in traditional medicine for malaria treatment in African and Asian countries, including Nigeria, Uganda, Benin, Ghana, and India.

6) ALOE VERA



Fig 6. Aloe vera

Aloe vera has been studied for its potential antimalarial activity, although research is limited. Some studies suggest that Aloe vera extracts may:

Inhibit parasite growth: Aloe vera extracts have shown antimalarial activity against *Plasmodium* parasites in vitro.

Boost immune system: Aloe vera's immunomodulatory properties may help enhance the body's natural defense against malaria.

Potential benefits:

1. Natural remedy: Aloe vera is a widely available and relatively safe natural product.
2. Complementary therapy: Aloe vera might be used alongside conventional antimalarial treatments.

Limitations and future directions:

1. More research needed: Further studies are required to confirm Aloe vera's efficacy and safety as an antimalarial agent.
2. Standardization: Standardized extracts and dosages need to be established for potential therapeutic use. While Aloe vera shows promise, it's essential to consult healthcare professionals for proper diagnosis and treatment of malaria.

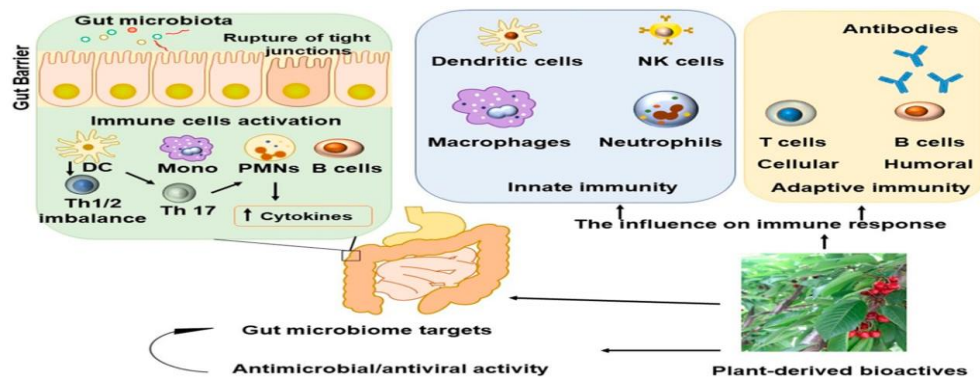


Fig No: 2 Herbal Plant MOA

Sr.no	Herbal Plant	Family	Part use	Active Constituents	Ref. No
1)	Curcumin	Zingiberaceae	Root	Curcumin, Comphor Demethoxycurcumin	8
2)	Clove	Myrtaceae	Fruit	Flavonoid, Ferulic, caffeic, ellagic, s alicylic acid.	10
3)	Lemongrass	Poaceae	Leaf	Citral, isoneral Citronellal, Citronellol.	9
4)	Moringa	Moringaceae	Leaf	Flavonoids, Amino acid, Isoquercitrin, Rhamnetin.	11
5)	Sandalwood	Santalaceae	Bark	Sesquiterpene, Alcohol, Teresantalic	12

6)	Aloe vera	Liliaceae	Leaf	B- carotene, Antraquinene, Chromones, Flavonoids	20
7)	Musa sapientum	Musaceae	Fruit	Carbohydrates, Proteins	11
8)	Cassia occidentalis	Fabaceae	Flowers, Leaves	Anthraquinones, Anthrones	9
9)	Anacardium occidentale	Anacardaceae	Bark, Leaves	Phenolics, Flavonoids	15
10)	Eucaliptus indica	Myrtaceae	Leaves	P-cymene, and Terpinen-4-ol	19
11)	Psidium guajava	Myrtaceae	Bark, Leaves	Favonoids, phenolic acids,	10
12)	Cymbopogan citrate	Poaceae	Leaves	Myrcene, Geraniol, Citronellol,	14
13)	Mangifera indica	Anacardiaceae	Bark, Leaves	Phenolic acids, Flavonoids	15
14)	Azadirachta india.	Meliaceae	Bark, Leaves	Alkaloids, Triterpenoids, Flavonoids,	17
15)	Carica Papaya	Caricaceae	Bark, Leaves	Chymopapain, flavonoids, Phenolic acids	9
16)	Citrus Aurrantium	Rutaceae	Stem, Fruit	Flavonoids, Phenolic acids,	8
17)	Khaya Grandifolia	Meliaceae	Bark, Leaves	Alkaloids, flavonoids	11
18)	Allium sativum	Liliaceae	Bulb	Saponins, flavonoids	14

19)	Vernonia amygdalina	Compositae	Leaves	flavonoids, terpenes	13
20)	Datura metel L.	Solanaceae	Leaves, Fruit	Saponins, flavonoids, terpenes	12
21)	Citrus medica	Rutaceae	Bark	flavonoids, tannins, Phenols,	10
22)	Piper nigrum	Piperaceae	Seed	limonene and citral	16
23)	Rauwolfia serpentine	Apocyanaceae	Root	Volatile oils, starch, proteins	20
24)	Xanthium strumarium	Compositae	Leaves	Ferulic acid, Chlorogenic acid	18
25)	Cinchona officinalis	Rubiaceae	Stem, Bark	Tannins, Quinine	19

CONCLUSION:

Effective mosquito repellents are crucial for preventing mosquito-borne diseases like malaria, dengue fever, and Zika virus. Various options are available, including Medicinal plants, such as *Artemisia annua* and *Cinchona*, have played a pivotal role in the treatment of malaria. Artemisinin, derived from *Artemisia annua*, forms the cornerstone of modern malaria treatment due to its efficacy against *Plasmodium falciparum*, particularly in Artemisinin-based Combination Therapies (ACTs). Similarly, quinine, obtained from *Cinchona* bark, was historically the first effective antimalarial and remains in use for severe cases. These plants highlight the importance of natural sources in developing effective antimalarial drugs, although ongoing research and careful management of resistance are crucial for their continued success in malaria control.

Future Directions

1. Development of new, effective repellents
2. Research on natural and sustainable options
3. Improved understanding of mosquito behavior and repellent mechanisms

By using effective mosquito repellents and taking preventive measures, individuals can reduce their risk of mosquito-borne diseases.

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