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Essential Oils: A Perfect Solution for Headlice.

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ABSTRACT

The humans head lice are a nuisance for millions of people worldwide with high prevalence in children. Head lice have been treated by methods that include the physical removal of lice, various domestic treatments and conventional insecticides. None of these methods render complete protection and there is clear evidence for the evolution of resistance and cross-resistance to conventional insecticides. Non-toxic alternative options are hence needed for head lice treatment or prevention and natural products from plants, especially essential oils (EOs) are good for safer control agents that may provide good anti-lice activity and low levels of evolved resistance. A few Essential oils have been tested as repellents with promissory results, although often in vitro tests and clinical trials produce contradictory results. The use of pyrethroids to control head louse infestations have suffered considerable loss of efficacy due to the development of resistance. In the last past few years, several new alternative products to synthetic pyrethroids have been developed and are sold in the market against head lice. The present study investigated the efficacy of some essential oil that have high medicinal value and therefore use against head lice as Chemical constituents of essential oils present a wide range of biological activities. The aim of this work was to evaluate insecticidal activity of essential oil specially clove oil and eucalyptus oil and compare the relative toxicity of essential oil. In the present study, it is observed that from literature survey it is given that eucalyptus have higher toxicity than clove but practically clove oil have higher toxicity as compare to eucalyptus oil to head lice. This essential oil was obtained by distillation process and components were identified by GC/MS.

KEYWORD: nuisance, insect repellents, contradictory

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INTRODUCTION

The 3 major lice that infest humans are:

Pediculus humanus capitis **(head louse),**
Pthirus pubis **(crab louse) and**
Pediculus humanus humanus **(body louse)**.

Patients with louse infestation present with scalp pruritus, excoriations, cervical lymphadenopathy and conjunctivitis. A hypersensitivity rash also results from it. Head lice infestation crosses all economic and social boundaries and therefore, Lice infestation of any part of the body is known as "**Pediculosis**".

Head lice or louse are tiny wingless parasites biologically known as ***pediculus humanus capitis*** that inhabit and thrive on hair and the scalp. They feed on very small amount of blood that they draw from the scalp. Head lice infestation is common in all over among children 3 to 12 years of age approximately 4 to 10 million have infestations each year. Head lice are not a health hazard or a sign of uncleanliness and are not responsible for the spread of any disease. The most common symptom is itching. Individuals with head lice infestation may scratch the scalp to alleviate itching and there rarely may be secondary bacterial skin infection. Head lice are the cause of much embarrassment and misunderstanding, many unnecessary days lost from school and work and millions of dollars spent on remedies.

Many Dermatologists says that, "Head lice problem occurs more in women than men, because women usually have longer hair. Loose long hair is more susceptible to lice. And managing a lice infestation is more difficult on a long-haired person, as it is difficult to comb, inspect and treat." Head lice are passed from person to person by direct contact with the hair of an infected person. Cosmetic dermatologist and trichologist says that, "Anyone who comes in close contact with someone who already has head lice or even their contaminated clothing and other belongings such as hats/caps, scarves, coats, sports uniforms or hair ribbons is at risk of an infestation too." Personal contact is common during play and sports activities and at school/college, home, slumber parties or camps amongst children and teenagers. One should refrain from using infested combs, brushes or towels and avoid lying on a bed, couch, pillow, carpet or keep away from stuffed animals that has recently been in contact with a person with lice.

But actually Trichologist says that, "Lice aren't dangerous and don't spread any particular disorder but are contagious and cause itching that can be terribly annoying and embarrassing. Lice bite may cause one's scalp to become itchy and inflamed and persistent scratching may lead to skin irritation and even infection. It can lead to a bacterial infection which causes the skin to become red and tender and also involves crusting and oozing of pus along with swollen lymph glands."

Symptoms

- ✓ Intense itching of the scalp.
- ✓ Small, red bumps on the scalp, neck, and shoulders (bumps may become crusty and ooze).
- ✓ Tiny white specks (eggs, or nits) on the bottom of each hair those are hard to get off.

The control of human head lice worldwide depends primarily on the continued applications of organochlorine (DDT and lindane), organophosphorus (malathion), carbamate (carbaryl), pyrethrin, pyrethroid (permethrin and 6-phenothrin) and avermectin (ivermectin-originated from Streptomyces avermitilis) insecticides[1-3]. The repeated use of permethrin and other insecticides for the control of head lice during past decades has resulted in the development of marked levels of resistance. Thus, new alternative insecticides are needed for the control of head lice. We studied the fumigant and repellent properties of essential oils and their chemical components against head lice.

Many modern pediculicides tend to fail because of low efficacy on lice eggs, whereas essential oil constituents are reputed to have good ovicidal capabilities [4]. They are responsible for the characteristic odors of plants such as eucalyptus, pine, mint, peppermint and lemon. Several plant products such as aniseed, coconut, neem and tea tree oils are used in different available compositions for the treatment of head lice infestation.

Plant essential oils have been suggested as an alternative source of materials for insect control because they constitute a rich source of bioactive chemicals and are commonly used as fragrances and flavoring agents for foods and beverages [5]. Because of this, much effort has been focused on plant essential oils or phytochemicals as potential sources of commercial head lice control agents.

LIFE CYCLE OF THE LICE

The ***Pediculus humanus capitis*** is an ectoparasite of humans. Head lice are wingless insects spending their entire life on human scalp and feeding exclusively on human blood. Humans are the only known hosts of this specific parasite while chimpanzees host a closely related species *Pediculus schaeffi*. Other species of lice infest most orders of mammals and all orders of birds [6].

Like all lice, head lice differ from other hematophagic ectoparasites such as the flea in that lice spend their entire life cycle on a host [7]. Head lice cannot fly and their short stumpy legs render them incapable of jumping or even walking efficiently on flat surfaces.

Pediculus humanus var. capitis is an ectoparasite of the order Psocodea whose only host is humans [Figure 1]. The louse chiefly resides in close contact to human scalp and takes blood meals, which is postulated to be 6 times per day [8]. With each blood meal a minute quantity of louse saliva gets inoculated into the scalp skin and the host becomes sensitized to louse antigen

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and fecal matter eliciting an inflammatory response leading to scratching and secondary impetignization.

The life cycle of the head louse has 3 stages: Egg, nymph and adult.

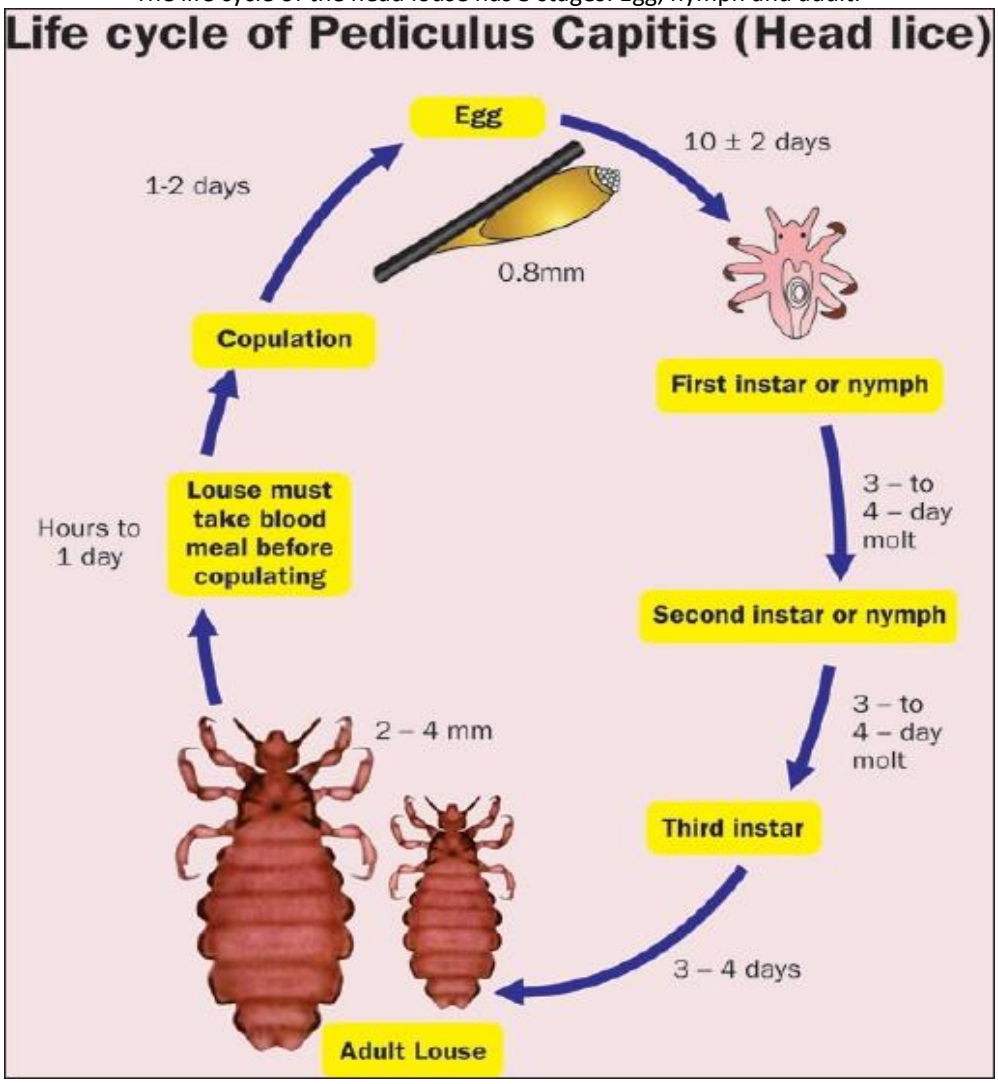


Figure No.1

The non-disease carrying head louse differs from the related disease-carrying body louse (*Pediculus humanus*) in preferring to attach eggs to scalp hair rather than to clothing. The two subspecies are morphologically almost identical but do not normally interbreed, although they will do so in laboratory conditions. From genetic studies, they are thought to have diverged as subspecies about 30,000–110,000 years ago, when many humans began to wear a significant amount of clothing [9] A much more distantly related species of hair-clinging louse, the pubic or crab louse (*Pthirus pubis*) also infests humans. It is visually different from the other two species and is much closer in appearance to the lice which infest other primates [10]. Head lice (especially in children) have been and still are subject to various eradication campaigns. However and unlike body lice, head lice are not the vectors of any known diseases. Except for rare secondary infections that result from scratching at bites, head lice are harmless and they

have been regarded by some as essentially a cosmetic rather than a medical problem. It has even been suggested that head lice infections might be beneficial in helping to foster a natural immune response against lice which helps humans in defense against the far more dangerous body louse which is capable of transmission of a number of dangerous diseases.

WORLDWIDE MARKET OF HEAD LICE RESISTACE

FORMULATION

In today's world there are numerous of product available for one problem so for head lice, starting from chemical product to natural formulation are available, from which some are orally taken or topically applied they are as:

Pediculicides

Pyrethrins Plus Piperonyl Butoxide

Manufactured from natural extracts from the chrysanthemum, pyrethrins plus piperonyl butoxide are neurotoxic to lice but have extremely low mammalian toxicity. However, pyrethrins should be avoided in persons allergic to chrysanthemums. These products are mostly shampoos that are applied to dry hair and left on for 10 minutes before rinsing out [11]. None of these natural pyrethrins are totally ovicidal 20% to 30% of the eggs remain viable after treatment [12].

Permethrin (1%)

Manufactured as a synthetic pyrethroid, 1% permethrin is currently the recommended treatment of choice for head lice [13-15]. It has even lower mammalian toxicity than do pyrethrins and does not cause allergic reactions in individuals with plant allergies. It is left on for 10 minutes and then rinsed off, and it leaves a residue on the hair that is designed to kill nymphs emerging from the 20% to 30% of eggs not killed with the first application [13]. However, it is suggested that the application be repeated if live lice are seen 7 to 10 days later. Some experts recommend routine retreatment [16]. Resistance to 1% permethrin has recently been reported [17-19] but the prevalence of this resistance is not known.

Lindane (1%)

Lindane is an organochloride that has central nervous system toxicity in humans if used incorrectly; several cases of severe seizures in children using lindane have been reported[20-23].It is available only by prescription as a shampoo that should be left on for no more than 10 minutes with repeated application in 7 to 10 days. It has low ovicidal activity about 30% to 50% of eggs are not killed[8] and resistance has been reported worldwide for many years [24, 25]. For these reasons, it should be used very cautiously.

Malathion (0.5%)

It is available only by prescription as a lotion that is applied to the hair left to air dry, then washed off after 8 to 12 hours. Malathion has high ovicidal activity [13, 26] but the product should be reapplied if live lice are seen in 7 to 10 days. The major concerns are the high alcohol content of the product, making it highly flammable and the risk of severe respiratory depression if accidentally ingested. For these reasons, it should be used with extreme caution in the treatment of only those cases in which resistance to other products is strongly suspected [15].

Other Topical Agents

Permethrin (5%)

Five percent permethrin is available by prescription only as a cream usually applied overnight for scabies. It should be applied to the scalp and left on for several hours or overnight [13, 14] then rinsed off. No case-control studies have reported efficacy to date. One study suggested that lice resistant to 1% permethrin will not succumb to higher concentrations.

Crotamiton (10%)

This product is available by prescription only as a lotion usually used to treat scabies. A single study showed it to be effective against head lice when applied to the scalp and left on for 24 hours before rinsing out [27]. Safety and absorption in children, adults, and pregnant women have not been evaluated.

Oral Agents

Sulfamethoxazole/Trimethoprim

This antibiotic sometimes called cotrimoxazole and used in otitis media doses, has been cited as effective against head lice [28]. This antibiotic is postulated to kill the symbiotic bacteria in the gut of the louse or perhaps to have a direct toxic effect on the louse. Rare severe allergic reactions like Stevens- Johnson syndrome to this medication make it a potentially undesirable therapy if alternatives exist. It is not currently approved by the FDA for use as a pediculicide.

Ivermectin

This product is an anthelmintic agent structurally similar to the macrolide antibiotics but without antibacterial activity. An oral dose of 200 micrograms/kg, repeated in 10 days, has been shown to be effective against head lice [29]. If ivermectin gets past the bloodbrain barrier, it blocks essential neural transmission; young children may be at higher risk for this

adverse drug reaction. Therefore, ivermectin should not be used for children who weigh less than 15 kg [30, 31]. It is not currently approved by the FDA as a pediculicide.

Newer developments

1. **Spinosad (0·9% cream)** is a recently introduced topical pediculicidal agent in the therapeutic armamentarium [32]. The efficacy of **hexane flower bud extracts** of Syzygium aromaticum (Myrtaceae) against P. humanus capitis in a closed and open chamber method.
2. The pediculicidal and ovicidal effects of 1 application of **a silicon-oil complex** composed of dimethiconol and castor oil [33].
3. **Galenic meta-emulsion (Oxyphthirine®)** comprising of triglycerides, isohexadecane, sorbitane ester and water [34].
4. The efficacy of clove, Eugenia caryophyllata, and eucalyptus, Eucalyptus globulus, essential oils and 15 formulations containing these essential oils alone against susceptible and pyrethroid/malathion-resistant head lice [35].
5. **Dimeticone 4% lotion** is a physically acting pediculicidal compound based on 4% high molecular weight dimeticone in a cyclomethicone base [36].
6. The insecticidal activity of essential oils from native and cultivated aromatic plants from Argentina for their activity against permethrin-resistant head lice [37].

From all these study it is observed that, pediculicides or anti-head lice formulation mainly turns to use of essential oil because it has minimium side reaction to human skin with active toxicity towards head lice. The essential oil has neurotoxicity to head lice and work against their nervous system by either blocking nerve impulses or by over stimulating them.

Essential oil

Essential oils are extracted from various aromatic plants generally localized in temperate to warm countries like Mediterranean and tropical countries where they represent an important part of the traditional pharmacopoeia. These are natural and volatile compound which is characterized by a strong odour and are generated from aromatic plants as secondary metabolites. They are volatile liquid and rarely colored, lipid soluble and soluble in organic solvents with a generally lower density than that of water. They can be synthesized by all plant organs i.e. buds, flowers, leaves, stems, twigs, seeds, fruits, roots, wood or bark and are stored in secretory cells, cavities, canals, epidermic cells or glandular trichomes[38].

They are usually obtained by steam or hydro-distillation. They are known for their antiseptic i.e. bactericidal, virucidal, fungicidal and medicinal properties and fragrance. Due to their bactericidal and fungicidal properties they are more uses in pharmaceutical and food and more widespread as alternatives to synthetic chemical products to protect the ecological equilibrium. They are used in preservation of foods and as antimicrobial, analgesic, sedative, anti-inflammatory, spasmolytic and locally anesthesic remedies. Up to the present day, these

characteristics have not changed much except that more is now known about some of their mechanisms of action, particularly at the antimicrobial level.

There are also several advance methods for extracting essential oils. These may include use of liquid carbon dioxide or microwaves and mainly low or high pressure distillation employing boiling water or hot steam. For perfume uses, extraction with lipophilic solvents and sometimes with supercritical carbon dioxide is favoured. Thus, the chemical profile of the essential oil products differs not only in the number of molecules but also in the stereochemical types of molecules extracted, according to the type of extraction and the type of extraction is chosen according to the purpose of the use.

Chemical composition

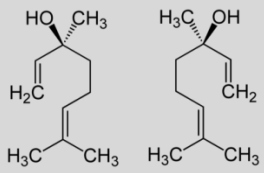
Essential oils are very complex mixtures which can contain about 20–60 components at quite different concentrations. They are characterized by two or three major components at fairly high concentrations (20–70%) compared to others components present in trace amounts. For example,

1. In Origanum compactum essential oil, carvacrol (30%) and thymol (27%) are the major components,
2. Linalool (68%) of the Coriandrum sativum essential oil,
3. 1, 8-cineole (50%) of the Cinnamomum camphora essential oil.

Generally, these major components determine the biological properties of the essential oils. The components include two groups of distinct biosynthetical origin [39-42].

In the current study, potencies varied according to oil type and dose. The contact pediculicidal activity was more pronounced in cardamone, clove bud, eucalyptus, myrtle, pennyroyal, cade, rosemary and marjoram than to the insecticides & phenothrin. These essential oils seem to be good candidates as naturally occurring control agents for P. humanus capitis. This activity of an essential oil is mainly due to their active chemicals constitutes therefore here some of the oil listed below with their active constituents:

Table1: Essential oil and their ingredients

Sr.No.	Essential oil	Constituents	Major Constituent
1.	Sweet Basil	Linalool, Methylchavikol, Methylcinnamat, Linolen, Citral, Eugenol And Geraniol	Linalool 
2.	Bay Leaf	1,8-Cineole, P-Menthanehydroperoxides, Costunolide,	1,8-Cineole

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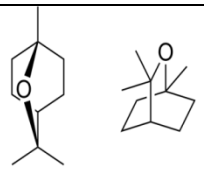
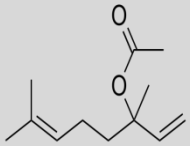
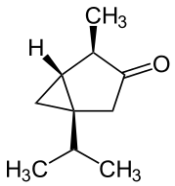
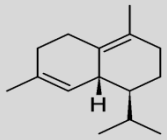
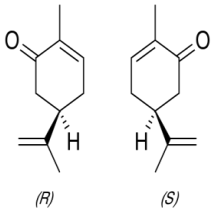
		Dehydrocostus Lactone, Reynosin, Santamarine, 3α-Acetoxyeudesma-1,4(15),11(13)-Trien-12, 6 α-+ ++Olide And 3-Oxoeudesma-1, 4, 11(13)-Trien-12,6alpha-Olide.	
3.	Bargamot	α-Pinene, β -Pinene, Myrcene, Limonene, α-Bergamotene, β -Bisabolene, Linalool, Linalyl Acetate, Nerol, Neryl Acetate, Geraniol, Geraniol Acetate, α-Terpineol	Linalyl Acetate 
4.	Black Pepper	α-Thujone, α-Pinene, Camphene, Sabinene, β -Pinene, α-Phellandrene, Myrcene, Limonene, Caryophyllene, β -Farnesene, β -Bisabolene, Linalool And Terpinen-4-Ol	A-Thujone 
5.	Cade	δ -Cadinene, *P*-Cresol And Guaiacol	Δ-Cadinene 
6.	Caraway	Carvone, α-Terpene, Limonene, Carveol, Dihydrocarveol, Dihydrocarvone, Thujone, Pinene, Phellandrene, α-Thujene, β-Fenchene,	Carvone  (R) (S)

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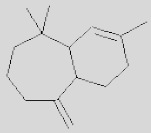
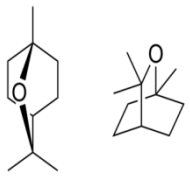
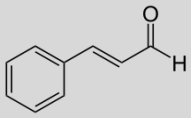
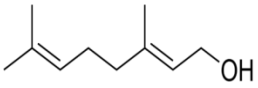
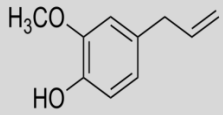
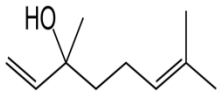
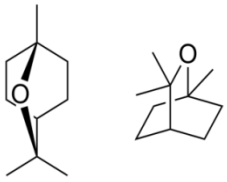
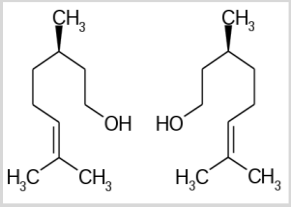
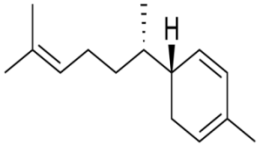
7.	Cedar Atlas	α-Himalchene, β-Himalchene And γ-Himalchene	α-Himalchene, 
8.	Chamomille Roman	α-Pinene, Camphene, β -Pinene, Sabinene, Myrcene , 1,8 Cineole, G-Terpinene, Caryophyllene, Propyl Angelate And Butyl Angelate	1,8 Cineole 
9	Cinnamon	Cinnamaldehyde, Eugenol, Benzyl Benzoate, α-Pinene, 1,8-Cineole, Linalool And Caryophyllene	Cinnamaldehyde 
10.	Citronella Java	Citronellal, Geraniol, Citronellol, Geranyl Acetate, Limonene And Elemol	Citronellal 
11.	Clove Bud	Eugenol, Eugenol Acetate, Iso-Eugenol And Caryophyllene.	Eugenol 
12.	Coriander	*D*-Linalool, Decyl Aldehyde, *Trans*-Tridecene-(2)-Al-(1), Borneol, Geraniol, Geranyl Acetate, Camphor, Carvone, Anethole, Caryophyllene Oxide, Elemol, Γ-Terpinene, α- And B-Pinene, *D*-Limonene, *P*-Cymene,	*D*-Linalool, 

		β-Phellandrene, And Camphene	
13.	Cypress	3-Carene, α –Pinene, Camphene, Sabinene, β -Pinene, Myrcene, α - Terpinene, Terpinolene, Linalool, Bornyl Acetate, Cedrol, Cadinene.	3-Carene 
14.	Eucalyptus	1, 8-Cineole, α -Pinene, β -Pinene, α -Phellandrene, Limonene, Terpinen-4-Ol, Aromadendrene, Epiglobulol, Piperitone And Globulol.	1, 8-Cineole 
15.	Geranium	Citronellol, α -Pinene, Myrcene, Limonene, Menthone, Linalool, Geranyl Acetate, Geraniol	Citronellol 
16.	Ginger	Zingiberene, α -Pinene, Camphene, β -Pinene, 1,8-Cineole, Linalool, Borneol, Γ -Terpineol, Nerol, Neral, Geraniol, Geranial, Geranyl Acetate And β -Bisabolene	Zingiberene 
17.	Grapefruit	D-Limonene, α -Pinene, β -Pinene, Sabinene, Myrcene, Citronellal, Decanol, Linalool And	D-Limonene,

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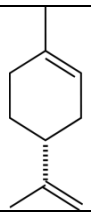
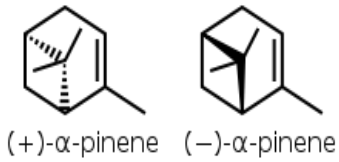
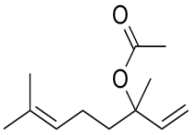
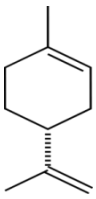
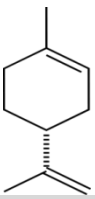
		Nootkatone	
18.	Juniper Berry	α -Pinene, Camphene, β-Pinene, Sabinene, Myrcene, α-Phellandrene, α-Terpinene, G-Terpinene, 1,4-Cineole, β-Phellandrene, P-Cymeme, Terpinen-4-Ol, Bornyl Acetate And Cayophyllene	α- Pinene  (+)-α-pinene (−)-α-pinene
19.	Lavender	Linalyl Acetate, α-Pinene, Limonene, 1, 8-Cineole, Cis-Ocimene, Trans-Ocimene, 3-Octanone, Camphor, Linalool, Caryophyllene, Terpinen-4-Ol, Lavendulyl Acetate	Linalyl Acetate 
20.	Lemongrass	Limonene, Linalool (Traces), Citronellal, Myrcene, Citral, Geranyl Acetate, Nerol, Geraniol, Neral, Geranial And Borneol	Limonene 
21.	Mandarine	Limonene, α-Thujone, α-Pinene, Camphene, Sabinene, β-Pinene, Myrcene, G-Terpinolene, Linalool,	Limonene 

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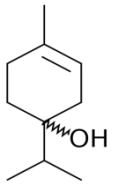
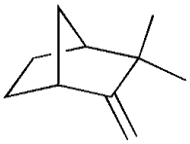
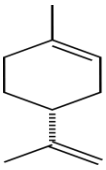
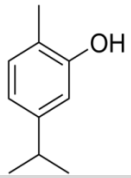
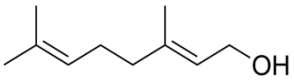
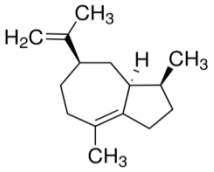
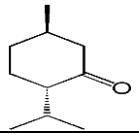
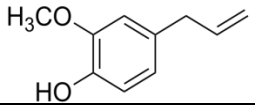
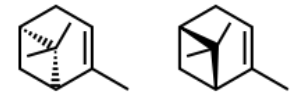
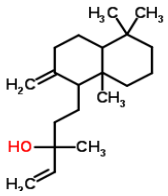
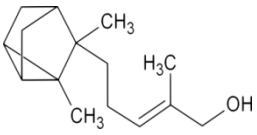
		Citronellal, Terpinen-4-Oll, Nerol And Geranial	
22.	Marjoram	Terpinen-4-Ol, *Cis*-Sabinene Hydrate, *P*-Cymene And *Γ*-Terpinene.	Terpinen-4-Ol 
23.	Nutmug	Camphene, α-Pinene, β-Pinene, Sabinene, Myrcene, α-Phellandrene, α-Terpinene, Limonene, 1,8-Cineole, Y-Terpinene, Linalool, Terpinen-4-Ol, Safrole, Methyl Eugenol And Myristicin.	Camphene 
24.	Orange	D-Limonene, α-Pinene, Sabinene, Myrcene, Linalool, Citronellal, Neral And Geranial.	D-Limonene 
25.	Oregano	Carvacrol, Thymol, β-Bisabolene, Caryophyllene, *P*-Cymene, Borneol, Linalool, Linalyl Acetate, Geranyl Acetate, α-Pinene, β-Pinene, α-Terpinene, *Cis*-Sabinene, Germacrene And Ocimene	Carvacrol 
26.	Palmarosa	Geraniol,	Geraniol

		Myrcene, Linalool, Geranyl Acetate, Dipentene And Limonene	
27.	Paltchouly	α-Bulnesene, β-Patchoulene, α-Guaiene, Caryophyllene, α-Patchoulene, Seychellene And Norpatchoulenol	α-Bulnesene 
28.	Peppermint	Menthone, Menthol, Menthyl Acetate, Menthofuran And 1,8-Cineol	Menthone 
29.	Pimento Berry	Eugenol, Menthyl Eugenol, Cineol, Phellandrene And Caryophyllene.	Eugenol 
30.	Rosemary	α-Pinene, Borneol, β-Pinene, Camphor, Bornyl Acetate, Camphene, 1,8-Cineole And Limonene.	α-Pinene  (+)-α-pinene (−)-α-pinene
31.	Sage	Manool, 1,8- Cineole, Cis-Thujone Viridiflorol And β-Caryophyllene	Manool 
32.	Sandalwood	Santalol, Santyl Acetate And Santalene.	Santalol 
33.	Spearmint	Carvone, Trans Carveol,	Carvone

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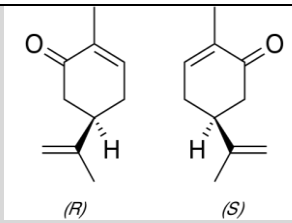
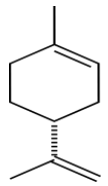
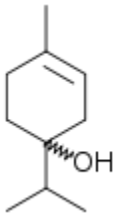
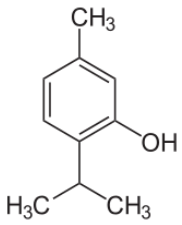
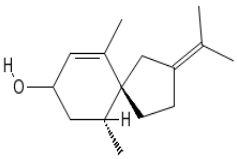
		α-Pinene, β-Pinene, 1, 8-Cineole, Linalool, Limonene, Myrcene, Caryophyllene And Menthol	
34.	Tangerine	Limonene, α-Thujone, α-Pinene, Camphene, Sabinene, β-Pinene, Myrcene, Y-Terpinolene, Linalool, Citronellal, Terpineol-4-Ol, Nerol And Geranial	Limonene 
35.	Tea Tree	Terpinen-4-Ol, Γ-Terpinene, A-Terpinene, 1,8-Cineole, α-Terpinolene, α-Terpineol, α-Pinene, P-Cymene	Terpinen-4-Ol 
36.	Thyme Oil	Thymol, α-Thujone, α-Pinene, Camphene, β-Pinene, P-Cymene, α-Terpinene, Linalool, Borneol, β-Caryophyllene And Carvacrol	Thymol 
37.	Vetiver Haiti	Vetiverol, Benzoic Acid, Furfurol, α And β-Vetivone, Vetivene And Vetivenyl Vetivenate.	Vetiverol 
38.	Warmwood	α-Thujone, β-Thujone, Sabinene, Myrcene, Trans-Sabinol,	α-Thujone

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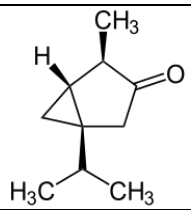
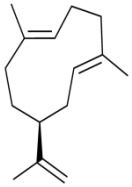
		Trans- Sabinyl Acetate, Linalyl Acetate And Geranyl Propionate.	
39.	Ylang Ylang	Germacrene D Alpha Farnesene Benzyle Acetate Benzyle Benzoate Linalol Methyl Paracresol Isoeugenol Cinnamyl Acetate Phenol	Germacrene D 

Many plant derivatives are known to possess repellent, ovicidal, antifeeding and insecticidal activities against various insect species [43,44]. For example, neem Azadirachta indica A. oil is found to have a variety of biological activities including insecticidal activity against nearly 200 species of insects without any adverse effects on most non-target organisms. Pediculicidal activity has been reported for some essential oils such as aniseed, cinnamon leaf, thyme red, tea tree and nutmeg oils [45],neem oil [46], anise and ylang ylang oils [47].

Table 2: Relative toxicity of 49 essential oils against female P. humanus capitis by using the filter paper contact bioassay at 0.25 Mg/cm^2

Essential oil	LT_{50}(mins)	RT^e
Basil	27.9	0.8
Bay	35.1	0.7
Bergamot	54	0.4
Bitter orange	57.3	0.4
Black pepper	60.4	0.4
Cade	19.2	1.2
Caraway seed	43.8	0.5
Cardamone ceylon	25.4	0.9
Cedar Atlas	>300	
Chamomille roman	42.9	0.5
Cinnamon	36.3	0.6
Citronella java	72.3	0.3
Clary sage	52.7	0.4
Clove bud	19.6	1.2
Clove leaf	21.6	1.1
Coriander	24	1

Cypress	24.7	0.9
Eucalyptus	4.2	5.5
Geranium	70.4	0.3
Ginger	>300	
Grapefruit	58.1	0.4
Juniper berry	53.3	0.4
Lavander	31.6	0.7
Lemon eucalyptus	26.8	0.9
Lemongrass	53.4	0.4
Lemon 10-fold	157.6	0.1
Lime dis 5F	48.4	0.5
Mandarine	47.1	0.5
Marjoram	11.4	2
Nutmug	32.3	0.7
Orange	43.8	0.5
Oregano	57.6	0.4
Palmarosa	121.9	0.2
Paltchouly	>300	
Pennyroyal	7	3.3
Peppermint	18.8	1.2
Pimento berry	29.9	0.8
Rosemary	14.3	1.6
Rosewood	22.4	1
Sage	18	1.3
Sandalwood	>300	
Spearmint	22.9	1
Tangerine	70.6	0.3
Tea tree	31.5	0.7
Thyme red	47.6	0.5
Thyme white	49.9	0.5
Vertiver haiti	>300	
Warmwood	47	0.5
Ylang ylang	>300	

This Table2, gives relative information of relative toxicity that assesses the potential of plant essential oils as commercial pediculicides. Pediculicidal activity of 49 essential oils against adult P. humanus capitis was compared with those with one another for best one selection as pediculicidal.

Plant essential oils have potential as natural products for *P. humanus capitis* control because some of them are selective and have little or no harmful effects on non-target

organisms and can be applied to humans in the same way as other conventional insecticides [48].

CONCLUSION

In light of the review of pediculosis study, there was a resistance consideration, market view, specifically in the formulation containing essential oil and there toxicity towards head lice is the favored for head lice. A patient infected with head lice at any given time will have lice existing at different points in the life cycle. The adult lice kill more easily than egg.
As natural source for head lice treatment is more pronounce than that of synthetic formulation because it has least side reaction therefore, this review mainly focus on essential oil, their active ones and relative toxicity towards head lice.

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[38] Biological effects of essential oils – A review F. Bakkali a,b, S. Averbeck a, D. Averbeck a,*, M. Idaomar b Institut Curie-Section de Recherche, UMR2027 CNRS/IC, LCR V28 CEA, Baˆ t. 110, Centre Universitaire, 91405 Orsay cedex, France b Universite´ Abdelmalek Essaˆadi, Faculte´ des Sciences, Laboratoire de Biologie et Sante´ , BP 2121, Te´touan, Moroccopage no. 446-475
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