J. Sci. Innov. Nat. Earth: Vol. 5, Issue 2, 2025, Page No-122-126 ISSN (Online) 2583-2093 OPEN ACCESS

Journal of Science Innovations and Nature of Earth

Journal homepage : https://jsiane.com/index.php/files/index

International, Double-Blind, Quarterly, Peer-Reviewed, Refereed Journal, Edited and Open Access Research Journal

A review on Larvicidal Activity of Plant extracts against mosquito

Khushbu[1], Anil Kumar[1], Gauravi Yadav[1], Neelam[1], Vishan Kumar[1], Hridayesh Arya[1]
[1]Department of Zoology, N.R.E.C. College, Khurja, Bulandshahr, Affiliated to Chaudhary Charan Singh University, Meerut, Uttar Pradesh, India
*Corresponding Author E-mail: khushbubhati421@gmail.com
DOI: https://doi.org/10.59436/jsiane.456.2583-2093

Abstract

The usage of active harmful chemicals from plant extracts as a substitute method for mosquito management dates back to antiquity.These are biodegradable, nontoxic, widely available at reasonable costs, and demonstrate a broad range of target-specific activity against various vector mosquito Species. In article talks about what we know now about phytochemical sources and their ability to kill mosquitoes, how they work on the target population, how their ability to kill larvae changes depending on the species of mosquito, the stage of development, the polarity of the solvents used during extraction, the nature of the active ingredient, and any possible improvements that have been made in the biological control of mosquitoesusing plant-derived secondary metabolism mosquito larvae. However, despite their potential, challenges such as formulation standardization, scalability, and regulatory approval still exist. In summary, plant extracts provide a sustainable, effective, and environmentally responsible an other method of controlling mosquitoes.
Keywords*:* mosquito control, larvicidal activity, plant extract, integrated management, insecticides.

Received 28.03.2025 Revised 22.05.2025 Accepted 19.06.2025 Online Available 20.06.2025

Introduction

The previous decades, considerable Studies have been conducted to investigate the insecticidal properties of plant-based products in relation to mosquitoes. Reducing the widespread misuse of synthetic pesticides, which raise mosquito resistance and present serious threats to the environment and public health, is a current and urgent issue in parasitology. The extensive body of research on plant extracts used as larvicides for mosquitoes is covered in this review. Aqueous and alcoholic extracts are especially well-suited because they are simple to formulate in water without the need for surfactants (who, 1996). Important vectors from the Anopheles, Aedes, and Culex genera, among others. Additionally included are the antagonistic and synergistic effects of certain plant extracts as well as those between them and traditional pesticides. The effectiveness of pure chemicals extracted from the majority of potent plant extracts, their mode of action when accessible, andtheir effects on non-target species are also discussed.

Their classified as secondary metabolites and include aliphatics, sterols, flavonoids, coumarins, anthraquinones, xanthones, alkaloids, alkamides, sesesquiterpenest triterpenes, and acerogenins. They can cause midgut injury, suppression of detoxifying enzymes, neurotoxicity, and/or larval development in mosquito larvae. Current limitations and major research problems, such as technologies to enhance stability and synergise efficacy—and consequently field activities of the selected plant.

The final part is a list of excerpts. Unfortunately, relatively few studies were done to validate their usefulness in the field, and neither the possible epidemiological impact nor the overwhelming amount of laboratory evidence proving their effectivenessof these vector control operations nor their efficacy in the field have been evaluation(aw, 1986).

They transmit majority of fatal diseases, such as yellow fever, and malaria and soon.in baie and er dele van die wereld, in byna al die tropiese en subtropiese lande.

Mosquito control is noodsaaklik om die verspreiding van mosquito-borne siektes te stop en die kwaliteit van die omgewing en die algemene gesondheid te verbeter (Chandra, 2012).

Larvicidal Activities of Plant Extracts

When the plant as dry powder applied directly to the water surface, it was also found to help stop adult emergence. Revealed that the methanolic fraction of seeds of *Cassia tora*, *Cassia obtusifolia*, and *Vicia tetrasperma* has the ability to larvicide *Aedes aegypti* and *Culex pipiens*. At 'n konsentrasie van 200 ppm, het methanolic seed extracts van al drie plants meer as 90% larval mortality veroorsaak. There is a well-documentedlist of several plants and products that have demonstrated a variety of functions, including insecticidal/larvicidal, growth-inhibiting, chemosterilant, and mosquito-repellent properties.

Neem (*Azadirachta indica*) seraw aqueous extracts was tested to be effectiveagainst Anopheles mosquito larvae. After 12 hours of exposure to concentrated seed, leaf and bark extracts, die larvae suffered a mortality rate of 100, 98 and 48 persent, respectively Aliero (2005)Volgens Sakthivadivel and Thilagavathy (2003), petroleum ether extracts from *Argemone mexicana* seed inhibit *Aedes aegypti* second-instar larvae. At 'n konsentrasie van 200 ppm was daar die hoogste larvicidal en chemosterilant. Dit het bloedmeal intake by 27.70%, fecundity by 19.0%, by 100% verminder. Rajkumar and Jebanesan (2004) found that *Moschosma polystachyum* leaf extract possesses larvicidal qualities. *Culex quinquefasciatus* egg raft was behandel met leaf extract in doses van 125–200 mg/l. Die exposure het 100% dood veroorsaak in 3-6 uur Singh *et al*., (2005) conducted a study on the ability of Calotropis procera's fresh leaf extract to kill larves of *Culex quinquefasciatus*, *Anopheles stephensi* larvae in their early fourth instar was in a lab assesseer deur die.WHO (2005). Die methanolic fraction of the leaf showed significant larvicidal efficacy Choochote *et al*., (2005) studied the Curcuma aromatic rhizomes and oils for their chemical makeup and larvicidal properties. The volatile oil of *C. aromatica* killed fourth-instar *Aedes aegypti* larvae with LC_{50} values of 36.30 and 57.15 ppm, respectively, in comparison to hexane extracts. *Chamaecyparis obtusa* leaves methanolic extracts was demonstrated to have a high larvicidal potential, according to Jang *et al*., (2005). The fourth instar Campbell (1933) het die eerste navorsing gepubliseer oor die effek van plantekstrakte op mosquito larvae. Volgens Campbell (1933), *Anabasis aphylla* bevat alkaloids wat *Culex pipiens* larvae doodmaak. Phytochemicals impact different stages of mosquito larva development volgenes Osmani and Sighamony (1980), geranium (*Pelargonium roseum*), linalool (*Bursera delpechiana*) and lemon grass (*Cymbopogon citratus*) oils were poorovicides and did not affect larvae in the first instar. But they slowed down growth and killed *Aedes aegypti* in later development stages. The phytochemicals effect is also affected by the solvent system used for the extraction. Sheril and Hall (1985) tested the larvicidal capacity of *Culex quinquefasciatus* with aqueous and organic solvent extracts of *Artemisia cana* and *Microcytic pyrifera*. Larval mortality increases with the organic solvent extract (Russell TL, 2009).

Sujatha *et al*. (1988) beweer dat verskillende solvent extracts verskillende larvicidal eienskappe het. Sheril and Hall (1985) ondersoek die larvicidal eienskappe vanbeide aqueous and organic solvent extracts of *Artemisia cana* and *Microcytic pyrifera* against *Culex quinquefasciatus*. Larval mortality increases with the organic solvent extract Sujatha *et al*. (1988). het gesê dat verskillende solvent extracts verskillende maniere het om mosquito larvae . Plants such as an *Ageratum conyzoides* and *Acorus calamus* showed different susceptibilities to mosquito larvae. This was caused by the different extracts solution in polar and non-polar solvents.

Tested the ethanolic extract of *Descurainia sophia* against *Culex quinquefasciatus*. When late third instar larvae exposed to ethanolic extract (EE) at concentrations of 100, 500, 1000, and 1500 ppm, was daar 'n concentration-dependent larval 41 mortality and adult emergence inhibition of 2%, 1818%, 60%, 76%, 9%, 16%, 32%, 76%, and 100%. A review of the use of botanical derivatives to combat mosquitoes, Sukumar *et al*. (1991).

Bioactive compounds word in plants se leaves, fruits, flowers, roots, seeds en bark gestoor. When phytochemicals are extracted using certain solvents, their bioactivity is greatly affected. Studies tot dusver het getoon dat sommige phytochemicals be invloed insect three levels: general toxicants (insecticidal/larvicidal); Achary *et al*. (1993) developed a mosquito larvicide from lemon peel oil extract. Daar is ontdek dat die olie giftig is vir *Culex quinquefasciatus* eggs, pupae, and larvae. (RC, 1947)

The larvae of *Culex quinquefasciatus* was controlled with *Pomea carnea* leaf extract. This extractinterrupted the mosquito life cycle and caused a high concentration of larval death at 0.01%, suggesting its potential use as a larvicide (Mwaiko and Savaeli, 1994). In 'n bioassay is die larval- en adult-sterftes van *Aedes aegypti* , *Anopheles stehpensi* against agetes minuta flower extracts gelyktydig met water gedistilleer is (Perich *et al*., 1994) Mittal *et al*. (1995) het getoon dat neem olie en ander kommersiële neem formule rings 'n hoë potensiaal as mosquito larvicides het. Pushpalatha and Muthukrishnan (1995) found that plants Vitex negundo, Nerium oleander, and Syzigium jambolanum kill larves of *Culex quinquefasciatus* and *Anopheles stephensi*. Volatile komponente van neemolie verander die gonotrofiese cycle en stop ovulation in *Anopheles stephensi*.

States at petroleum ether solvent extracts of the *Curcuma domestica* bevestig dat dit giftig was vir Anopheles culicifacies met 'n LC_{50} waarde van 4.5 ppm. Steam distillation showed toxicity of Acorus calamus (Acoraceae) in larval stages from the seeds of Citrus reticulata, three limonoids have been identified: limonin, nomilin, and obacunone. (Sukumar K, 1991)

These limonoids stopped *Culex quinquefasciatus* larvae from growing in their fourth instar, with EC_{50} values van 6.31, 26.61, and 59.57 ppm, respectively, to stop adult emergence (Jayaprakasha *et al*., 1997). reported larvicidal properties of plants of the Compositae family. Among 83 plant species in the Compositae family, *Tagetes minuta* larva *Aedes fluviatilis*. Metabolite thiophene was fractionated from *T. minuta* and was found to be an active substance. Murty *et al*. (1997) studied *Polyalthia longifolia*'s larvicidal and growth-inhibiting abilities on *Culex quinquefasciatus* pupae and larvae. Leaf extract het aansienlike larvicidal en growth-inhibiting eienskappe. When the extract was added to tanks and drains at a concentration of 250–350 ppm, Die volwasse uitkoms van *Culex quinquefasciatus* is by 64 96% onderdruk. Batra *et al*. (1998) assesseer die effektiwiteit van neemolie-emulsion op *Aedes aegypti*, *Culex quinquefasciatus*, *Anopheles stephensi*. They said that using oil emulsion stopped mosquitoes breeding for 21 days. El-Hag en kollegas 1999: investigated the effects of *Azadirachta indica*, *Rhazya stricta*, and *Syzygium aromaticum* methanol and ether on *Culex pipiens* in terms of both toxicity and development retardation. R. stricta methanolic extract and ether extract both had significant acute and chronic effects on *Culex pipiens* larvae, with LC_{50} values of 140 and 211 ppm, respectively, in all drie plants wat ondersoek is. Markouk *et al*. (2000) het gevind dat verskeie solvent-gebaseerde extracts van medicinal plants *Solanum elaeagnifolium*, *Calotropis procera*, *Solanum sodomaeum*, *Cotuta cinerea*, *Anopheles labranchiae* larvicidal. Daar is getoon dat elke extract 'n verskillende larvicidal potensiaal het met LC_{50} konsentrasies van 28 ppm tot 325 ppm. the acetone fraction of Feronia limonia leaves. killed larvae of *Anopheles stephensi*, *Aedes aegypti*, and *Culex quinquefasciatus* fourth instar.Daar is getoon dat elke extract 'n verskillende larvicidal potensiaal het met LC_{50} konsentrasies van 28 ppm tot 325 ppm. Extract of acetone *F. limonia* was fractionated to obtain the active compound N-hexadecanoic acid. Limonia acetone extract was fractionated. Tawassin *et al*. (2001) studied the reactions of *Culex quinquefasciatus*, Anopheles dirus, and *Aedes aegypti* to volatile oils extracted from *Cymbopogon winterianus* and *Ocimum americanum* plant species. Oil was 'n uitstekende mosquito killer in cage tests, wat 4–8 hours. Mehra *et al*. (2002) in a laboratory environment studied the insecticidal properties of crude acetone extract of Cuscuta hyaline in preadult *Culex quinquefasciatus* stages. At concentrations van Third-instar larvae receive 50 ppm, while fourth-instar larvae receive 75 ppm. The cetone fraction had negative effects on larvae and pupae, and stopped adul mosquito emergence A betroubare ovipositor-deterring effek van die extract is geyend by 80 pm. larvae of *Celeritous togoi* pallens die at 100% at 100 ppm concentrations when exposed to methanolic leaves extract. The corresponding LC_{50} values were 2.91, 2.60, and 1.33 ppm. Through spectroscopic analysis has beta-thujaplicin, the bioactive ingredient in *C. obtusa* leaf extract, been identified. studied the efficacy of ethanolicleaf extracts on *Culex quinquefasciatus* fourth instar larvae by examining Piper longum, *P. ribesoides*, and *P. argentum*. Die drie plante het effektiewe LC_{50} konsentrasies van 2.23, 4.06 en 8.13 ppm respectively. Patil en kollegas (2006) gesê dat extracts from Clerodendron inerme ondersoek is virhul on *Culex quinquefasciatus* larvae and pupae te stop om te groei.After roughly 18 to 20 hours, the data indicated pupal mortality in the 40, 50, and 60 mg powder samples Dosis het sterftekoerse beinvloed. Pupal death rates in the same treatment groups were 48, 74, and 96% at 72 hours. Omena *et al*. (2007) ondersoek die vermoë van 51 species van 42 genera van Brazilian medicinal plant *Aedes aegypti* mosquito larvae te dood. In the 84 extracts tested, 11 had larvicidal activity (LC_{50} 100 g mL-1) when tested.

Effects on *Culex quinquefasciatus* mosquitoes were assessed by two cucurbitaceous plants, *Citrus colocynth's* and *Cucurbita maxima*. Both plants se leaf extracts, ethyl acetate-based, outperformed the methanolic extract (Mullai and Jebanesan, 2007). Senthil Nathan (2007) het navorsing gedoen oor secondary metabolites wat afkomstig is van die native plant *Eucalyptus stereticornis* sp. (Myrtaceae), wat in die verlede mosquito-bestrydende eienskappe getoon het. Forest redgum essential oil extract het sterk larvicidal eienskappe; LC_{50}-waardes was 18.3.ppm for larvae in their first instar and 23.8 ppm for larvae in their second instar.

Vir LC_{90}-waardes. In the treatments that were tested against the mosquito vector *Anopheles stephensi*, there was no adult or pupae emergence, so all mortality was achieved within 24 hours of exposure. Hanem and Afaf (2008) studied various plant oils in order to determine their insecticidal potency on *Culex pipiens* fourth larval instars. Earth almond (*Cyperus esculentus*), oilbanum (*Boswellia serrata*), mustard (*Brassica compestris*), rocket (*Eruca sativa*), fenugreek (*Trigonella foenum grecum*) and parsley (Carum ptroselinum) se LC_{50} konsentrasies was 32.42, 47.17, 71.37, 83.36, en 152.94 ppm, respectively. The larvae 47 showed a number of morphological abnormalities after being exposed to the oils that were applied. Larval and pupal lengths even at the lowest concentrations of fenugreek and oilbanum oilswere notably prolonged. Mustard olie het die pupationtempo aansienlik verminder by 1000 ppm. Fenugreek en earth almond oils stop adult emergence at 25 ppm.

To assess the larvicidal, pupicidal, adult repellant, and ovicidal properties of Euphorbia hetrophylla whole plant ethanolic extracts and petroleum ether seedextracts against *Culex quinquefasciatus*, the *Bancroftian filariasis* vector. There have been evidence that seed extracts from ethanol and petroleum ether work well against all kinds of instar pupae and larvae (Kuppusamy and Murugan, 2008). Rawani *et al*. (2009) ondersoek die larvicidal eienskappe van drie verskillende plante: *Cleistanthus collinus*, *Murraya paniculata* and *Carica papaya* on *Culex quinquefasciatu* the *Bancroftian filariasis* vector. There have been evidence that seed extracts from ethanol and petroleum ether work well against all kinds of instar pupae and larvae (Kuppusamy and Murugan, 2008). Rawani *et al*. (2009) ondersoek die larvicidal eienskappe van drie verskillende plante: *Cleistanthus collinus*, Murraya paniculata and Carica papaya on *Culex quinquefasciatus*. Die loop van 'n 24-hur exposure, het die drie plantkomponente die hoogste sterftekoers vir third-instar larvae getoon met LC_{50} values van 0.07, 0.07, 0.08 en 0.29 ppm. Terwyl LC_{90}-waardes 51.6 en 63.9 ppm, 18.3 ppm vir first instar larvae and 23.8 ppm vir second instar larvae.

Aedes aegypti in various solvents *Volgens Govindarajan* (2009), die konsentrasie van die extract was direk again eggs en het 'n omgekeerde verband met die persentasie hatchability. Kamraj *et al*. (2010) onthuldat solvents se polar and nonpolar properties determines phytochemical solubility. *Dolichos biforous*, *Aristolohia indica*, and *Zingiber hexane*, methanol, and ethyl acetate were used as solvents to create the extracts larvicidal potential of *Culex quinquefasciatus* and *Culex gelidus* was demonstrated by all of the solvent extracts.

Govindarajan (2011a) tested leaf extracts of *Andrographis paniculata*, *Cardiospermum halicacabum*, and *Eclipta alba* for larvicidal and ovicidal effects on *Anopheles stephensi*. Furthermore, for the evaluation of crude leaf extracts of Cardiospermum halicacabum researchers studied third-instar larvae of *Aedes aegypti* and *Culex quinquefasciatus* using five different solvents: methanol, benzene, hexane, ethyl acetate, and chloroform. (Govindarajan, 2011b). Die resultate dui daarop dat elkeen van die drie plants 'n hoe vermoe het om larven te produseer. Toe te skat die dengue-virus-verspreider, *Aedes aegypti*, Millettia pachycarpa root and bark larvicidal and ovicidal potentiality. (Lalchhandama, 2011). On *Aedes aegypti* larves and adults is mentha piperita oil extracted from peppermint leaves studied for its larvicidal and repellent properties. Die bevindinge dui daarop dat die essensiële olie van *M. piperita Aedes aegypti* beveg (Kumar *et al*., 2011).Gebruik in vitro tegnieke on Culex tritaeniorhynchus. phytochemical makeup en mosquito ovicidal and repellent properties van Calotropis procera se aqueous leaves extract. Die ovicidal en repellent eienskappe van die ekstrakte is gedemonstreer (Kumar *et al*.)., in 2012. Use of in vitro techniques, the phytochemical makeup and mosquito activity of Calotropis procera aqueous leaf extract is studied again Culex tritaeniorhynchus and *Culex gelidus*. Die ovicidal en repellent eienskappe van die ekstrakte is gedemonstreer (Kumar *et al*., 2012).

Extracts of the *Melothria maderaspatana* plant leaf were tested against *Aedes aegypti* for their ovicidal and repulsive properties. the course of 48 hours, a review of the hatch rates was conducted. In a lab setting, the repellent's effectiveness was assessed by three dosages: 1.0, 2.0, and 3.0 mg/cm2. Doses wat tussen 120 en 240 ppm was, het 50% tot 100% eggdood in *Aedes aegypti* veroorsaak Marimuthu *et al*. (2012) conducted studies on Delonix elata leaf and seed extracts for larvicidal and ovicidal effects on *Culex quinquefasciatus* rishnappa *et al*. (2012) het die vermoë van Gliricidia sepium om malaria-verspreider *Anopheles stephensi* te beveg deur sy ovicidal, larvicidal enpupicidal eienskappe te under soek.

In studie is Pemphis acidula medicinal plant, ondersoek vir sy larvicidal and ovicidal abilities against the mosquito vectors Anopheles subpictus and Culex tritaeniorhynchus repellent properties of Acalypha alnifolia leaf extracts on *Aedes aegypti*, *Culex quinquefasciatus*, and *Anopheles stephensi*. Daar is navorsing gedoen *Nerium oleander* extract se ovicidal en adulticidal eienskappe in *Anopheles stephensi* Liston. In a lab, the extract's ovicidal and adulticidal properties were evaluated using a variety of plant sections (Roni *et al*., 2013). Acetone, benzene, ethyl acetate, and methanol were used (Krishnappa *et al*., 2013). Deepak *et al*. (2014) found that *Cassia occidentalis* petroleum ether and n-butanol solvent extract caused 100% larval mortality at 200 and 300 ppm against *Culex quinquefasciatus* late third instar larvae. gebruik *Aedes aegypti*, *Anopheles stephensi*, and *Culex quinquefasciatus* as testsubjects to assess the ovicidal, larvicidal, and pupicidal abilities of different solvent extracts from Annona reticulata. After 24 hours, third instars of *A. aegypti*, *A. stephensi*, and *C. quinquefasciatus* were exposed to extracts made from methanol, benzene, chloroform, and ethyl acetate. They showed moderate larvicidal efficacy. The investigated mosquito eggs did not hatch after 48 hours of exposure.Methanol extracts had the best ovicidal effects on specific vector mosquitoes. Benzene, chloroform, and ethyl acetate followed them up. Volgens Rajesh en Shamsuddin (2017) het Kalanchoe pinnata larvicidal. In a lab environment, the ovicidal effect on the *Culex quinquefasciatus* mosquito species was assessed at various doses from 50 to 300 ppm. Die filarial vector was more sensitive to extracts of Kalanchoe pinnata in aqueous, ethyl acetate, benzene, petroleum ether, and acetone. Acetone crude extract was shown to be the mosteffective in its larvicidal and ovicidal abilities against the filarial vector.

3. **Phytochemical** - Phytochemicals, are botanicals that are insecticides that occur naturally from floral resources. Phytochemicals have been used to control mosquitoes since the 1920., (Shahi M, 2010) However, the development of synthetic insecticides like DDT in 1939 followed the use of phytochemicals in mosquito control initiatives. After experiencing numerous issues due to unfair pesticides in nature, phytochemicals that are readily biodegradable and do not negatively impact non-target organisms were valued. Since then, researchers have been looking for novel plant-based bioactive substances.As well as a search for its structure and commercialproduction. Phytochemicals verteenwoordig tans tot 1% van die wêreld se pesticidemark (MB, 1997) *et al*. Botanicals, wat hoofsaaklik secondary metabolites is, beskerm plants teen voortdurende seleksie deur herbivore predators en ander omgewingsfaktouse Insecticidal eienskappe van 'n verskeidenheid phytochemicals, soos alkaloids, steroids, terpenoids, essential oils, and phenolics, is voorheen gedokumenteer. Daar is 'n aantal faktore wat beïnvloed hoe skadelik plant-ekstrakte is vir insekte. Dit sluit in die soort plant, die soort mossie, die soort plek waar dit gebruik word, en die soort solvents wat gebruik is tydens extraction. Die mosquito toxins is uit 'n verskeidenheid plante verwyder, insluitend trees, herbs en shrubs. Phytochemicals were obtained either from the whole body of small herbs or from different parts of larger plants or trees, such as fruits, leaves, stems, barks, root and soon as. Elke geval, die mees skadelike stowwe is ontdek en onttrek om mosquito control te bevorder. Daar is 'n wye verskeidenheid chemicals wat deur plante gemaak word, waarvan baie medisinale en pesticidale eienskappe het. More as tweeduisend plantvariëteite is bekend om waardevolle chemical factorsand metabolites te produseer vir programme wat ompeste beheer.

Application of Phytochemicals as Mosquito Larvacide: An Assential Component Imm- IMM is 'n besluitnemingsproses vir die bestuur van mosquito populations wat 'n kombinasie van strategieë en metodes gebruik om 'n lae vector aantal vir 'n lang tydperk te handhaaf.

IMM se doelwitte is om mense se gesondheid te beskerm teen mosquito-verwante siektes, te handhaaf 'n gesonde omgewing deur die regte gebruik en afval van pesticides, en te verbeter die algehele kwaliteit van lewe deur praktiese en doeltreffende metodes van pest control.

(i)Goeie sanitasie, waterbestuur in permanent en permanents waterbronne, en kanalirrigasie help om hulpbronne en habitat te verminder. In order to remove Protecting and feeding mosquito larvae vegetasiebestuur is ook nodig.

(ii)Gebruik dipteran-spesifiekeoils, microorganisms, pest growth regulators, surface coatings, expanded polystyrene beads, phytochemicals, and organophosphates.

(iii)Adulticiding deur die gebruik van synthetic pyrethroids, organophosphates, insecticide-bedekte bed nets, genetic manipulations van vector species, ens

(iv) Gebruik van biologische beheertegnieke met behulp van pesticide-bedekte bed netts, genetic modifications of vector species, entomophagous bacteria, fungus, microsporidians, predators, and parasites ens.

(v) Beoordeling van mosquito bevolkings in volwasse en larval toestande en monitering van infeksies; en

IMM-beheer, is die larvicIn vergelyking met and er strategies vir iding metode meer doeltreffend, gefokus op die spesifieke organisme en veiliger as die beheer van adult mosquitoes. As 'n noodsaaklike komponent van IMM, was die gebruik van larvicide from botanical origin baie bestudeer. Deurbanises is verskeie soos ocimenone, rotenone, capllin, quassin, thymol, eugenol, neolignans, arborine, and goniothalamin are mosquito control agents.

5. Variation of Larvae Variation of Larvicidal Potential According To Mosquito Species Plant Parts and Polarity of Solvent- When used against mosquito larvae, phytochemicals can be highly effective. This species is significantly impacted by the plant species, parts used, age of the plant parts (young, mature, or senescent), extraction solvent, and species of vectors available (Sukumar K, Botanical derivatives in mosquito control, 1991) (Kassir JT, 1989). However, the primary function of the current documentation is to record modifications in the larvicidal activity of the plant extract. Because the particular solvent utilised for extraction has changed. As gevolg van die verskillende solvents wat gebruik is, het die larvicidal potential van dieselfde plant verander. Hierdie veranderinge sluit in Solanum xanthocarpum16, Euphorbia tirucalli, Momordica charantia Eucalyptus. (Raghavendra K, 2009)**.** It has been shown demonstrated that the polarity of the solvents used determines how active biochemicals from plants extracted are. Polar solvents sal polar molecules onttrek, terwyl non-polar solvents non-polar molecules sal onttrek. Dit is hoofsaaklik bereik deur die gebruik van elf verskillende solventstelsels, wat wissel van hexane of petroleum ether, wat die mees nie-polar is, tot water, wat die mees polar is en biochemicals met higher molecular weights soos proteins, glycans, ens. Chloroform of ethyl acetate is relatief polar en bestaan hoofsaaklik uit extracts van steroids, alkaloids en ander overbidding.Solvents with the lowest polarity (such as petroleum ether's soos hexane) or the highest polarity (such as soos aqueous or steam distillation) are used in the majority of investigations. However, other bioassays demonstrated that the biochemicals that were extracted using solvents that were moderately polar also performed well. As gevolg hiervan kan die potensiaal van extracted plant compounds aansienlik beinvloed word deur die verskeidenheid solventsoorte and there is difference in the chemo-profile of the plant species. Several other plants such as (Al-Doghairi M, 2004)*et al*. Nyctanthes arbotristis, Atlantia monophylla, Centella asiatica40, Cryptotaenia paniculatawere also reported with promising LC50 values.To identify the bioactive toxic chemical responsible for larval toxicity, these extracts can be separated. Culex was the most commonly used in the experiments, and Aedes was the least commonly used. In plaas van om 'n spesifieke solvent te gebruik, is 'n kombinasie van solvents of. Serial extraction deur verskeie solvents gebaseer op hul polarity ook getoets. In 'n aantal studies is daar gevind dat hierdie metodes 'n hoë larvicidal vermoë het (SE, 2000).

6. Nature of Active Ingredients Responsible For Larval Toxicity

Plante geskei en getoon dat hulle skadelik is vir verskillende mosquito soorte. Phytochemicals from the plant world, which are rich and unexplored, can be used to replace synthetic insecticides in mosquito control programs. (ishore N, 2011) *et al*.undersoil die effek van phytochemicals op mosquito larvae op grond van hulle chemical nature. Hulle het ook die vermoë om verskillende plant-gebaseerde secondary materials, soos alkanes, alkenes, alkynes, simple aromatics, lactones, essential oils and fatty acids, terpenes, alkaloids, steroids, isoflavonoids, pterocarpans, and lignans. against mosquito larvae. Daarbenewens het hulle verskeie bioaktiewe skadelike komponente uit verskillende. (Kishore N, 2011)

7. **Mode of Action of Phytochemicals in Target Insect Bo** (RS, 2010) *et al*.manufacturing Secondary metabolites that have developed to shield plants from herbivores are typically the active poisonous components of plant extracts. The insects that consume these secondary metabolites may come into contact with harmful compounds that affect a variety of molecular targets in a non-specific manner. (RS, 2010) and others. These targets include nucleic acids, biomembranes, proteins (enzymes, receptors, signalling molecules, ion-channels, and structural proteinsenzymes, receptors, signalling molecules, ion-channels, and structural proteins), and other elements of the cell98. Abnormalities in the nervous system (such as in neurotransmitter synthesis, storage, release, binding, and re-uptake, receptor activation and function, and enzymes involved in the signal transduction pathway) are the main cause of this, which in turn impacts insect physiology in a variety of ways and at different receptor sites.

Rattan examined how plant secondary metabolites affect insect bodies and reported a number of physiological disturbances, including pyrethrin's disruption of sodium and potassium ion exchange, rotenone's inhibition of cellular respiration, essential oils' inhibition of acetylecholinestrase, and Thymol's GABA-gated chloride channel inhibition. These disruptions include ryanodine's blocking of calcium channels, sabadilla's action on nerve cell membranes, thymol's blocking of octopamine receptors, hormonal imbalance, mitotic poisonings, azadirachtin's disruption of molecular events of morphogenesis, essential oil's alteration of cholinergic system behaviour and memory, and more. The most important of these is the inhibitioninhibition of acetylcholinerase activity (AChE), an essential enzyme that prevents nerve impulses from passing through the It is widely acknowledged that one of the main resistance mechanisms in insects is ache, which has been shown to be resistant to carbamates and organophosphorus. (RS., 2012)

8. **Some Medicinal Plant Extracts as Source of Larvicidal Agent**

8.1. *Argemone mexicana*

According to Chopra *et al*. (1956), *Argemone mexicana* is a significant medicinal herb in India. The yellow liquid that the plant produces when it is injured has so long been used to cure ailments such as dropsy, jaundice, jaundice, ophthalmia, scabies (Bose *et al*., 1963), and dermatological issues (Ambasta, 1986). According to Prajapati *et al*. (2003), seeds and seed oil can be used to treat intestinal disorders such as dysentery, ulcers, and asthma. Emetic, expectorantdemulcent, and diuretic qualities are among the many elements of this plant that are utilized to treat chronic skin issues (Savithramma *et al*., 2007). Leaves and seeds can promote good blood circulation and cholesterol levels, according to (Albuquerque *et al*.,2007). Nonetheless, flowers are known to be expectorants and have been utilized historically.Examined the larvicidal potential of leaf water extract and chloroform,hexane and methanol fraction of seed of *Argemone mexicana* on *Culex pipiens* and *Aedes aegypti*. Using various solvents, *Argemone mexicana* leaf extract was applied to Heliothis armigera, after 24 and 96 hrs of treatment. The effect of *Argemone mexicana* leaf extract in ethanol and acetone solvent on H. armigera reveals the severity of the epithelial lining's damage, with epithelial cells displaying vacuoles in some locations.

Also, it was ddiscoverdThat the gut lining had been harmed, and the ethanol extract of A. mexicana had caused the lumen to enlarge. Due to tissue clumping in the acetone extract of A. mexicana, the foregut Wall thickness has risen, resulting in a decrease in foregut diameter. As a result, the lumen Shrank and the vacuoles were visible in the columnar epithelial cell *Argemone mexicana* plant komponente extracted in acetone, ethyl acetate, petroleum ether, and methanol acted against Spodoptera litura Fab. They showed many anti-insect properties, including feeding deterrent, insecticidal, and insect growth regulation activities. One of the studied solvents, acetone, had the highest antifeedant activity (98.01%). Methanol was the next most active solvent, with 98.01%. In terme van die feeding deterrent wat onder die plantdele ondersoek is, het die saadekstrak die leafekstrak oortref.Various plant components extracted with different solvents failed to demonstrate a significant feeding deterrence (over 60%). Only the methanol extract of the seed had the greatest insecticidal potency (80 percent larval mortality), and it ended up killing all the treated insects (nil adult emergencThe ethyl acetate solvent extract's most effective anti-insect effect was found to control insect growth. It had minimale impak op adult emergence, al het dit 40% en 60% van larval en adult deformities veroorsaak. Soos enige plantdeel wat ondersoek is, het petroleum ether, 'n solvent extract, die laagste anti-insecteienskappe (Ramanan and Selvamuthukumaran, 2016).52 studies het gekyk na hoe exposure to crude *Argemone mexicana* extracts the growth and the second-instar *Aedes aegypti* mosquito larvae's developmental phases have been seen. Inhibition, mortality, and larval and pupal phases were evaluated. Mosquito larvae were given crude extracts of flowers, stems, and seeds based on ethanol during their second instar. Floral extract is the most effective larvicidal. Effek met 18.61 ppm na 24 uur van exposure en 9.47 ppm na 48 uur. Die effektiwiteit van stem- en saadekstrakte was aansienlik laer (Granados *et al*., 2018). *Argemone mexicana* leaf extract het larvicidalmeienskappeet 7.65 mg/ml in ethanol en 10.17 mg/ml in aqueous solutionrespectively (LD_{10}= 7.17 mg/ml, LD_{50}= 31.55 mg/ml). According to the findings, the mortality rate increase, if the concentration increase.

The third instar larvae of *Spodoptera litura* demonstrated stronger larvicidal activities when exposed to the ethanol solvent extract of *Argemone mexicana*. (Vetal and Pardeshi, 2019).Larvae of Tribolium castaneum in their sixth instar were assessed for their resistance to extracts from *Argemone mexicana* seeds. Daar was 100% mortality wanneer wheat behandel is met acetone extract by 'n dose van 1.6 ml/kg wheat. Aan die ander kant, wanneer wheat behandel is met ethanol extract by dieselfde dose, was daar 56.6+4.16 larvicidal effekte en 20.1+1.73 adults uitpupated remains (Patil, 2019). Using petroleum ether, seeds, aerial parts, and roots of *Argemone mexicana* was tested for their insecticidal abilities on Callosobruchus chinensis and Sitophilus oryzae (stored grain pests).volgens Hasan (Ali,2019) deur die gebruik van petroleum ether, chloroform ($CHCl_3$) en methanol (CH_3OH) extracts. Petroleum ether, CHCl3, and CH_3OH extracts did not cause any 53 deaths in the air section or the roots. However, *S. oryzae* and *C. chinensis* were successfullykilled by seed extracts from the same extracts.

The biological and life table parameters of *Chrysoperla carnea* (Neuroptera: Chrysopidae) were affected by an ingesting plant extract based on *Argemone mexicana* in controlled circumstances in the lab. Diluted *A. mexicana* extract in different solvents had only a minor effect on biochemical parameters. Daar was egter geen impak op die intrinsieke groeikoers nie. Die sterftekoers van predatore het toegeneem in vulnerable stadiums, wat beteken dat daar 'n impak sou wees op die predator se ontwikkelingsstadium.More as vyftig persent van the insects was killed by both multiple therapies as well as the commercial insecticide imidacloprid that was examined in the research (Aragon and Sanchez 2020). (Miriam Noemi 2022) looked at *Argemone mexicana*'s ethanolic leaf extractfor Diaphorina citri.,Leaf extracts at concentrations of 5, 10 and 15 persent was gebruik vir D. citri.

The disease known as Huanglongbing (HLB) is caused by the Candidatus liberibacter and spread by the bug Diaphorina citri. This disease causes significant annual economic losses for citrus cultivation and trade worldwide.

8.2. ***Tinospora cordifolia***

Tinospora cordifolia is 'n groot, deciduous climbing shrub wat op hoër hoogtes groei. Sy unieke blooms is groenish-geel. "Guduchi" in Sanskrit is another name for a member of the Menispermaceae family (Rana *et al*., 2012). Die bloeiseltyd strek oor die somer en winter (Upadhyay *et al*., 2010). Various active substances have been isolated from various plant parts, including the root, stem, and entire plant). It has been gebruik in die behandeling van verskeie siektes, soos fever, vomiting, diabetes, jaundice, anemia, polyuria, en skinprobleme. It is a common feature of many natural remedies. It has anti-allergic, immunomodulatory, antioxidant, and antineoplastic anti-allergic, antipyretic, and anti-inflammatory properties. It has hypoglycemia as well (Khan and Chowdhury, 2017). (Paul *et al*. 2020) ondersoek die larvicidal krag van ethanolic extracts of Tinospora cordifolia leaf. The T. cordifolia leaf ethanolic extract exhibited high larvicidal activity at 100.64 ppm LC_{50} and 386.37 ppm LC_{90}. Later, they mixed the ethanolic leaf extract of *T. cordifolia* with the methanolic extract of Andrographispaniculata. The combined extracts had a greater larvicidal potential as the extracts from either plant alone. Posing 113.20 ppm LC50 en 236.08 ppm LC90. Tinospora cordifolia het 'n inhibisie van insekte se groei getoon teen Spodoptera litura larvae (Shakil and Saxena. 2006). Daarbenewens is die larvicidal eienskappe van hierdie plant leaf extract showed higher larval mortality at concentrations of 300 ppm with LC_{50} and LC_{90} values of 55.432 and 221.027 ppm for A. stephensi and 104.104 and 483.622 ppm for C. quinquefasciat.

8.3 *Prunus persica*- Prunus persica, a Rosaceae family and Amygdaloidea subfamily member, is mostly found in India, China, and Spain (Dhingra *et al*., 2014). Peaches is antimicrobial, antiallergic, anticancer, antibacterial, antitumor, antioxidant, and anti-inflammatory. Peach plant leaves, wat ook antihelmintic, insecticidal, vermicide, sedative, and laxative are 55 (Haleema *et al*., 2020), can be used to treat whooping cough and leukoderma.Shehata (2019) studied Prunus persica's larvicidal capacity by using third-instar larvae of *Culex pipiens*. Daar was 100% larval mortality met LC50 concentrative van 132.70, 70.8, en 33.30 ppm na 24 uur, 48 uur en 72 uur van exposure. The larvicidal properties of Prunus persica extracts were tested on *Musca domestica* (L.) houseflies. Daar is getoon datdruppels van *Prunus persica M. domestica* (L.) kan larve.(Seo and Park, 2011) Aylmarson and Vasudevan (2021) studied the larvicidal properties of Prunus persica leaf extract by using *Anopheles stephensi* and *Culex quinquefasciatus* (4th instar) as subject to investigate the larvicidal properties of Prunus persica leaf extract. Methanolic leaf extract showed higher larval mortality at concentrations of 300 ppm with LC_{50} and LC_{90} values of 55.432 and 221.027 ppm for A. stephensi and 104.104 And 483.622 ppm for C. quinquefasciatus, respectively.

9. **Phytochemicals With Larvicidal Activity**

The past, several phytochemicals, such as, have been shown to possess beneficial propertSing. Phenolics, alkaloids, steroids, terpenoids, and essential oils have insecticidal properties.(Pelah *et al*., 2002)(Shaalan *et al*., 2005). Researchers are interested in their capacity to eradicate mosquito larvae. I have examined a wide range of chemicals, including alkanes, alkenes, alkamides, aromatics, simple thiophenes, xanthones, tri-, diterpenoids, steroids, isoflavonoids, and alkaloids, as well as limonoids, polyacetylenes, sesquiterpene lactones. Most of them, according to reports are known to be essential for the induction or constitution of plant chemical defenses against damaging factors.Pathogens and insects (Ghosh and Pavela 2019).According to Roopan and Wadje (2012), some of these substances act as a defense mechanism.Plant defense mechanisms against pests, herbivores, and microbes. Although anthraquinones, steroids (Ghosh *et al*., 2010), saponin (Wiesman *et al*., 2005), ketones, and phenols (Sendelbach, 1989)Tannin molecules (Khanna and Kannabiran, 2007) and (Ak,2008) are known to play a significant role.Flavonoids and aromatic acids are also involved in plant defense mechanisms against bugs and microbes.Known for its medicinal and many pesticidal qualities (Singha and Chandra, 2010)

10. Scope for future research: isolation of toxic larvicidal active ingredients Screening of floral biodiversity to find unrefined plant extracts with potential as mosquito larvicidal agents.Plant extracts have been shown in numerous studies to be effective against mosquito larvae as a reservoir pool of bioactive toxic chemicals. A few number, however, have been widely employed In vector control programmes and commercially produced. The primary causes of the inability to land movements of bioactive toxic phytochemicals in laboratories are inadequate characteriszation and ineffectiveness in identifying the structure of the active toxic components that give larvicidal action. To create an environmentally friendly biopesticide. In any phytochemical research strategy, the following actions can be suggested:

(i) screening floral biodiversity for crude plant extracts with promise as mosquilarvicidal agents.solvent extracts from king plants, beginning with non-polar substances.

(i)compounds and working your way up to polar ones, and figuring out which solvent extract works best.

(ii)Determining the deadly concentration (LC_{50}/$LC1_{00}$ values) by evaporating the liquid solvent to produce a residue solid.
(iii) The solid residue is subjected to phytochemical analysis, and toxic phytochemicals with larvicidal potential are purified and isolated using different types chromatography.
(iv)Using examinations using gas chromatography and mass spectrometry (GCMS), nuclear magnetic resonance (NMR), and infrared (IR), the structure of the active principle is determined.
(v)Research on how the active component affects organisms that are not the intended target; and before being recommended for use in commercial and vector control, the active principle was tested in the field.

Conclusion

Environmental protection is given top priority in today's society. To be considered acceptable, an insecticide should be environmentally friendly in nature, but it does not have to kill a large number of target species. Since phytochemicals are generally safe, inexpensive, and easily accessible in many regions of the globe, they may be used as such. Traditional medicines from various regions of (Bowers WS, 1995). The world employ many plants for their ability to repel mosquitoes. According to Bowers *et al*. (100), screening locally accessible medicinal plants for mosquito control will decrease dependency on expensive, imported items, promote local efforts to upgrade the public health infrastructure, and generate jobs locally. When searching for new bioactive toxins from plants, ethno-pharmacological methods appear to be more predictive than the random screening strategy. Plants' interest as a source of innovative larvicidal chemicals has grown as a result of recently discovered new isolation techniques, chemical characteriszation using various spectroscopic and chromatography methods, and new pharmacological testing. Synergistic methods, including applying microbial insecticides and botanical blends with mosquito predators, will have a greaterimpact on lowering the vector population and the severity of the epidemic.

Reference

Sabiha, H., , S., Islam, S., Rekha, S. B., Nesa, M. Lethal action of *Argemone mexicana* L. extracts against *Culex quinquefasciatus* Say larvae and Tribolium castaneum adults. Journal Pharmacognosy Phytochemistry 20012. 6: 466 469.

M. Z. Y. and Badran R. A. M. Mosquito control with extracts from plants of the Egyptian Eastern Desert. Journal Herbs Spices Medicinal Plants 1996. 3: 3540-80.

. WS, Sener B, Evans PH, Bingol F, Erdogan I. Activity of Turkish medicinal plants against mosquitoes *Aedes aegypti* and Anopheles gambiae. Insect Sci Appl. 1995;16:339–42.

.Al-Doghairi M, El-Nadi A, El hag E, Al-Ayedh H. Effect of Solenostemma argel on oviposition, egg hatchability and viability of *Culex pipiens* L. larvae. Phytother Res. 2004;18:335–8. Doi: 10.1002/ptr.1432.

.Bhatt RP, Khanal SN. Environmental impact assessment system in Nepal – an overview of policy, legal instruments and process. Kathmandu Univ J Sci Enginnering Tech. 2009;5:160–70.

.Bowers WS, Sener B, Evans PH, Bingol F, Erdogan I. Activity of Turkish medicinal plants against mosquitoes *Aedes aegypti* and Anopheles gambiae. Insect Sci Appl. 1995;16:339–42.

.Brown AW. Insecticide resistance in mosquitoes: a pragmatic review. J Am Mosq Control Assoc. 1986;2:123–40.

.Chowdhury N, Bhattacharjee I, Laskar S, Chandra G. Efficacy of Solanum villosum Mill.(Solanaceae: Solanales) as a biocontrol agent against fourth Instar larvae of *Culex quinquefasciatus* Say. Turk J Zool. 2007;31:365–70.

.CTD/WHO PES/IC/96.1. Geneva: WHO; 1996. World Health Organization; p. 69.

.Isman MB. Neem and other Botanical insecticides: Barriers to commercialization. Phytoparasitica. 1997;25:339–44

.Kamaraj C, Rahuman AA, Bagavan A, Abduz Zahir A, Elango G, Kandan P, *et al*. Larvicidal efficacy of medicinal plant extracts against *Anopheles stephensi* and *Culex quinquefasciatus* (Diptera: Culicidae) Trop Biomed. 2010;27:211–9.

.Kamaraj C, Rahuman AA. Larvicidal and adulticidal potential of medicinal plant extracts from south India against vectors. Asian Pacific J Trop Med. 2010;3:948–55.

.Khatune NA, Md. Haque E, Md. Mosaddik A. Laboratory Evaluation of Nyctanthes arbortristis Linn. Flower extract and its isolated compound against common filarial Vector, Cufex quinquefasciatus Say (Diptera: culicidae) Larvae. Pak J Bio Sci. 2001;4:585–7.

.Krishnan K, Senthilkumar A, Chandrasekaran M, Venkatesalu V. Differential larvicidal efficacy of four species of Vitex against *Culex quinquefasciatus* larvae. Parasitol Res. 2007;10:1721–3.

.Lee SE. Mosquito larvicidal activity of pipernonaline, a piperidine alkaloid derived from long pe pepper, Piper longum. J Am Mosq Control Assoc. 2000;16:245–7

.Maniafu BM, Wilber L, Ndiege IO, Wanjala CCT, Akenga TA. Larvicidal activity of extracts from three Plumbago sp against Anopheles gambiae. Mem Inst Oswaldo Cruz. 2009;104:813–7.

Prabhakar K, Jebanesa A. Larvicidal efficacy of some cucurbitacious plant leaf extracts against *Culex quinquefasciatus*. Bioresource Tech. 2004;95:113–4.

Roark RC. Some promising insecticidal plants. Econ Bot. 1947;1:437–45.

Rose RI. Pesticides and public health: integrated methods of mosquito management. Emerg Infect Dis. 2001;7:17–23. Doi: 10.3201/eid0701.010103. [DOI] [PMC free article]

.Russell TL, Kay BH, Skilleter GA. Environmental effects of mosquito insecticides on saltmarsh invertebrate fauna. Aquat Biol. 2009;6:77–90.

Senthil Nathan S, Savitha G, George DK, Narmadha A, Suganya L, Chung PG. Efficacy of Melia azedarach L. extract on the malarial vector *Anopheles stephensi* Liston (Diptera: Culicidae) Bioresource Tech. 2006;97:1316–23

Senthilnathan S, Choi MY, Seo HY, Paik CH, Kalaivani K, Kim JD. Effect of azadirachtin on acetylcholinesterase (AChE) activity and histology of the brown planthopper Nilaparvata lugens (Stål) Ecotox Environ Safety. 2008;70:244–50.

Senthil-Nathan S, Kalaivani K, Sehoon K. Effects of Dysoxylum malabaricum Bedd. (Meliaceae) extract on the malarial vector *Anopheles stephensi* Liston (Diptera: Culicidae) Bioresource Tech. 2006;97:2077–83.

Shaalan EAS, Canyonb D, Younesc MWF, Abdel-Wahaba H, Mansoura AH. A review of botanical phytochemicals with mosquitocidal potential. Environ Int. 2005;3:1149–66. Doi: 10.1016/j.envint.2005.03.003.

Shahi M, Hanafi-Bojd AA, Iranshahi M, Vatandoost H, Hanafi-Bojd MY. Larvicidal efficacy of latex and extract of Calotropis procera (Gentianales: Asclepiadaceae) against *Culex quinquefasciatus* and *Anopheles stephensi* (Dipterans: Culicidae) J Vector Borne Dis. 2010;47:185–8.

Sivagnaname S, Kalyanasundaram M. Laboratory evaluation of Methanolic extract of Atlanta monophyletic (Family: Rutaceae) against immature stage of mosquitoes and non-target organisms. Mem Inst Oswaldo Cruz. 2004;99:115–8.

Sukumar K, Perich MJ, Boobar LR. Botanical derivatives in mosquito control: a review. J Am Mosq Control Assoc. 1991;7:210–37.

World Health Organization. Regional Framework for an Integrated Vector Management Strategy for the South-East Asia Region. 2005:1–13. SEA-VBC-86.

Yadav R, Srivastava VK, Chandra R, Singh A. Larvicidal activity of Latex and stem bark of Euphorbia tirucalli plant on the mosquito *Culex quinquefasciatus*. J Communicable Dis. 2002;34:264–9.

Yang YC, Lim MY, Lee HS. Emodin isolated from Cassia obtusifolia (Leguminosae) seed shows larvicidal activity against three mosquito specie. J Agri Food Chem. 2003;51:7629-21.

Yenesew A, Derese S, Midiwo JO, Heydenreich M, Peter MJ. Effect of rotenoids from the seeds of Millettia dura on larvae of *Aedes aegypti*. Pest Manage Sci. 2003;59:1159–61

.Bagavan A, Kamaraj C, Rahuman A, Elango G, Zahir AA, Pandiyan G. Evaluation of larvicidal and nymphicidal potential of plant extracts against Anopheles subpictus , *Culex quinquefasciatus* and Aphis gossypii Glover. Parasitol Res. 2009;104:1109–17. 7.

Matasyoh JC, Wathuta EM, Kairuki ST, Chepkorir R, Kavulani J. Aloe plant extracts as alternative larvicides for mosquito control. Afr J Biotech. 2008;7:912–5.

Agra, M. F., Baracho, G. S., Nurit, K., Basilio, I. J. L. D. and Coelho, V. P. M. (2007). Medicinal and poisonous diversity of the flora of "Cariri Paraibano", Brazil. Journal Ethnopharmacol. 111: 383-395.

Aliero, B. L. (2003). Larvicidal effects of crude extracts of *Azadirachta indica* (neem) on the larvae of Anopheles mosquito. African Journal of Biotech. 2(9): 325-327.

F. A., Taha, N. A., Mashaly, A. M. A. and Wadaan, M. A. (2013). Larvicidal activity of selected xerophytic plants against *Culex pipiens* and Aedes caspius (Diptera: Culicidae). Pakistan Journal of Zoology. 45(1): 241-246.

K. O., Mendie, U. E., Smith, S. T., Oyefolu, A. O. and Coker, A. O. Screening of some medicinal plants used in South-West Nigerian traditional medicine for anti-salmonella typhi activity. Journal of Herbal Pharmacotherapy. 2005(1): 45-60.

Kishore N, Mishra BB, Tiwari VK, Tripathi V. A review on natural products with mosquitosidal potentials. In: Tiwari VK, editor. Opportunity, challenge and scope of natural products in medicinal chemistry. Kerala: Research Signpost; 2011. pp. 335–31.

M., Serratos, C., Huerta-de la Peña, A., Aragón García, A., Pérez-Torres, B., Effect by Ingestion of Extracts of *Argemone mexicana* L. on Biological Parameters and Capability of *Chrysoperla carnea* (Stephens) to Increase in a Laboratory. Southwestern Entomologist. 202045: 405.

N., and Al-Mekhlafi, F. A.Evaluation of the safe use of the larvicidal fraction of Cappariscartilaginea decne. Against Aedes caspius (Pallas) (Diptera: Culicidae) larvae. African Entomology. 2022: 838-846.

P. M., Subudhi, S and Das, C. C Laboratory evaluation of Ipomoea leaf extract in the control of *Culex quinquefasciatus*. Population Environment Ecology.2011(3): 519 522.

R. A., Cavasin, G. M., Silva, H. H. G., Geris, R., and Silva, I. G. Alteraçoes morfo histológicas emlarvas de *Aedes aegypti* (Linnaeus, 1762) (Diptera, Culicidae) causadas pela atividade larvicidado óleo- resina da planta medicinal Copaifera reticulata Ducke (Leguminosae). Revista de Patologia Tropical. 36: 75-86

Rattan RS. Mechanism of action of insecticidal secondary metabolites of plant origin. Crop Protec. 2010;29:913–20.

V., Lakshmi, T., Sakthivadivel, M. and Daniel, T. Effect of certain plant extracts against the fourth instar larvae of filarial vector, C. quinquefasciatus, Journal of Ecobiology.20 12(2): 93-32