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RESEARCH ARTICLE

A REVIEW ON PHYTO-PRODUCTS FOR PEST AND VECTOR CONTROL FROM 1990 TO 2000

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ABSTRACT

Mosquitoes are important vectors for both human and veterinary diseases. Pathogens and parasites cause widespread sickness and mortality, as well as a significant negative impact in many countries. Synthetic pesticides are now the standard of protection against these lethal mosquitoes. Synthetic pesticides, on the other hand, have a huge cumulative effect on nature, such as non-target effects, pollution, and so on. As a result, the researchers shifted their focus to a new alternative strategy that would be acceptable for both the environment and public health. The use of bio-insecticides derived from botanical extracts appears to be a potential way of vector control. Many plant extracts contain secondary metabolites, which have stronger insecticidal properties. Similarly, pests are another natural organism that causes enough harm to crops to put the human population at risk. There are numerous pests that are unique to each plant species. We use synthetic insecticides to control pest populations, but this has negative implications such as health risks. As a result, efforts are being made to isolate biological molecules from plant sources, which are both environmentally beneficial and cost effective. In this regard, a variety of medicinal plants have been investigated for pest management since these botanicals offer pesticidal properties. The goal of this review was to assess current research on botanicals as potential insecticides and pesticides in terms of chemical composition and biological activity.

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INTRODUCTION

Arthropods are a successful category of joint-footed animals with diversity unmatched by any other. With over 1 million scientifically identified species, insects are among the most distinctive and intriguing animals on the planet. Every year, entomologists describe hundreds of new species. As a result, insects account for more than half of the 1.5 million species of living beings known to science (Marquardt and Kondrafieff, 2005). They can be found all across the world, from the Himalayan peaks to the coastal tide pools. Insects are usually our most important competitors for food, fibre, and other natural resources because they dominate all terrestrial habitats that support human life. They also have a significant impact on human and domestic animal health by generating nuisance, inflicting bites and stings, and spreading dangerous infections. Insects, on the other hand, are useful because they pollinate crops, function as natural enemies of pest insects, and create food. Coleoptera, Lepidoptera, Hymenoptera, and Diptera are four insect orders that have a wide range of characteristics. Over 2, 50,000 species from 188 families and 10,000 genera make up the latter. Several species of medical and veterinary importance have been identified, with the majority of them belonging to the Nematocera suborder, which includes the Culividae (mosquitoes), Ceratopognidae (biting midges), Psychodidae (Phletrobominae subfamily, sand flies), and Simulidae (sand flies) families (Black flies). Except for Antarctica, mosquitoes can be found everywhere around the planet (Marquardt and Kondrafieff, 2005). Many new and re-emerging illnesses are transmitted by arthropod vectors, including mosquitos, which are vectors of pathogens that cause disease in humans and domesticated animals (Brogdon and Mc Allinter, 1998). Viruses (arboviruses), filarial worms (helminthes), and protozoa are among the pathogens transmitted by mosquitoes, accounting for roughly 17% of the worldwide burden of infectious illnesses eradicated (WHO 2006). Mosquitoes belonging to the genera *Anopheles*, *Aedes*, and *Culex* cause more disease and mortality in humans than any other group of species (Harbach, 2007). Most medical entomologists regard 30 to 40 Anopheles species to be the world's most important malarial vectors. *Anopheles gambiae* and *Anopheles furentus* in Africa, *Anopheles albimanus* and *Anopheles darling* in the New World tropics, and *Anopheles stephensi* and *Anopheles culcifates* in Asia are examples of malaria vectors. Besides *Aedes aegypti* is one among the world's most important medical species. However, it is also the principal vector of dengue and chikungunya, as well as the recent Zika threat in India. *Culex quinquifaciatus* is a vector of the nematode worm that causes lymphatic filariasis in India and a variety of arboviral infections in other parts of the world (Marquqrdt and Kondratieff, 2009)

Pathogens, parasites and Disease transmission: Viruses, Bacteria, Fungi, Nematodes, and Prototherians are among the parasites and pathogens that Mosquitoes host. Only a small percentage of the 500 or so viruses listed in the international virus database have been identified from mosquitoes, and only a small percentage of these are arbovirals, or viruses that reproduce in both vertebrates and invertebrates. *Aedes africanus*, a rain forest canopy species that accepts human hosts, and *Aedes simpnoi*, a species that breeds in plants near human homes, are both engaged in the transfer to man in East Africa. Many researchers working in pest and vector control management are paying attention to indigenous plant materials, plant products, and chemical constituents these days. These plant materials or products work as repellents, antifeedants, toxic/insecticides, larvicides, and disease protection. Reproduction, development, growth, oviposition, egg hatching, and other biological functions are all harmed by the plant components we utilized as repellents.

Pest control is the regulation or management of organisms that are considered pests, usually because they are harmful to people's health, the environment, or the economy. The usage of pesticides raises a number of environmental issues. Non-target species, air, water, and soil are all destinations for over 98 percent of sprayed insecticides and 95 percent of sprayed herbicides, respectively. Pesticides are a source of water contamination, and certain pesticides are persistent organic pollutants that pollute the soil. Pesticide use also diminishes biodiversity, reduces nitrogen fixation, adds to pollution degradation, degrades habitat (particularly for birds), and puts endangered species at risk. Pesticide resistance occurs when pests acquire resistance to pesticides, necessitating the use of a new pesticide. To combat resistance, a higher dose of the pesticide and a stronger pesticide can be employed, however this will exacerbate the problem of ambient pollution. Plant resources and products from indigenous plants are now used in pest control and pest management. There are numerous studies being conducted on the use of phytoproducts to manage pests. Against many agricultural and stored food products, as well as some vectors, these plants operate as repellents, antifeedants, toxic/insecticides, ovicides, and grain protectants. These plant repellents have a negative impact on reproduction, including development, growth, oviposition, egg hatching, and other biological functions. Sulphur, fumigants, oils, sprays, Bitumen, sticky bands, oils and ash, and other concoctions were used by the ancient Greeks and Romans to control insects. In Japan, whale oil was used to control insects in rice fields, but as knowledge grew, better methods became needed, and the primary focus shifted to the application of various chemical concentrations for insect pest management.

LITERATURE SURVEYED

Plant products for pest and vector control

Vector Control: Plant products have a long history of being employed for insecticidal or repellant characteristics all across the world. Synthetic insecticides have been employed in significant quantities to manage insect pests in the last few decades because they are both inexpensive and effective. However, the drawbacks of synthetic insecticides were eventually recognised. Synthetic pesticides are often non-target specific and, because of their persistence, can harm the environment. As a result, natural pesticides have been discovered to be environmentally friendly and are preferred. A vast range of terrestrial plants have been tested for mosquito larvicidal and/or repellent properties in this context (Thangam and Kathiresan, 1990). We were prompted to investigate marine plants for their larvicidal skin or smoke repellent activities against the mosquito *Aedes aegypti*, the vector of dengue and yellow fever, and *Culex quinquifaciatus*, the vector of *Bancrofti filariasis*, because there has been no report of mosquito larvicidal or repellent activities against the mosquito *Aedes aegypti*, the vector of dengue and yellow fever.

Scientists are paying more attention to plant-derived compounds, and over 2000 plant species have already been identified as having pesticide capabilities (Balandrin 1985, Rawls 1986, Sukamar *et al*. 1991). Natural insecticides like pyrethrum, rotenone, and nicotine, among others, were widely employed for insect control until recently (Balandrin 1985). Limonoids found in Meliaceae and Rutaceae species, such as azadirachtin and gedunin, are known to be harmful to insects and are employed in a variety of insecticide formulations around the world (Dua *et al*. 1995, Nagpal *et al*. 1996). The finding of insecticide activity of phototoxins found in Asteraceae species has sparked interest in this plant family in the search for new plant-derived insecticides (Rawls, 1986).

Many vector populations have developed resistance to organo chlorides, organophosphates, and even carbamates and pyrethroids as a result of continued and indiscriminate pesticide usage, particularly in tropical nations for public health or agricultural goals. For example, DDT resistance has been found in 19 species of culex (Amin, 1989). Insecticide use in agriculture appears to amplify vector population resilience (Mariappan and Reddy. 1982). Synthetic pyrethroids were developed as a result of a hunt for new and more effective insecticides. These broad-spectrum insecticides held a lot of promise because they are extremely poisonous to target organisms, biodegradable, and less dangerous to mammals (Rajavanshi *et al*., 1982). Synthetic pyrethroids have been shown to be more effective than highly effective organophophosphorus compounds against a variety of pests and insects, making them important for public health (Mulla *et al*., 1982; Rajavanshi *et al*., 1982). Synthetic pyrethroids' larvicidal potential has been thoroughly tested in the field and in the laboratory against a variety of mosquito species (Rahman, 1989; Vijayan and Ninge Gowda 1993; Vijayan and Revanna 1994). *Micron paniculata* L. (Tilicaceae) is a shrub that grows in secondary forests and can also be used as a hedge (Dassanayake and Fosbery, 1991).

Our research on the insecticidal properties of its leaves was spurred by its historic use in the management of headlice. The isolation of a piperidine alkaloid, N-methyl-6-(deca-1:3:5–trienyl)-3 methoxy-2-hydroxymethyl–piperidine (micropine), from *M. philippinensis* is the sole known work on the genus (Aguinaldo and Reed, 1990). The shrub *Cordia linnaei* Stern is found throughout Central and South America. A leaf decoction is used in Costa Rica to treat fevers and liver problems (Morton, 1981). It has not been documented that the roots are used in traditional medicine. Many Panamanian plants have been examined in our search for new natural antifungal and larvicidal chemicals. The dichloromethane extract from the roots of *Cordia linnaei* was discovered to have noteworthy antifungal properties against *Cladosporium cucumerinum* (Homans and Fuchus, 1970), *Candida albicans* (Rahalison *et al*., 1991), and the larvae of the yellow fever transmitting mosquito *Aedes aegypti* (Cepleana. 1993). *Cordia curassavica* Roemer and Schultes (Boraginaceae) is a 2 to 4 m tall shrub that can be found throughout Central America and the Caribbean Islands. This plant can be found in dry places below 2000 metres in Panama (D'Arcy, 1987). In Trinidad (Morton, 1981), the leaves of *C. curassavica* are used as a decoction for colds, flu, pneumonia, or cough, and in Nicaragua for colds, flu, cough, headache, and parasitic disorders (Barett, 1998). The roots, on the other hand, are not said to be used in traditional medicine. We previously discovered antifungal and larvicidal chemicals extracted from the roots of *C. linnaei* Stearn in our search for new bioactive products from Panamanian plants (Ioset *et al.,* 1998). Although JE virus strains have been isolated from 11 species in Karnataka, including *Cx. gelidus* (Mourya *et al*., 1989), no attempts have been made to investigate the susceptibility status of these vectors in Mandya, a JE endemic district in south India. Although these are neighbouring districts, *Cx. quinquefaciatus*, a filarial vector from the same district, has shown greater tolerance than the Mysore population (Vijayan and Ninge Gowda, 1993). This led us to look into JE vectors further, as they are primarily paddy field breeders, and Mandya is an irrigated granary in Karnataka with year-round pesticide pressure, as opposed to Mysore, which is an urban setting with no irrigated areas (Vijayan and Revanna 1994).

Phytochemicals from various botanicals have significant potential for the control of agricultural pests and medically relevant insect species. The increased use of phytochemicals for pest control can be ascribed to the fact that people all over the world are becoming aware of the hazards of conventional insecticides, notably their negative impact on the environment (Pitasawat *et al*., 1998). Pyrethrum, rotenone, nicotine, quassin, sabadilla, and other plant insecticides have been employed since World War II. Natural pyrethrum from chrysanthemum flowers is used primarily as a quick knockdown agent for crawling and flying insects that damage man and animals, and it is only used on a limited range of crops due to its severe toxicity to fish. Today, insecticides like as nicotine, sabadilla, and quassin are rarely utilised. *Piper longum, Acorus calamus, Alium sativum, Ocimum basilicum,* and *Ocimum sanctum* (Sukumar *et al*., 1991) are examples of plants with carminative qualities. In an attempt to find and integrate traditional or new plants used in the development of effective mosquito control and the larvae of the yellow fever transmitting mosquitoes *Aedes aegypti*, ten kinds of plants with carminative qualities were chosen for inquiry (Cepleanu, 1993).

It appeared to be of interest to compare several commercial plant oils used as mosquito repellents to the studies on hydro and lipophilic extracts from Swedish plants and their effects on mosquitoes (Thorsell, 1988; Thorsell and Tunon, 1994a and b; Tunon and Thorsell, 1996; Tunon *et al*.,1994). An ethanol extract of yarrow, *Achillea millefolium* L., was compared to plant oils such as birch/pine tar-, citronella-, clove-, eucalyptus-, geranium-, lavender-, lily of the valley-, and peppermint-oils. N,N-diethyl-m-toluamide and N,N-diethyl-mandelic acid amide were utilised as reference repellents (Thorsell *et al*., 1998). Because of the downsides of synthetic chemical pesticides, such as environmental effect, toxicity to mammals and non-targets, insect population resistance development, and so on, interest in producing bio-pesticides with natural origins has developed in recent years. The phytochemical insecticides based on the neem tree, *Azadirachita indica* A. Juss, in which the principal active pesticidal component, azadirachtin, is produced, have garnered a lot of attention (AZ). In the fields of phytochemistry and entomology, the bioactivity of AZ and related compounds has been extensively studied (Schmutterer, 1990, 1995; Mordue and Blackwell, 1993). Various companies have developed and registered a number of commercial AZ formulations for the control of phytophagous insects (Ascher, 1993). Recent research have found that AZ-rich fractions and other related components are efficient against mosquitoes, with some employing crude extracts from seed kernels and leaves of the neem tree and others using pure AZ. The findings revealed that neem products were largely used as larvicides (Naqvi *et al*., 1991; Rao *et al*., 1992, 1995; Amorose, 1995; Mulla *et al*., 1997). The effects of neem products on mosquito reproduction (Dhar *et al*., 1996) and host landing/biting repellency (Sharma *et al*., 1993a, b; Sharma and Ansari, 1994) were also investigated in some mosquito species.

Entomologists have turned their focus to natural plant products in response to the different challenges caused by the usage of synthetic pesticides. In many nations, extracts and isolated chemicals from neem, *Azadirachta indica*, and *Melia azedarach* (Meliaceae) are being studied. Several people have looked at this work (Jacobson, 1986). Furthermore, Ahmed *et al*. (1984) analysed the effects of a variety of plant products. In the Third International Neem Conference, Naqvi (1986) made a brief mention to it. The mosquitoes develop genetic resistance to synthetic insecticides (Wattal *et al*, 1981) and even biopesticides like *Bacillus sphaericus* (Tabashnik, 1994; Rodchareon and Mulla, 1994), it is recommended to use easily degradable botanicals for mosquito control (Alkofahi *et.al*., 1989). The larvicidal activity of alkaloids, nicotine, anabasine, methyl-anabasine, and lupinine isolated from the Russian plant Anabasis has been reported to be high against Culex species (Campbell *et al*., 1993). The significance of plants in animal habitat selection has garnered a lot of attention, notably in the case of phytophagous insects (Denno *et al*., 1995). Many larval insects in freshwater habitats feed on allochthonous leaf debris (Merritt *et al*., 1992). Such a plant–insect interaction is particularly relevant in alpine hydrosystems, where biogeographic studies first demonstrated the mosquito communities' discriminatory impacts of the surrounding vegetation (Pautou *et al*., 1973). Ecophysiological studies imply that dietary tannins and, more broadly, phenolic chemicals (tannins – phenolics) from decaying leaves in the water of breeding sites have a role in mosquito and other detritus-feeder arthropod habitat segregation (Rey *et al*., 1996, 1998a, 1999a).

Plant tannins–phenolics are well known to be toxic to phytophagous larval Lepidoptera and adult Orthoptera (Scriber *et al*., 1989), but their toxicity to dipteran larvae has only been reported in a few *Culicine taxa* associated with tree hole habitats (Steinly and Berenbaum, 1985; Sota, 1993; Mercer, 1993; Walker *et al*., 1997). In this investigation, we use tannic acid to investigate the toxicity of leaves from alpine mosquito breeding locations on the taxa previously studied by (Rey *et al*., 1999a). Insecticidal or insect repellent chemical compounds have developed to protect plants from herbivores and are found in almost all plants. In tropical Africa, a number of plant species with strong efficacy against blood-sucking insects grow naturally (Berger, 1994; Berger and Mugoya, 1995; Curtis *et al*., 1991). *Hyptis suaveolens* Poit. (Lamiaceae) and *Daniellia oliveri* Rolfe (Caesalpiniaceae) are two such plants that have traditionally been utilised to control mosquito populations indoors at night (Curtis *et al*., 1991). In both East and West Africa, e.g. *Hyptis* and *Ocimum* spp. are commonly used against mosquitoes and to protect stored cereals from damage by various insects (Curtis *et al.,* 1991; Singh and Upadhyay, 1993). An ethanolic extract of *Achillea millefolium* L. (Asteraceae) was found to have a high antifeedant effect on the mosquito *Aedes aegypti* L. in studies. This effect was said to be greater than the sum of its individual active ingredients. Caffeic acid, mandelonitrile glucoside, pyrocatechol, and salicylic acid were shown to have free hydroxy groups in ortho position among the active molecules (Tunon *et al*., 1994).

Several plant extracts and oils, particularly on malaria vectors, have been studied for larvicidal and repellant properties (Ansari and Razdan, 1994,1995; Ansari *et al*., 1999: Bhatnagar *et al*., 1993). The larvicidal and repellant properties of *Dalbergia sissoc* oil were discovered during a screening procedure at this centre (Ansari *et al*., 2000). Larvicidal activity and reproductive suppression were observed in adults after larvae were exposed to various doses. Although higher doses had larvicidal activity, smaller levels impaired the reproductive potential of adults to a greater extent. The epidemiological impact and concentration effectiveness of natural oils that have been found to be useful in mosquito control must be evaluated in pilot studies. In study, waste remnants after the separation of various fibres from *Agave sisalana* leaves were used to generate a larvicide for the control of mosquito-borne tropical diseases. To determine fatal doses, *Aedes aegypti* and *Culex quinquifaciatus* larvae were subjected to varied concentrations of Agave extract for 24 hours. In secondary woodland, *Microcos pinnuculata* L (Tiliaceae) is a common shrub. (Dassanayake and Fosberg, 1991). Our research into the insecticidal activity of its leaves was driven by its traditional use in the management of headlice. A novel alkaloid found in the bark of *M. pinnuculata* was found to have good insecticidal efficacy against *Aedes aegypti*. Both dichloro methane and methanol extracts of *M. pinnuculata* stem bark showed moribund/toxic *and* growth inhibitory effect on the second instar larvae of *Aedes aegypti.*

Pests Control: Repellents are chemicals that make insects unappealing, distasteful, or irritating to plants or animals, preventing insect damage. These compounds operate as triggers in insects, assisting them in "avoiding reaction." Leaves, flowers, seeds, barks, stems, rhizomes, roots, oils, and other plant parts have been found to have insect repellent characteristics. Similarly, the repellency of pith raj, *Aphanamixix polyntachya* ground leaves, barks, seeds, and four different seed extracts against *C. chinensis* (Talukder and Howse, 1994b) and *T. castaneum* (Talukder and Howse 1995) was documented. Similarly, repellant effects of *Azadractin* and neem extracts (Xie *et al*., 1995a) and bark extracts of *Melia toosendum* (Xie *et. al*., 1995b) have been observed against *Cryptolestes ferrugineus, S. oryzae*, and *T. castaneum*. Extracts of *Latana camara, Adonoclyms sleviana, Crisum bulbinpersmum, Dauwolfia serpentine,* and *Aloe vera* have been found to have repellent action against *Statherotin luccaspis* larvae. The most effective repellant was discovered to be Slivicena (Singh *et al*., 1996). Similarly, numerous plant extracts have been extensively researched for their insect repellant properties against a variety of stored-product insects (Novo *et al*., 1997; Pascal, 1998; Pradeep and Radhakrishnan, 1999). Similarly, Egwunyenga *et al*., 1990, tested the repellent activity of *Deunentia tripetala* powder and extracts in acetone, ethanol, and water against the larvae of the leather beetle, *Dermertes maculatin*, and compared it to a pyrethrin standard, finding that the seed powder of this plant had higher repellency than pyrethrin. Prototypes among plant natural products have been a possible source for new pesticides in the last decade (Ansari *et al*., 1989). The neem tree *A. indicus* is one such natural pesticide source. For ages, the seeds and leaves of this tree have been employed to control pests. Recent interest in neem, the plant extract with the most anti-fungal properties, has centered on the Allium and Caspium species. After 24 to 48 hours, a 10% dilution of the extract registered sub 40.00 OD in fungal growth and fully inhibited spore germination of *B. cinera*, while essential oils from red thyme (*Thymus zygin*) demonstrated the best inhibition of *B. cinera* spore production. Plant insect pest resistance and essential oil secretion. The pulse beetle *Callosobruchus analis* (Coleoptera: Bruchidae) and the house fly *Musca domestica* were bioassayed using chromatography fractions of *Himalayan cedarwood* oil (*Cedrus deodara*: Pinaceae) (Diptera: Muscidea). The goldenrod *Solidago canadensis* L. (Asteraceae) was toxic to *Sitophilus granarius* (Coleoptera: Curculionidae), while oils from *Eucalyptus or Thymus vulgaris* (Lamiaceae) were harmful to *Rhizopertha dominica* (Coleoptera: Bostrychidae) (Thakur and Sankhyan, 1992; Kurowska *et al*., 1991). Several essential oils derived from *Mediterranean* spices and pot herbs were potent against *R. dominica, Oryzaephilus surinamensis* (Coleoptera: Cucujidae), *S. oryzae*, and *T. castaneum* (Shaaya *et al*., 1991). The essential oils of *Asterrissia tridentate* and *Chrysothmmus nauseosus*, both found in sagebrush community plants, had antifeeding activities against the colarado potato beetle *Leptinotarsa decemlineata* (Jerry *et al*., 1991).

Neem (*Azadirachta indica* A. Juss.) has demonstrated to be the most promising of the several plants studied. The varied behavioural and physiological impacts of neem affect over 400 insect species, including many important agricultural pests. (Schlutterer and Singh, 1995). Insect-growth-regulating, oviposition and feeding deterrent. Many Diptera have been reported to be oviposition deterrents by neem seed kernel extracts, ranging from crude to refined extracts (Anon, 1992). In this study, the effects of neem seed kernel extracts made with four different solvents, namely water, hexane, ethanol, and acetone, on oviposition of *B. cucrbitae* and *B. dorsalis* were compared to pure azadirachtin. Many secondary metabolites of plants, such as essential oils and their constituents, have been studied extensively in the development of novel pesticides (Singh and Upadhyay 1993). Clove essential oils are harmful to *Sitophiles oxyrae* L and *Phyzoperpha dominica* F (Singh *et al*., 1986), however garlic oil (Ho, *et al*., 1996) and nutmeg oil (Hang *et al*., 1997) are insecticidal to *T. castenium* and *S. zaemais*. The adults and nymphs of American cockroaches *Periplanata americana* (L) are poisoned by oil derived from the edible fruit of *Dennettia tripetala* L. (Iwuala *et al*., 1981) the potential application of several major constituence of essential oil from plants which are long being used in the pharmateutical and food industries as cockroach control agent. Natural products in use today, such as pyrethrin, rotenone, nicotine, ryanie, neem oil, and several other plant-derived chemicals, have been recognised as poisonous, repellant, anti-feedant, and for limiting parenting on arthropod pests. As a result, AZA is an effective natural insect control agent since it has both anti-feedant (anti-feedant) and toxic (insect growth regulator). Over 200 pest insect species from seven orders are known to be vulnerable to azadicrachtin's bioactivity (Saxena 1989), accounting for over 90% of the species studied thus far. In field studies, crude aqueous emulsions of neem oil were effective against insect pests, suggesting that crude oil could be a useful starting material for the development of a neem-based insecticide. So, according to the findings of this study, AZA is substantially responsible for neem oils' anti-feedant (behavioural) and growth regulating (physiological) effects. Using bioassays tailored to each action. AZA, the hypothesised main active ingredient in neem oil, has shown efficacy as a crop protectant against insect pests (Schumettere and Ascher 1984).

Tropical cattle ticks (*Boophiles micro-plus*) are well-known for causing significant economic losses in developing livestock, particularly cattle. Ticks are vectors for protozoan and infectious disease transmission in cattle. As a result, novel pesticides derived from plants are in high demand. As a result of our prior screening, we discovered certain plants with strong acaricidal characteristics (Chungsamarmyart *et al*., 1990 b, 1991 a). The *Citronella grass* (lemon grass) ethanol extract also had a good larvicidal activity. However, neither the volatile oil nor the lemon grass oil has been tested. On mosquitoes and flies, the volatile oil from lemon and *Citronella grass* has shown insecticidal, repellant, and anti-feedant properties, as well as reducing tropical ticks (Grainge and Ahmed 1988). The volatile oil from lemon grass leaves, both fresh and dry, had higher acaricidal activity than the oil from citronella grass. *Citronella grass* ethonal extract been shown to have a significant larvicidal activity (Chungsamarmyart *et al*., 1988). In regions where modern storage procedures have not been implemented, insect damage to stored grains and pulses can range between 0 and 40%. Many spices and herbs, as well as their extracts, have insecticidal properties, which are commonly found in the essential oil fraction (Schmidt *et al*., 1991; Shaaya *et al*., 1991). On many Coleoptera damaging post-harvest items, toxic effects of the terpenoids d-limonene, linalool, and terpineol were identified (Coats *et al*., 1991; Weaver *et al*., 1991). A range of essential oils and their monoterpenoids were tested for their fumigant poisonous action and reproductive suppression against the bean weevil *Acunthoscelides obtectus* (Say) and the moth *Sitotroga cerealella* (Regnault-Roger and Hamraoui, 1995). El-Nahal *et al*. (1989) investigated the toxicity of *Acorus calamus* (L) essential oil on the adults of a variety of stored-product insects. The volatile secondary metabolite (essential oil) was isolated from the fresh leaves of the selected plant *Cymbopogon flexuosus* (Steud) Wats. (Family- Poaceae) and tested against three common storage fungi: *Aspergillus flavus* Link, *Penicillium italicum* Wehmer, and *Alternaria alternata* (Fr.) Keissler, as well as some major stored-product insect pests such as (*Arachis hypogea*). (Shukla *et al*., 2000). The only Japanese Thujopsis species, *Thujopsis dolabrata* var. *Hondai siebet* Zucc. (Family Cupressaceae), is insect resistant. After approximately 1200 years, a small pagoda fashioned from this tree was discovered in a well-preserved form in Nara, Japan, with no damage from insects such as termites. As a result, we looked for insecticidal and acaricidal ingredients in extracts of this tree's sawdust.

Summary

Chemical pesticides are still used heavily in vector control programmes around the world due to their quick effect. Many vector populations have developed resistance to organochlorides, organophosphates, and even carbomates and pyrethroids as a result of widespread and indiscriminate pesticide usage, particularly in tropical nations for public health or agricultural goals. There is no doubt that there are a variety of natural products, such as plant items, that can protect against mosquitoes. It's also clear that each of these natural products contains a variety of ingredients, some of which have yet to be discovered. According to available toxicological research, some oils and their constituents have less desirable qualities. An insect repellent should have a clear definition and be safe for people and larger animals. It's possible that single components with substantial anti-mosquito action and low toxicity are present in evaluated natural products. Because of the limitations of synthetic chemical pesticides, such as environmental effect, toxicity to mammals, and non-targets, the development of biopesticides with natural sources has increased in recent years.

In order to isolate mosquito repellent chemicals, more than 200 kinds of plants have been examined. Many plant families, including Lamiaceae, Caesalpiniaceae, Arecaceae, Meliaceae, Verbinaceae, Asteraceae, and others, are used in pest and vector management studies. Some plants are poisonous, fragrant, and medicinal. Leaves, stems, bark, fruits, flowers, and seeds are among the plant parts that are utilised. Sea weeds, in addition to terrestrial plants, are employed as insecticidal plants. Terpenoids, alkaloids, phenols, diterpins, quinine, and other substances found in plants act as insecticides and influence oviposition, growth, and reproduction. Insects, mites, plant diseases, fungi, and other nematodes require these products to be controlled. Several oil extractions from the plants have been found to have larvicidal / insecticidal activity. Some oils, such as Neem, Eucalyptus, and Pongamia, have been shown to be more efficient in insect and vector control. Finally, I came to the conclusion that phytoproducts are more successful at controlling pests and vectors, and they are safe for both humans and animals. Plant materials should be used instead of chemical pesticides to avoid or kill pests in stored foods, and phytoproducts compounds are also extremely useful in the agriculture area to control pests. These items cause no harm to other animals and have no disadvantages. So farmers should use these items to manage pests so that they can increase agricultural yields while also preventing health hazards and even death.

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