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## **Green Pesticides Handbook Essential Oils for Pest Control**

Leo M.L. Nollet, Hamir Singh Rathore

### **Essential Oil Mixtures for Pest Control**

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## 27

## Essential Oil Mixtures for Pest Control

Leo M.L. Nollet and Hamir Singh Rathore

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## 27.1 Introduction

Essential oils are rapidly growing in popularity because they are being used in industries, namely, the food, pharmaceutical, and cosmetic industries; veterinary products; industrial deodorants; and tobacco without any side effects. Pertinent examples are

- *Calendula*: Bright orange candela flowers are also known as marigolds. Calendula essential oil is particularly good for sensitive skin and can be used to reduce the appearance of acne scars. It can also be put in bathwater to soothe psoriasis.
- *Frankincense*: Frankincense is a must-have essential oil in our home. It is used for relaxation, such as in baths, and to help minor cuts and bug bites heal more quickly. It can be used for depression, inflammation, and immunity, and to increase spiritual awareness.
- *Oregano*: It is a well-known flu fighter. This strong-tasting oil has natural antibacterial qualities, so it can help to fight colds and other illnesses. It is taken topically, often by putting a few drops on the tongue—the taste is not pleasant, but many people swear by it during flu season.
- *Chamomile*: Chamomile is often used as a tea. It is particularly well known for its relaxing effects, which is why the tea is popular to drink before bed. Add to the effect with a few drops of the oil on your pillowcase.
- *Grapefruit*: This essential oil has properties similar to those of lemon oil. It is a great choice for people experiencing fatigue, and it is useful in jet lag. It is also a natural antiseptic, so one can add it to homemade household cleansers to keep one's home safe and clean.

Recently, their uses in pest control have been explored. Some essential oils, such as thyme, cloves, salvia, mint, oregano, and pine, possess antibactericidal properties. Others are insecticides, for example

- Against ants: *Mentha spicata* (spearmint) and *Tanacetum*
- Against aphids: Garlic, other *Allium*, coriander, aniseed, and basil
- Against fleas: Lavender, mints, and lemongrass
- Against flies: Rue, citronella, and mint
- Against lice: *M. spicata*, basil, and rue
- Against moths: Mints, hisopo, rosemary, and dill
- Against coleopteran: *Tanacetum*, cumin, wormwood, and thyme
- Against cockroaches: Mint, wormwood, eucalyptus, and laurel
- Against nematodes: Tagetes, salvia, calendula, and asparagus

Essential oils have been used for thousands of years in various cultures for the above-mentioned purposes. They are obtained [1–10] from different parts of plants, including flowers, leaves, barks, roots, resins, and peels. In ancient times, Jews and Egyptians used a simple procedure to obtain essential oils, for example, by soaking the plants or plant parts in oil for a required period and then filtering the oil through a line bag.

Essential oils are volatile (steam volatile) and liquid at room temperature. Their distillates are initially colorless or slightly yellowish. The specific density of most essential oils is less than that of water. They are high-refractory index compounds and have nearly always rotational properties. They are soluble in alcohol, as well as in high-grade alcohol, and in other common organic solvents, such as ether and chloroform. They are slightly soluble in water and are liposoluble. As they are steam volatile, they can be dragged out using steam for their extraction from plants.

Instead of a single essential oil, generally their mixtures are used in many formats for different purposes (daily needs). The admixtures are useful for the following reasons:

1. By mixing two or more essential oils together, their effect increases considerably. For example, lavender and chamomile oils are both good for anti-inflammatory purposes, and by combining them, their effect will be even greater together, as an anti-inflammatory, than either of them used alone.
2. The blend created by mixing two or more oils that have the same therapeutical properties works synergistically and with more density than just a single oil alone.
3. The high concentration of essential oils can produce the opposite effect; that is, concentrated lavender oil can cause restlessness, agitation, and insomnia rather than relaxation. Therefore, a liquid solvent is used to lower to a proper concentration.
4. The additives and diluents are also cost-effective; that is, they minimize the cost of the product.
5. Blended into correct concentrations, they are safe to use, especially for those who are unfamiliar with them.
6. The blended product is ready for immediate use—no fuss and no mess.

However, few studies have reported on the mixing effects of essential oils.

A small number of publications exist in this area [3–10]. These and a few other references are summarized in the following pages. The authors are aware that some references are not proven by scientific tests, but they give an idea of the culture of using essential oils in the garden, at home, and so forth.

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## 27.2 Nine Clever Ways to Use Essential Oils in the Garden [10]

### 27.2.1 To Repel Insect Pests

Rosemary oil, peppermint oil, thyme oil, and clove oil are known as potent repellents for many types of pests. A mixture containing equal parts of rosemary, peppermint, thyme, and clove oils (about 10 drops of each) in a spray bottle filled with water has been found to be effective in getting rid of skittering, creeping, crawling, or flying pests.

### 27.2.2 To Suppress Fungus

Oils such as tea tree, neem, rosemary, citronella, oregano, thyme, peppermint, clove, cinnamon, garlic, and onion (1 tablespoon in a cupful of water) and their mixtures (8–10 drops in a cupful of water) are effective in controlling fungus.

### 27.2.3 To Stop Slugs and Snails

A diluted solution (1 teaspoon in a spray bottle filled with water [1 cup]) of cedarwood, hyssop, and pine oils can be sprayed in a ring around plants where slugs and snails are found in order to keep gastropods off the plants. These oils have been claimed to be the best for this purpose. The spray can be recycled if required.

### 27.2.4 To Discourage Vermin

Cotton balls impregnated with one or two drops of fresh peppermint oil have been reported to repel mice and other rodents. The impregnated balls are tucked into the entrances of mouse holes, squirrel nests, and other rodent burrows to persuade rodent residents to relocate. The plugs can be replaced if required.

### 27.2.5 To Dissuade Pets

Cloth strips or small pieces impregnated with diluted (1 teaspoon in 1 cup of water) rosemary oil can be used to keep the neighborhood tomcat from leaving his delightful presents amidst your herbs and veggies. The strips or pieces can be hung between garden rows around plants or around the garden perimeter where the cat likes to dig. From time to time, replacement of the strips or pieces is required. Similarly, impregnated cloth strips or small pieces with black pepper oil may be used to deter larger mammals from the garden. The overuse of black pepper oil may hurt humans as well. A spray of diluted rosemary oil can also be used for the same purposes.

### 27.2.6 Treat Bites and Stings

A cotton ball or pad impregnated with the mixture of two drops of lavender oil, two drops of chamomile oil, one drop of basil oil, and 1 teaspoon of orange apple cider vinegar (ACV) is used to treat bites and stings of bees, wasps, ants, and other insects. A mixture of these oils in jojoba oil in place of ACV can also be applied for the same purpose. The treatment can be made more effective by prior cleaning and dab drying the effective portion, and then applying the impregnated cotton ball.

### 27.2.7 Attract Pollinators

The scent of Neroli (orange blossom) is known to be an irresistible attractant for bees. The essential oils obtained from many small-blossomed flowers, such as lavender, hysop, marjoram, *Helichrysum*, basil, sage, and rosemary, also possess these characteristics. A spray of lavender, yarrow, catmint, fennel, *Helichrysum*, or sage essential oils gives good results in attracting butterflies to the garden.

### 27.2.8 Enhance the Mood

Mountain rose herbs are known for their calming effects to relax after a long and stressful day.

### 27.2.9 Mosquito Repellent

Citronella oil is one of the widely known mosquito repellents. An admixture of 1 ounce of organic witch hazel and 10 drops of jojoba oil in a small glass spray bottle containing 2 ounces of water is used successfully to repel mosquitoes.

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## 27.3 Green Cleaning: 10 Essential Oils That Naturally Repel Insects [3,4,6,7,11]

### 27.3.1 Lavender Oil (*Lavandula angustifolia* [Mill])

Lavender pillows and sachets are used in linen cupboards and chests of drawers to keep away moths and other insects, as well as to have a fresh scent. Lavender oil is well known to provide relaxation and restful sleep. In many places, it is used for its lovely aroma and soothing qualities. Lavender oil may be sprayed from an atomizer or placed in a saucer to keep away ants and insects and to disinfect the air.

### 27.3.2 Basil Oil (*Ocimum basilicum* [L.])

Basil oil sprays are available on the market for repelling mosquitoes, larvae, and dust mites in wet climates. Basil oil is also used for a zesty addition to tomato sauce and to clean green.

### 27.3.3 Thyme (*Thymus vulgaris* [L.])

Thyme has been found to be a highly effective insecticide against houseflies. It is an excellent mosquito repellent as well.

#### 27.3.4 Pine Oil (*Pinus sylvestris* [L.])

Pine oil sprays are used to repel mosquitoes, as well as to provide a fresh, forest-like smell.

#### 27.3.5 Vetiver Oil (*Vetiveria zizanioides* [Nash])

Vetiver essential oil spray has been found to be very useful in repelling mosquitoes and creating a spicy and Balinese ambience for summer in houses of workers of the vetiver craft industry in Java, Indonesia. In Indonesia, there is a sustainable vetiver essential oil production. It has developed into a viable vetiver industry, producing items such as aromatic mats, baskets, candles, and soaps from the spent root.

#### 27.3.6 Bergamot Oil (*Citrus aurantium* [L.] var. *bergamia*)

It has been claimed that bergamot oil is one the favorite oils to use for green cleaning. It is a good insect repellent, and also adds a mood-boosting and fruity lift. Bergamot oil is phototoxic, so it may not be used for pest control. Bergamot oil is wonderful for topical use on insect bites or stings (without sun exposure).

#### 27.3.7 Peppermint Oil (*Mentha piperita* [L.])

Peppermint oil is a perfect choice as a natural insecticide and repellent to mosquitoes. Its fresh and minty clean aroma is used in bug spray. Its diluted solution (3 ml/L of water) completely kills larvae of *Culex quinquefasciatus* in 24 hours. Its mixture (peppermint–tea tree Australia: 1:1) is very effective on insect bites and stings. Peppermint oil is a great well-known recipe.

#### 27.3.8 Tea Tree Australia Oil (*Melaleuca alternifolia* [Cheel])

Sprays of Australian tea tree oil are a green cleaning powerhouse, as well as antiparasitic. It is capable of destroying or suppressing the growth of parasites such as fleas, leeches, lice, and ticks. Australian tea tree oil is helpful in controlling irritation from bites or stings.

#### 27.3.9 Eucalyptus Oil (*Eucalyptus globulus* [Labill])

Eucalyptus oil is a standard part of each and every natural green cleaning kit. It can also be used as an insecticide. Eucalyptus oils obtained from different species of eucalyptus tree have been found to be more effective against *Lutzomyia longipalpis* than other natural products.

#### 27.3.10 Lemon Eucalyptus Oil (*Eucalyptus citriodora* [Hook])

It is also used as a natural insecticide, especially by those who love a citrusy smell for summer. Its hydrosol is very effective against mosquitoes. It is safe to use around children and pets as a broad-range insecticide. Lemon eucalyptus oil has been thoroughly studied in Ethiopia as an insect repellent. *E. citriodora* is an excellent resource, as the tree grows quickly and has a fairly high yield of essential oil. This oil is also effective against bites and stings of the summer.



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## 27.4 All-Natural Homemade Bug Spray Recipes That Work [12]

Some natural, homemade, and inexpensive bug sprays are summarized in the following sections.

### 27.4.1 Essential Oil Bug Spray

Add witch hazel to fill almost to the top of a spray bottle (8 ounce) that is already half-filled with distilled or boiled water. Add  $\frac{1}{2}$  teaspoon vegetable glycerin, and then add 30–50 drops of essential oil or oils (citronella, clove, lemongrass, rosemary, tea tree, cajeput, eucalyptus, cedar, catnip, lavender, cinnamon, and mint). Mix well and store in a cool place. It works well and smells pleasant.

### 27.4.2 Fresh or Dried Herb Bug Spray

Take 3–4 tablespoons of dried herbs total in any combination, from peppermint, spearmint, citronella, lemongrass, catnip, lavender, and so forth. Mix well, cover, boil, and cool, and then strain herbs out. Mix the aliquot with 1 cup of witch hazel or rubbing alcohol and store in a spray bottle in a cool place. Use when desired. It provides a pleasant smell and is very refreshing to the skin.

### 27.4.3 Super Strong Insect Repellent Recipe

The following simple, inexpensive, and wonderful insect repellent spray may be made by mixing ingredients that are commonly available in one's kitchen.

Place 132 ounces of apple cider vinegar and dried herbs (tablespoon each of sage, rosemary, lavender, thyme, and mint) into a large glass jar; seal the jar tightly and shake daily for 2–3 weeks.

Then strain the herbs out and store in a spray bottle or tincture bottles, preferably in the refrigerator. Its diluted solution (50/50 v/v) may be applied on skin to cure insect bites and stings, and the spray can be used for serious bug control. This mixture has been found to be very strong and possess antiviral and antibacterial properties. It can also be used for any illness. The recommended dose is 1 tablespoon in water for adults several times a day and 1 tablespoon in water for children older than 2 several times a day.

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## 27.5 Aromatherapy and Pest Control [13]

The ornamental plants can be protected by the recipes described in the book *1001 All-Natural Secrets to a Pest-Free Property* by Dr. Myles H. Bader. These home remedies are very simple and inexpensive to prepare, and their composition can be altered to the individual need. They can be sprayed by using a glass sprayer and can be stored in a cool place. It is also easy to prepare fresh and add mixture when needed. Some of the recipes are described in the next sections.



### 27.5.1 Recipe for Keeping the Aphids Off

A mixture of oil, soap, and essential oils can be made in a ½ gallon of water by adding a squirt of dishwashing soap (Ivory liquid is the mildest), 2 tablespoons of cooking oil, and 10 drops of eucalyptus essential oil. Then, spray the solution on the plants, making sure to spray underneath the leaves, as well as on top. The oil will smother and drown the aphids, and the eucalyptus smell will deter other aphids from coming back. Lemon essential oil can be used, as well as tea tree. The solution can be painted on with a brush if one desires to be more area specific and/or make a smaller batch.

### 27.5.2 Recipe for Controlling Fungus

Mix baking soda (around 2 tablespoons) in a quart of water. Put six drops each of lemon and ginger essential oils in ½ tablespoon of dishwashing liquid and then add this to the baking soda solution and spray directly on the fungus. For mold, use ½ cup of white vinegar in a quart of water, with tea tree, lavender, or any of the citrus essential oils, and spray onto affected areas.

### 27.5.3 Recipe for Spiders, Mites, and Caterpillars

Mix quite a few drops of Tabasco and a small squirt of dishwashing liquid, and add a few drops of spearmint essential oil. Stir thoroughly and spray on the affected areas. In fact, any of the mint oils will be effective in this mix.

### 27.5.4 Recipe for Ants

Take honey or jam in a small container and mix in boric acid. This is very effective to control ants. A mixture of window cleaner with peppermint, cinnamon, or citrus essential oil is very effective in stopping ants moving on their route, while turmeric may be sprinkled around the hole and the ant would not be able to exit over the spice. A few drops of any of the essential oils dripped directly into the hole of the tunnel will ensure that the tunnel is dead.

### 27.5.5 Recipe for Roaches

A solution of Dr. Bronner's peppermint soap with a few drops of citronella essential oil can be sprayed directly on the roach to kill it. To deter roaches and ants from frequenting a place, a solution of borax mixed with crushed black pepper and bay leaves can be sprayed. The spray should be kept away from pets and children.

### 27.5.6 Recipe for Flies

The movement of flies can be restricted by the burning of eucalyptus, clove, or basil oil in the kitchen. A spray of essential oil in water can freshen the room, as well as dissuade pests from lingering. Lemongrass oil is also useful in pest control.

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## 27.6 Ten Homemade Organic Pesticides [14]

Long before the invention of harmful chemical pesticides, farmers and householders used multiple remedies for removing insect infestations from their garden plants and house vectors. The following sections offer some favorite, all-natural, inexpensive, organic recipes for pest control.

### 27.6.1 Neem

Add ½ ounce of high-quality organic neem oil and ½ teaspoon of mild organic liquid soap or Dr. Bronner's peppermint soap to 2 quarts of warm water. Stir slowly, and then add to a spray bottle and use immediately.

### 27.6.2 Citrus Oil and/or Cayenne Pepper Mix

Mix 10 drops of citrus essential oil with 1 teaspoon cayenne pepper and 1 cup of warm water. Shake well and spray in the affected areas. It is a great organic pesticide that works well on ants.

### 27.6.3 Soap, Orange Citrus, and Water

Mix 3 tablespoons of liquid organic castile soap with 1 ounce of orange oil to 1 gallon of water, shake well, and transfer into a spray bottle. This is a specifically effective treatment against slugs and can be sprayed directly on ants and roaches.

### 27.6.4 Eucalyptus Oil

Eucalyptus can be sprinkled to control flies, bees, and wasps. It is a great natural pesticide to repel insects.

### 27.6.5 Onion and Garlic Spray

Mince one organic clove of garlic and one medium-sized organic onion, add to a quart of water, wait for 1 hour, and then add 1 tablespoon of cayenne pepper and 1 tablespoon of liquid soap to the mix. Transfer to a spray bottle and store in the refrigerator. The mix is stable for 1 week and holds its potency. It works well against common pests.

### 27.6.6 Chrysanthemum Flower Tea

These flowers contain a powerful plant chemical known as pyrethrum that invades the nervous system of insects, rendering them immobile. Boil 100 g of dried flowers into 1 L of water for 20 minutes, strain, cool, and fill a spray bottle. It is stable for up to 2 months. Its effectiveness can be improved by adding some organic neem oil.

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## 27.7 Healthy Living: DIY Peppermint Spider Repellent [15]

Chemical pesticides have been found to be good for pest control all over the world. Unfortunately, for healthy living they have been found to be totally unsuitable because they lead to skin allergies, asthma, and serious illness. Avoiding chemicals and using natural products is a key to healthy living. If one has kids and pets, this is one more reason why one should opt for healthier options and avoid commercial pest control products. The key to healthy living can be developed by making our own pest repellent. It is well known that spiders do not like strong-smelling herbs like mint, lavender, and orange. They hate peppermint oil. So, useful and effective pest repellent recipes can be prepared. Examples are given in the following sections.

### 27.7.1 Peppermint Pest-Repelling Recipe

Add 10–15 drops of peppermint essential oil into a spray bottle containing 8–12 ounces of water. Spray around door frames, windows, small cracks, corners of the ceiling, and bathrooms. Use peppermint essential oil without water for a more potent version. Do this once a week, but in the summer, do it twice a week.

### 27.7.2 Mountain Rose Herb Recipe

Mountain rose herbs are a reputable source for essential oils. The repellent recipe can be made as above for fleas, ticks, ants, centipedes, mosquitoes, moths, mice, and so forth.

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## 27.8 Organic Pesticide and Fungicide Spray [16]

Some organic pesticide and fungicide sprays can be made as follows:

- Azadirachtin is toxic to many insects and acts as a feeding inhibitor and growth disrupter. It is a biodegradable and natural insecticide.
- *Aloe vera* acts as a source of salicylic acid, which is necessary for activating a plant's immune system to respond to threats.
- Potassium silicate is a natural fungicide, insecticide, and miticide. The essential oils used in the foliar spray have a variety of antifungal and pesticide properties.

### 27.8.1 Neem Recipe

Add ¼ tablespoon neem oil, ½ tablespoon 7.8% potassium silicate solution, and ¼ ounce (1.5 tablespoons or 150 drops) assorted essential oils (ginger, rosemary, clove, peppermint, and eucalyptus) to ¼ gallon (4 cups) of warm water. Shake well to entirely emulsify the mix. Finally, it should be nice and creamy looking, with no oil floating on top. This can be used to control many types of pest and fungus.

### 27.8.2 Aloe Recipe

Add 1 tablespoon *Aloe vera* juice. The juice can be made by shaking powdered *Aloe vera* in water. *Aloe vera* activates the immune system of the plant to give response to any threats.

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## 27.9 Pest Control Using Essential Oils for Ants, Mice, Cockroaches, and More [17]

Citronella oil is found in many natural insect repellents. It is distilled from citronella grass, grown mostly in southern Asia. The fragrance is lemony and bearable to most people, but pungent to many insects, especially mosquitoes. Other essential oils possessing insect-repelling properties are cedarwood, lemongrass, eucalyptus, peppermint, pennyroyal, lavender, and bergamot. Common pests and ways to use essential oils to repel them are given in the next sections.

### 27.9.1 Ant Repellent

A common natural way to get rid of ants is by using vinegar spray. Black pepper or cayenne pepper can also be used sprinkled on places where ants show up. Peppermint essential oil spray is useful in the kitchen and bedroom.

### 27.9.2 Aphid Repellent

Mix 10 drops of rosemary and lavender oil both in 1 L (4 cups) of salt water. Spray the affected plants. Other repellents are neem oil spray and calcium powder. Calcium powder is sprinkled around the plant's base.

### 27.9.3 Cockroach Repellent

Impregnated cotton balls with citronella oil can be placed in trouble areas, such as cupboards or under the sink. Peppermint oil and lemongrass oil may also be added to citronella oil to prepare impregnated cotton balls. A spray solution can also be made by mixing 5 drops of cypress essential oil and 10 drops of peppermint oil. Spray the solution whenever and wherever the cockroaches appear.

### 27.9.4 Fly Repellent

Place a handful of dried cloves in a bowl, and sprinkle a few drops of clove oil, lavender oil, and citronella oil or peppermint oil on the dried cloves. Place it in areas where flies may come or linger, such as a front or back door, kitchen, or near the garage.

### 27.9.5 Mosquito Repellent

Put a few drops of citronella oil or lemongrass oil in an oil burner. The oil is to be added again and again in the burner. A citronella candle also works well. A ribbon impregnated with a mixture containing five drops each of citronella oil, lemongrass oil, peppermint

oil, and lavender oil can be hung on doorways, in the patio, or in a window for repelling mosquitoes.

### 27.9.6 Mice Repellent

Place cotton balls impregnated with peppermint oil, eucalyptus oil, or spearmint oil in locations where mice may be entering the house, areas of an attic or garage, and behind appliances, such as the refrigerator, washer, or drier. The balls can deter mice, but further measures may be required if the infestation is serious.

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## 27.10 Advantages of Mixed Essential Oils [18]

1. The effect of mixtures of two or more essential oils is more than that of individual oils, as well as greater than the additive effective of individual oils. It has been found to be true in the mix of lavender oil and chamomile oil.
2. A mixture of two to four essential oils has the same therapeutic properties, and the mixture works synergistically and with more effectiveness than any oil alone.
3. The order of the mixture can be made pleasant by mixing pleasant oil in less pleasant or bitter oil.
4. A costly essential oil can be made affordable by diluting it with less expensive oil.
5. Mixed into the correct concentration, two or more mixed oils may remain safe to use and stable over a long duration.
6. Old products of daily use can be made attractive to customers by adding a suitable essential oil as a blend.
7. Mixed essential oils are ready for immediate use—no fuss and no mess.

---

## 27.11 Disadvantages of Mixing Essential Oils Together

1. Pure oil or concentrated oil usage can produce the reverse effect; that is, concentrated lavender oil can cause restlessness, agitation, and insomnia.
2. Little work has been carried out to understand the end properties of the mixed oil.

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