

## Herbal based Alternative Insecticides for Mosquito Control

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Mosquito is a major health concern as it is the principal vector of a number of diseases affecting human beings and other animals [1].

Members of genera Anopheles, Culex and Aedes are vectors for transmitting diseases like malaria, filariasis, Japanese encephalitis, dengue fever, dengue haemorrhagic fever, chikungunya and yellow fever [2].

S. No.	Species of Mosquito	Type of Disease caused
1	<i>Anopheles</i>	Malaria, Filariasis, Arbovirus
2	<i>Culex</i>	Encephalitis or Meningitis, Bancroftian filariasis, Elephantiasis
3	<i>Aedes</i>	Dengue, chikungunya, yellow fever, haemorrhagic fever

**Table 1:** Diseases caused by mosquito species [2,3].

In the past chemical larvicidal and repellents were used to control mosquitoes [4]. The commonly used chemicals as mosquito repellents in the past were dimethyl phthalate (DMP), 2-ethyl-1,3-hexanediol, dimethyl carbate and N,N-diethyl-m-toluamide (DEET) [5,6]. Conventional pesticides such malathion, DDT and pyre-throids that are generally used for mosquito control are known to cause the problem of environmental pollution, residual effects and resistance by their indiscriminate use. However, there was development of resistance to malathion [4] and to deltamethrin in adult *C. pipiens* as reported by some researchers. Resistance to synthetic organophosphate insecticides has been noted in all the vectors causing these mosquito borne diseases [7].

Moreover, the chemical based mosquito repellents cause problems like skin irritation, erythema, desquamation and bullae formation on the skin of the person [8]. DEET is most commonly used chemical mosquito repellent but it caused toxic effects like encephalopathy in children, urticaria syndrome, anaphylaxis, hypotension and decreased heart rate [9].

Due to the problem of pollution and vector resistance, safe plant products are being tested around the world as pest control agents. A survey of literature on larvicidal effects of plant products on mosquitoes indicates that most of the studies included well known horticultural and commonly grown plants [10].

The search for phytochemicals of plant origin having repellency activities against the malaria causing vectors and other diseases like Malaria, Dengue Fever, Japanese Encephalitis have been mainly stimulated by the fact that some of the major repellents like DEET and DDT have considerable drawback in term of resistance and toxicity. Phytochemical studies have also confirmed that traditionally used medicinal plants produce a variety of compounds of known therapeutic properties [11]. A number of plant species have been reported that are effective against mosquitoes [12].

During the last decade, various studies on natural plant products against mosquito vectors indicated them as possible alternatives to synthetic chemical insecticides [13,14]. In recent years interest in plant-based products has been revived because of the development of resistance, cross-resistance and possible toxicity hazards associated with synthetic insecticides and their rising cost. A large number of plant products have been reported to have mosquito larvicidal and/or repellent activity [15,16].

Phytochemicals obtained from the huge diversity of plant species are important source for safe and biodegradable chemicals, which can be screened for mosquito repellent and tested for mammalian toxicity [17] and therefore can be used as an alternative to synthetic insecticides or along with other insecticides under the integrated vector control.

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