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Medicinal Plants as Potent Power for Malaria Control: Review

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ABSTRACT

Mosquito vectors are living organisms that can transmit infectious diseases between human from animals to humans. It is bloodsucking insect that ingest disease-producing microorganisms during a blood meal from an infected host. This review aims to explain some medicinal plants that exhibit mosquitocidal agents on genus Anopheles mosquito species. Currently, the utilization of artificial chemicals to regulate insects and mosquitoes raises many considerations associated with environment and human health. Another aim is to use natural merchandise that possess sensible effectiveness, simple handiness, fewer adverse environmental impacts, and are environmentally friendly have crystal rectifier to the multiplied interest in plant origin chemical pesticides. It's supported original articles obtained by looking on major databases. Our literature review disclosed that 96 medicinal plants used in the all parts (leaves, root, bark and bud). This article envisaged to review the reports of ovicidal, oviposition deterrent, larvicidal, pupicidal and repellent activities, which might be employed in vector-borne disease management programs.

Keywords: *Mosquitocidal Activity, Medicinal Plants, Anopheles Species*.

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INTRODUCTION

Malaria

Mosquitoes have been accounted as the well-spring of different diseases influencing human. Including around 3500 species, mosquitoes are discovered past the tropical and subtropical locales of the world [1]. Malaria in people is brought on by contamination with one or a greater amount of a few types of *Plasmodium* (i.e., *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae*, and incidentally other *Plasmodium* species) parasites. The parasite is transmitted by the bite of an infective female Anopheles mosquito. *P. falciparum* and *P. vivax* species cause the most contaminations around the world. *P. falciparum* is the operators that most usually cause serious and possibly lethal malaria. As indicated by the most as of late accessible data, an expected 207 million clinical cases and 627,000 (0.3%) deaths were reported worldwide in 2012, for the most part among children matured five years living in sub-Saharan Africa. *P. vivax* and *P. ovale* have torpid liver stages, which can reactivate and cause malaria a while for years after the underlying disease. *P. malariae* can bring about durable diseases and if untreated or insufficiently treated, can continue asymptomatically in the human host for quite a long time, even a lifetime.

Malaria disease worldwide

Anopheles stephensi transmits of malaria fever in urban district of India. Among 53 Anopheline species present in India, 9 are vectors of malaria fever [2] and malaria is still the most critical reason for mortality with around a few million new cases emerging each year. A more effective approach to decrease mosquito populace is to focus on the hatchlings. The main arrangement is to keep the ailment conveying mosquito from

reproducing and gnawing people. In this situation, mosquito vector control is pivotal. *An. subpictus* Grassi is distributed throughout India, China, Afghanistan, Borneo, Malaysia, Sri Lanka, Philippines, Indonesia, and Java. It is a dominant species in Haryana and Uttaranchal states. Though it is a non-vector species, same infected specimens with malaria parasite have been reported from India, Indonesia, and Java. *An. subpictus* is a significant secondary vector in Sri Lanka [3, 4]. *An. subpictus* is recognized as the secondary vector of malaria in South East Asia, with a large number of cases being reported from India. India contributes 77% of the world's population [5, 6]. Members of the *An. gambiae* complex are the most important vectors of malaria in sub-Saharan Africa of which *An. gambiae* and *An. arabiensis* are the most widely distributed and most efficient vectors [7]. Mosquito larvae and pupae are normally focused on utilizing organophosphates, insect development controllers and microbial control operators. Inside lingering showering and insect spray treated bed net are likewise utilized to decrease transmission of malaria in tropical nations. Notwithstanding, engineered chemicals have solid negative consequences for human wellbeing and nature, and incite resistance in various mosquito species [8, 9].

Eruption of malaria disease in the world

Mosquitoes have been accounted for as the wellspring of different diseases influencing human, and are discovered in the tropical and subtropical locales of the world. In Asia, the mosquito is the most important vector of malaria, with 200 to 450 million infections annually worldwide; it sources up to 2.7 million deaths. WHO Malaria Report estimates that 3.3 billion people were at the peril of malaria in 2010, although of all geographical regions, populations living in sub-Saharan Africa (SSA) have the highest peril of obtaining malaria; among 216 million episodes of malaria in 2010, approximately 81%, or 174 million occasions, were noticed from the African region. There were estimated malaria demises of 655,000 in 2010, of which 91% were from Africa [7]. Malaria afflicts 36% of the world people i.e. 2020 million in 107 countries and territories position in the tropical and subtropical regions.

As indicated by the most recent evaluations, there were around 198 million cases with malaria fever in 2013 and an expected 584,000 passing. Most passing's happen among children living in Africa. Malaria death rates among children in Africa have been decreased by an expected percentage of 58% since 2000. Globally, 4.28 million deaths have been averted due to malaria control efforts between 2001 and 2013, of which 3.92 million (92%) are in children under 5 years of age in sub-Saharan Africa. They account for 20% of the 20 million child deaths; it has been estimated that it has been averted in sub-Saharan Africa between 2001 and 2013 through the overall reduction in child mortality rates [3]. In 2013, around 6.3 million children died before their fifth birthday, at a rate of around 17,000 per day. The risk of dying before age five varies enormously depending on where a child is born. In Luxembourg, the under-five mortality pace is fair 2 deaths per 1,000 live births; in Angola it is 167 per 1,000. Since 1990, 223 million children have died before their fifth birthday [9]. Malaria deaths dropped by 58% in African children under five years old from 2000-2013 [3]. As per the most recent evaluations from WHO, there were 214 million new instances of malaria worldwide in 2015 and there were an expected 438,000 malaria passing. Children under five are especially helpless to malaria ailment, disease and demise. Malaria slaughtered an expected 306,000 under-fives comprehensively, incorporating 292,000 kids in the African region [4]. Malaria incidence rate has declined by 41% since 2000, and 2010. Mortality has fallen by 61% since 2000 and 29% since 2015. Seventeen countries eliminated malaria between 2000 and 2015, with a further 13 countries "approaching elimination" [10]. According to the reports, India has 6% of all malaria cases in the world, 6% of the deaths, and 51% of the cases in global *P. vivax* cases. The report estimates the total cases in India as 1.31 million and the deaths as 194 [11]. History uncovers that the occurrence of malaria in India happened in the 1945s with an expected 75 million cases and 800,000 passed for each year. This makes female mosquito a perfect transmitter of different blood borne pathogens and operators of destroying human diseases. The year's malaria has been considered as one of the main sources of

deaths in India (http://nvbdcp.gov.in/malaria-new.html) (Table 1).

Medicinal plants based mosquito control

Medicinal plants might be elective wellsprings of mosquito control specialists since they constitute a rich wellspring of bioactive compounds that are biodegradable and conceivably suitable to control mosquitoes. Pesticides of organic inception might serve as suitable option for biocontrol procedures later on [12]. The use of synthetic chemicals for management of mosquitoes raises many issues connected to the environment and human health [13]. Eco-friendly tools to manage mosquito young instar populations in an IPM framework are urgently needed. Natural products are usually most preferred due to their less harmful nature and fast biodegradability. Plant products have been used traditionally by human communities in different rural areas worldwide against insect vectors and parasites [14]. Most of the mosquito control programs target the larval stage in their breeding sites with larvicides. Monoterpenes such as a-pinene, limonene, terpinolene, citronellol, citronellal, camphor and thymol are regular constituents of a number of essential oils of medicinal plants. The chemicals derived from plants have been projected as weapons in future mosquito control program as they are shown to act as general toxicant, growth and reproductive inhibitors, repellents and oviposition-deterrent [15]. Table 2 gives definite surveys of plant items reported for mosquitocides and insecticides tested against malarial species.

CONCLUSION

Plants as option for wellspring of larvicidal, ovicidal, oviposition deterrent, pupicidal and repellent activity reported in various ethnobotanical reviews. All the tried plants had diverse scope of larvicidal, ovicidal, oviposition deterrent, pupicidal and repellent action which might be utilized as traditional mosquito control operators. On the premise of the present examination results we presume that therapeutic plants extracts contains strong mosquitocidal bioactive standards which might be required further sanitizations to have its manufactured analogs, which will be done in future.

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Table 1. Incidence of Malaria surveillance data in India

Years	Total malaria cases million	*P. falciparum* million	Death due to malaria (Thousand)
1961	49,151	-	-
1962	59375	-	-
1963	87306	-	-
1964	112942	-	-
1965	99,667	-	-
1966	148012	-	-
1967	278214	-	-
1968	274634	-	-
1969	347975	-	-
1970	694017	-	-
1971	1322398	-	-
1972	1428649	-	-
1973	1930273	-	-
1974	3167658	-	-
1975	5166142	-	-
1976	6.47	0.75	59
1984	2.18	0.65	247
1985	1.86	0.54	213
1986	1.79	0.64	323
1987	1.66	0.62	188
1988	1.85	0.68	209
1989	2.05	0.76	268
1990	2.02	0.75	353
1991	2.12	0.92	421
1992	2.13	0.88	422
1993	2.21	0.85	354
1994	2.51	0.99	1122
1995	2.93	1.14	1151
1996	3.04	1.18	1010
1997	2.66	1.01	879
1998	2.22	1.03	664
1999	2.28	1.14	1048
2000	2.03	1.05	932
2001	2.09	1.01	1005
2002	1.84	0.90	973
2003	1.87	0.86	1006
2004	1.92	0.89	949
2005	1.82	0.81	963
2006	1.79	0.84	1707
2007	1.51	0.74	1311
2008	1.53	0.77	1055
2009	1.56	0.84	1144
2010	1.60	0.83	1018
2011	1.31	0.67	754
2012	1.07	0.53	519
2013	0.88	0.46	440
2014	1.10	0.72	561
2015	1.17	0.78	384
2016	1.09	0.71	331
2017	1.31	0.53	194
2018 (up to July)	172643	92436	14

Sources data (http://nvbdcp.gov.in/malaria-new.html)

Table 2. Plant reported for larvicidal, ovicidal, oviposition deterrent, pupicidal and repellent activity

Plant species	Family	Plant parts	Instars larvae / eggs / pupae / adults	Bioactivity	$LC_{50}$and LC_{90}values	References
Abrus precatorius	Fabaceae	Seed	IV instars	Larvicidal	Ethyl acetate extract was19.31 and 71.71 ppm, respectively	Bagavan and Rahuman [16]
Acalypha alnifolia	Euphorbiaceae	Leaf	NL	Ovicidal, repellent, adulticidal	Adulticidal activity of methanol extract was 274.76 and 495.88 ppm, respectively	Kovendan et al. [17]
Achras sapota	Sapotaceae	Leaf	III instars	Larvicidal, ovicidal, pupicidal and repellent	Methanol extract was 39.54 and 98.53 ppm, respectively	Krishnappa and Elumalai [18]
Adansonia digitata	Bornbacaceae	Leaf	III instars	Larvicidal and repellent	Methanol extract was 78.18 and 155.42 ppm, respectively	Krishnappa et al. [19]
Adhatoda vasica	Acanthaceae	Leaf	IV instars	Larvicidal	Acetone extract was 18.20 and 96.33 ppm, respectively	Kamaraj et al. [20]
Aloe vera	Asphodelaceae	leaves	I, II, III, IV instars	Larvicidal, pupicidal	Ethanol extract of LC_{50} value was 48.79, 59.09, 70.88, 83.58 ppm, respectively	Dinesh et al. [21]
Annona muricata	Annonaceae	Leaf	NL	Larvicidal	Aqueous extract of LC_{50} value was 61.38 and 156.55 ppm, respectively	Santhosh et al. [22]
Annona reticulate	Annonaceae	leaf	III instars	Larvicidal, ovicidal and pupicidal	Methanol extract of LC_{50} value was 74.36 and 93.85 ppm, respectively	Baluselvakumar et al. [23]
Annona sengalensis	Annonaceae	Leaf	IV instars	Larvicidal, ovicidal and pupicidal	N-hexane fraction of LC_{50} value was 298.8 and 572.9 ppm, respectively	Younoussa et al. [24]
Annona squamosa	Annonaceae	Leaf	IV instars	Larvicidal, oviposition deterrent and repellent	Petroleum ether extract was 118.4 and 213. 10 ppm, respectively	Vijaya kumar et al. [25]
Arachis hypogaea	Fabaceae	Leaves	IV instar	Larvicidal	Aqueous extract of LC_{50} value was 71.57 and 214.62 ppm, respectively	KuppanVelu et al. [26]
Artemisia nilagirica	Compositae	Leaves	I, II, III, IV instars	Larvicidal, pupicidal, adulticidal, repellent	Methanol extract was 272.50, 311.40, 361.51, 442.51 and 590.07, 688.81, 789.34, 901.59 ppm, respectively	Panneerselvam et al. [27]
Azadirachta indica	Meliaceae	Leaf, pod	IV instars	Larvicidal, repellent and smoke toxicity effect	Azadirachtin was 0.299 and 1.061 ppm, respectively	Murugan et al. [28]
Balanites aegyptiaca	Balanitaceae	Roots	IV instars	Larvicidal	Ethanolic extract of LC_{50} value was 6.61 ppm, respectively	Nganjiwa et al. [29]
Calotropis gigantean	Asclepiadaceae	Leaf	I, II, III, IV instars	Larvicidal, pupicidal	Methanol extract was 73.77, 89.64, 121.69,	Kovendan et al. [30]

					155.49 and 199.31, 245.07, 373.85, 415.31 ppm, respectively	
Catharanthus roseus	Apocynaceae	Leaves	IV instar	Larvicidal, pupicidal	Aqueous extract was 68.62 and 184.85 ppm, respectively	Subarani et al. [31]
Chlomolaena adorata	Asteraceae	Leaf	III, IV instars	Larvicidal	Methanolic extract was 1613 and 8306 ppm, respectively	Jagruti et al. [32]
Chomelia asiatica	Rubiaceae	Leaf	III instars	Larvicidal	Aqueous extract of LC_{50} value was 90.17 and 165.18 ppm, respectively	Muthu kumaran and Govindarajan [33]
Chrysanthemum indicum	Asteraceae	flower	I, II, III, IV instars	Larvicidal	Aqueous extract was 78.22, 110.63, 181.85, 298.79 and 417.30, 531.31, 675.76, 973.54 ppm, respectively	Arokiyaraj et al. [34]
Cissus quadrangularis	Vitaceae	Leaf	IV instars	Larvicidal and ovicidal	Methanol extract was 37.48 and 95.93 ppm, respectively	Krishnappa et al. [35]
Citrullus lanatus	Cucurbitaceae	Leaf	III, IV instars	Larvicidal	Methanolic extract was 84.23 and 989.39 ppm, respectively	Ajithadas aruna et al. [36]
Citrus sinensis	Rutaceae	Leaf	I, II, III, IV instars	Larvicidal	Ethanol extract was 182.24, 227.93, 291.69, 398.00 and 452.44, 544.72, 659.31, 858.92 ppm, respectively	Murugan et al. [37]
Clausena anisata	Rutaceae	Leaf oil	III instars	Larvicidal	Essential oil from119.59 and 209.96 ppm, respectively	Govindarajan [38]
Cleistanthus collinus	Euphorbiaceae	Leaf	III instars	Larvicidal	Ethyl acetate extract was 399.72 and 1251.76 ppm, respectively	Arivoli and Samuel [39]
Clerodendron inerme	Verbinaceae	Leaf	I, II, III, IV instars	Larvicidal	Crude extract was 55.04, 63.33, 73.05, 80.16 and 125.50, 137.16, 153.55, 156.93 ppm, respectively	Kovendan and Murugan [40]
Cochliobolus lunatus	Pleosporaceae	Leaves	II, III, IV instars	Larvicidal	Plant extract was 1.17, 1.30, 141 and 2.99, 3.13, 3.29 ppm, respectively	Rahul et al. [41]
Coleus aromaticus	Lamiaceae	Leaf	III instars	Larvicidal	Ethyl acetate extract was 28.88 and 65.35 ppm, respectively	Barani tharan et al. [42]
Commiphora caudata	Bursaceae	Leaf	III instars	Larvicidal	Ethyl acetate extract was 96.04 and 104.44 ppm, respectively	Barani tharan and Dhanasekaran [43]
Corchorus capsularis	Malvaceae	Leaf	III instars	Larvicidal, ovicidal	Methanol extract was 176.19 and 334.56 ppm, respectively	Elangovan et al. [44]
Cymbopogon citratus	Poaceae	Leaf	III instars	Larvicidal	Methanol extract was 74.02 and 158.20 ppm, respectively	Karunamoorthi and Ilango [45]
Cuminum cyminum	Apiaceae	Vegetables	III instars	Larvicidal (24, 48 and 72	Chloroform;methanol (1:1) extract of 0.15,	Singha, and Chandra [46]

				hours)	0.09, 0.04 and 1.21, 0.23, 0.12 ppm, respectively	
Datura metel	Solanaceae	Leaves	I, II, III, IV instars	Larvicidal	Aqueous extract was 34.69, 42.16, 47.16, 55.22 ppm and 105.47, 118.82, 133.25, 150.11 ppm, respectively	Murugan et al. [47]
Datura stramonium	Solanaceae	Leaf	IV instars	Larvicidal, repellent	Ethanolic extract of LD_{50} and LD_{90} values was 16.07 and 41.95 dose , respectively	Swathi et al. [48]
Derris elliptica	Fabaceae	Root, shoot	III instars	Larvicidal	Petroleum ether extract was 0.307 and 0.58 ppm, respectively	Dohutia et al. [49]
Elaeagnu indica	Elaeagnaceae	Leaf	IV instar	Larvicidal	Acetone extract of LC_{50} value was 3.30 and 6.94 ppm, respectively	Srinivasan et al. [50]
Eranthemum roseum	Acanthaceae	Leaf	III instars	Larvicidal, ovicidal, pupicidal	Acetone extract was 121.65 and 237.38 ppm, respectively	Elumalai et al. [51]
Ervatamia coronaria	Apocynaceae	Leaf	III instar	Larvicidal	Methanol extract was 86.47 and 159.59 ppm, respectively	Govindarajan et al. [52]
Euodia ridleyi	Rutaceae	Leaf		Larvicidal	Ethyl acetate extract was 120.0 and 178.20 ppm, respectively	Prathibha et al. [53]
Euphorbia hirta	Euphorbiaceae	Leaves	I, II, III, IV instars	Larvicidal, pupicidal	Methanol extract was 121.51, 145.40, 169.11, 197.40 and 236.44, 293.75, 331.42, 371.34 ppm, respectively	Agalya Priyadarshini et al. [54]
Exacum pedunculatum	Gentinaceae	Leaf	IV instars	Larvicidal and ovicidal	Ethanol extract was 121.24 240.57 ppm, respectively	Elangovan et al. [55]
Ficus benghalensis	Moraceae	Leaf	III instars	Larvicidal	Methanol extract of 56.66 and 100.88 ppm, respectively	Govindarajan et al. [56]
Gliricidia sepium	Leguminosae	Leaf	III instars	Larvicidal, ovicidal and pupicidal	Ethanol extract was 121.79 and 231. 98 ppm, respectively	Krishnappa et al. [57]
Gnetum ula	Gnetaceae	Leaf	III instars	Larvicidal, ovicidal and repellent	Ethanol extract of LC_{50} value was 82.86 ppm, respectively	Dhanasekaran et al. [58]
Gymnema sylvestre	Asclepiadaceae	Leaves	IV instar	Larvicidal	Petroleum ether extract of LC_{50} value was 166.28 ppm, respectively	Gopiesh Khanna et al. [59]
Hippophae rhamnoides	Elaeagnaceae	Leaf	IV instars	Larvicidal (24 hours only)	Ethanol extract was 1494.30 and 2605.78 ppm, respectively	Bazhir and Javid [60]
Hybanthus enneaspermus	Violaceae	Leaf	IV instar	Larvicidal	Aqueous extract of LC_{50} value was 117.83, respectively	Suman et al. [61]
Jatropha curcas	Euphorbiaceae	Leaf	III instars	Larvicidal	Methanol extract was 92.09 and 241.09 ppm, respectively	Zewdneh Tomass et al. [62]
Juniperus	Cupressaceae	Oil	III instars	Larvicidal	Essential oil was 14.42	Kaliyaperumal et

procera					and 24.65 ppm, respectively	al. [63]
Lantana camara	Verbenaceae	Flowers	III, IV instars	Larvicidal	Petroleum ether extract was 126.7 and 248.9 ppm, respectively	Babita et al. [64]
Leucas aspera	Lamiaceae	Leaf	III instars	Larvicidal	Ethyl acetate extract was 352.84 and 1033.60 ppm, respectively	Arivoli et al. [65]
Melissa officinalis	Lamiaceae	Oil	III instar	Larvicidal, ovicidal and repellent	Citronellal compound was 85.44 and 159.73 ppm	Barani tharan et al. [14]
Metarhizium anisopliae	Clavicipitaceae	Leaves	I, II, III, IV instars	Larvicidal, pupicidal	Ethanol extract was 1.40, 3.99, 5.56, 8.77 and 13.84, 17.62, 22.20, 25.71 ppm, respectively	Kovendan et al. [66]
Momordica charantia	Cucurbitaceae	Leaf	I, II, III, IV instars	Larvicidal, pupicidal	Methanol extract was 93.45, 123.74, 167.17, 216.15 and 454.96, 573.31, 630.66, 722.25 ppm, respectively	Subramaniam et al. [67]
Morinda citrifolia	Rubiaceae	Leaf	III instar	Larvicidal	Methanol extract was 261.96 and 505.06 ppm, respectively	Kovendan et al. [68]
Moringa oleifera	Moringaceae	Leaf	I, II, III and IV instars	Larvicidal, pupicidal and repellent	Methanol extract was 57.7, 63.9, 72.4, 78.9 and 125.9, 133.0, 139.8, 143.2 ppm, respectively	Prabhu et al. [69]
Murraya exotica	Rutaceae	Oil	IV instars	Larvicidal	Essential oil of LC_{50} value was 56.3 and 107.8 ppm, respectively	Krishnamoorthy et al. [70]
Nelumbo nucifera	Nelumbonaceae	Leaves	IV instar	Larvicidal	Methanol extract was 8.89 and 28.65 ppm, respectively	Santhoshkumar et al. [71]
Nepeta cataria	Lamiaceae	Leaf	IV instars	Larvicidal	Methanol extract of LC_{50} value was 0.93 ppm, respectively	Adewole et al. [72]
Nerium oleander	Apocynaceae	Leaf	I, II, III, IV instars	Larvicidal, pupicidal	Extract was 20.60, 24.90, 28.22, 33.55 and 41.62, 50.33, 57.78, 33.99 ppm, respectively	Mathath Roni et al. [73]
Nigella sativa	Ranunculaceae	Seed	IV instars	Larvicidal	Essential oil of LC_{50} value was 88.1 and 272.4 ppm, respectively	Adaikala Raj et al. [74]
Nymphaea lotus	Nymphaeaceae	Leaf	III instars	Larvicidal	Ethanolic extract of LC_{50} value was 62.8 ppm, respectively	Iman and Tajuddeen [75]
Ocimum basilicum	Lamiaceae	Leaf	III instars	Larvicidal	Methanol extract of 0.01 and 3.13 ppm, respectively	Mauryaet al. [76]
Ocimum gratissimum	Lamiaceae	Leaf	Instars larvae	Larvicidal	Ethanolic extract was 60.9 and 464.4 mg/ml, respectively	Pearl et al. [77]
Ocimum sanctum	Lamiaceae	Leaf	III instars	Larvicidal	Methanol extract was 115.32 and 209.25 ppm, respectively	Gokulakrishnan et al. [78]
Orthosiphon	Labiatae	Leaf	III instars	Larvicidal	Methanol extract of	Kovendan et al.

thymiflorus					118.74 and 377.09 ppm, respectively	[79]
Oxystelma esculentum	Apocynaceae	Leaf	III instars	Larvicidal	Methanol extract was 63.84 and 122.48 ppm, respectively	Balu et al. [80]
Pavonia odorata	Malvaceae	Leaf	III instars	Larvicidal and repellent	Methanol extract was 58.22 and 239.82 ppm, respectively	Balu et al. [81]
Pedalium murex	Pedaliaceae	Leaf	III instar	Larvicidal, ovicidal and repellent	Methanol extract was 111.66 and 200.01 ppm	Gokulakrishnan et al. [82]
Pemphis acidula	Lythraceae	Leaf	III instars	Larvicidal and ovicidal	Methanol extract of 22.1 and 43.71 ppm, respectively	Samidurai [83]
Pergularia daemia	Asclepiadaceae	Leaves	I, II, III, IV	Larvicidal	Crude aqueous extract was 81.47 and 159.51 ppm, respectively	Chandrashekhar et al. [84]
Piper nigrum	Piperaceae	Seed	III instars	Larvicidal and repellent	Ethyl acetate was 24.54 and 108.03 ppm, respectively	Kamaraj et al. [85]
Pisonia alba	Nyctaginaceae	Leaves	III instars	Larvicidal and ovicidal	Petrolium ether 1.0 ppm 2.0	Tamizhazhagan et al [86]
Pithecellobium dulce	Fabaceae	Leaf, seed	III instars	Larvicidal and ovicidal	Methanol extract was 145.43 and 251.23 ppm, respectively	Govindarajan et al. [87]
Polianthes tuberose	Agavaceae	Bud	I, II, III and IV instars	Larvicidal and repellent (24 hours only)	Crude plant extract of 0.18, 0.51, 0.05, 0.30 and 1.38, 0.51, 0.29, 7.03 ppm, respectively	Rawani et al. [88]
Polygala arvensis	Polygalaceae	Leaf	III instars	Larvicidal, ovicidal and repellent	Methanol extract was 46.37 and 189.82 ppm, respectively	Deepa et al. [89] and Lakshmanan et al.[90]
Pongamia pinnata	Fabaceae	Bark	IV instars	Larvicidal	Methanol extract was 151.7 and 299.4 ppm, respectively	Guna et al. [91]
Prosopis juliflora	Fabaceae	Leaf	III instars	Larvicidal	Leaf extracts was 37.55 and 514.35 ppm, respectively	Tyagi Varun et al. [92]
Quassia africana	Simaroubaceae	Leaf, stem, roots	IV instars	Larvicidal	Methanol extract of LC_{50} value was 17.58 ppm, respectively	Woquan Sama et al. [93]
Ricinus communis	Euphorbiaceae	Leaf	III instars	Larvicidal	Ethanol extract was 282.70 and 501.23 ppm, respectively	Awad et al. [94]
Sesamum indicum	Pedaliaceae	Leaf	III instar	Larvicidal	Methanol extract was 338.27 and 538.50 ppm, respectively	Barani tharan et al. [95]
Sida acuta	Malvaceae	Leaf	III instars	Larvicidal and repellent	Methanol extract was 38.64 and 74.78 ppm, respectively	Govindarajan [96]
Solanum trilobatum	Solanaceae	Leaf		Toxicity	116.64 ppm	Premalatha et al. [97]
Spondias mombin	Anacardiaceae	Leaf	IV instars	Larvicidal	Hexane fraction was 92.2 and 245.37 ppm, respectively	Elijah et al. [98]

Tinospora cordifolia	Menisperma-ceae	Leaf	IV instars	Larvicidal	Aqueous extract of LC_{50} was 53.93 ppm, respec-tively	Jayaseelan et al. [99]
Tridax pro-cumbens	Compositae	Whole	IV instars	Larvicidal (24 hours only)	Methanol extract was 57.991 and 172.280 ppm, respectively	Devan Elumalai et al. [100]
Vernonia anthelmintica	Asteraceae	Seed	III, IV instars	Larvicidal	Ethanol extract was 1.95 and 10.49 ppm, respec-tively	Alina et al. [101]
Zanthoxylum gilletii	Rutaceae	Oil	III instars	Larvicidal	Essential oil LC_{50} value was 57.73 and140.24 ppm, respectively	Ombito et al. [102]