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## Natural Tick Repellents and Pesticides

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### Overview

Although tick repellents and pesticides for use on skin, clothing, or in the yard are considered safe and effective when used as directed, many people are reluctant to use them. In order to provide other options, scientists have been developing all-natural chemical compounds made from plants that can repel or kill ticks. Scientists have also studied the use of fungi to kill ticks. Many natural products that come from plants or fungi and repel or kill ticks are described below.

### EPA Registration

Before insect repellents can be sold to the public, most must be registered by the Environmental Protection Agency (EPA). EPA registration means that a product has been evaluated and approved as safe and effective for people to use on their skin when applied according to label instructions. Any EPA-registered product will have an EPA Registration Number on the product label (for example, 123456-1).

Some insect repellent products for sale in the United States do not currently require EPA registration. In the 1990s, EPA evaluated the active ingredients in these unregistered products for safety (but not effectiveness). EPA determined that these all natural plant oils (like peppermint, thyme, eucalyptus, garlic, etc.) used in insect repellent products were safe for people and posed minimal risk to human health. EPA determined that products made from these all-natural ingredients do not require registration. **Note that products made from these ingredients have not been evaluated by EPA for effectiveness.**

For more information, see [EPA's Regulation of Skin-Applied Repellents \(http://www2.epa.gov/insect-repellents/regulation-skin-applied-repellents\)](http://www2.epa.gov/insect-repellents/regulation-skin-applied-repellents)

### Natural Compound-based Products that Repel or Kill Ticks

**Active ingredient:** 2-undecanone

**EPA-registered:** Yes

**Natural source:** Essential oil from leaves and stems of the wild tomato plant, *Lycopersicon hirsutum*

**Repels:** Ticks (including the blacklegged tick and the lone star tick)

**For use on:** Skin, clothing, gear

**Commercially available:** Yes

**References:**

- Bissinger, B.W., C.S. Apperson, D.W. Watson, C. Arellano, D.E. Sonenshine, and R.M. Roe. 2011. Novel field assays and the comparative repellency of BioUD, DEET, and permethrin against *Amblyomma americanum*. (<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2915.2010.00923.x/abstract;jsessionid=0EC7495D65E5C90A374D8EABDBB23C1B.f01t02>) *Med. Vet. Entomol.* 25:217-226.
- Bissinger, B.W., C.S. Apperson, D.E. Sonenshine, D.W. Watson, and R.M. Roe. 2009. Efficacy of the new repellent BioUD against three species of ixodid ticks. (<http://www.ncbi.nlm.nih.gov/pubmed/19140016>) *Exp. Appl. Acarol.* 48:239-250.

**Active ingredient:** Garlic Oil

**EPA-registered:** Exempt

**Natural source:** Essential oil from garlic plants

**Repels:** Ticks (blacklegged tick)

**For use on:** Lawns and gardens

**Commercially available:** Yes

**Reference:**

- Bharadwaj, A., L.E. Hayes, and K.C., III, Stafford. 2015. Effectiveness of garlic for the control of *Ixodes scapularis* (Acari: Ixodidae) on residential properties in western Connecticut (<http://jme.oxfordjournals.org/content/early/2015/04/21/jme.tjv044>) . *J. Med. Entomol.* 52:722-725.

**Active ingredient:** Mixed Essential Oils (rosemary, lemongrass, cedar, peppermint, thyme, and geraniol)

**EPA-registered:** Exempt

**Natural source:** Essential oils from rosemary, lemongrass, thyme, and geraniol plants

**Repels:** Ticks (blacklegged tick)

**For use on:** For use on skin, lawns, and gardens

**Commercially available:** Yes

**References:**

- Elias, S.P., C.B. Lubelczyk, P.W. Rand, J.K. Staples, T.W., ST. Amand, C.S. Stubbs, E.H. Lacombe, L.B. Smith, and R.P. Smith, Jr. 2013. Effect of a botanical acaricide on *Ixodes scapularis* (Acari:

Ixodidae) and nontarget arthropods. (<http://www.ncbi.nlm.nih.gov/pubmed/23427661>) *J. Med. Entomol.* 50:126-136.

- Jordan, R.A., M.C. Dolan, J. Piesman, and T.L. Schulze. 2011. Suppression of host-seeking *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae) nymphs after dual applications of plant-derived acaricides in New Jersey. (<http://www.ncbi.nlm.nih.gov/pubmed/21510219>) *J. Econ. Entomol.* 104:659-664.
- Jordan, R.A., T.L. Schulze, and M.C. Dolan. 2012. Efficacy of plant-derived and synthetic compounds on clothing as repellents against *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae). (<http://www.ncbi.nlm.nih.gov/pubmed/22308777>) *J. Med. Entomol.* 49:101-106.
- Rand, P.W., E.H. Lacombe, S.P. Elias, C.B. Lubelczyk, T.W., ST. Amand, and R.P. Smith, Jr. 2010. Trial of a minimal-risk botanical compound to control the vector tick of Lyme disease (<http://www.ncbi.nlm.nih.gov/pubmed/20695287>) *J. Med. Entomol.* 47:695-698.

**Active ingredient:** Nootkatone

**EPA-registered:** EPA registration filed and under review

**Natural source:** Essential oils from Alaska yellow cedar trees, some herbs, and citrus fruits

**Kills and repels:** Ticks (blacklegged tick) and other arthropods

**For use on:** For use on skin, lawns, and gardens

**Commercially available:** No

#### References:

- Panella, N.A., M.C. Dolan, J.J. Karchesy, Y. Xiong, J. Peralta-Cruz, M. Khasawneh, J.A. Montenieri, and G.O. Maupin. 2005. Use of novel compounds for pest control: insecticidal and acaricidal activity of essential oil components from heartwood of Alaska yellow cedar (<http://www.ncbi.nlm.nih.gov/pubmed/15962787>) *J. Med. Entomol.* 42:352-358.
- Dietrich, G., M.C. Dolan, J. Peralta-Cruz, J. Schmidt, J. Piesman, R.J. Eisen, and J.J. Karchesy. 2006. Repellent activity of fractioned compounds from Alaska yellow cedar (*Chamaecyparis nootkatensis*) essential oil against nymphal *Ixodes scapularis*. (<http://www.ncbi.nlm.nih.gov/pubmed/17017233>) *J. Med. Entomol.* 43:957-961.
- Dolan, M.C., G.B. Dietrich, N.A. Panella, J.A. Montenieri, and J.J. Karchesy. 2007. Biocidal activity of three essential wood oils against *Ixodes scapularis* (Acari: Ixodidae), *Xenopsylla cheopis* (Siphonaptera: Pulicidae), and *Aedes, aegypti* (Diptera: Culicidae). (<http://www.ncbi.nlm.nih.gov/pubmed/17461093>) *J. Econ. Entomol.* 100:622-625.
- Dolan, M.C., R.A. Jordan, T.L. Schulze, C.J. Schulze, M. Manning, D. Ruffalo, J.P. Schmidt, J. Piesman, and J.J. Karchesy. 2009. Ability of two natural products, nootkatone and carvacrol, to suppress *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae) in a Lyme disease

endemic area of New Jersey. (<http://www.ncbi.nlm.nih.gov/pubmed/20069863>) *J. Econ. Entomol.* 102:2316-2324.

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- Schulze, T.L., R.A. Jordan, and M.C. Dolan. 2011. Experimental use of two standard tick collection methods to evaluate the relative effectiveness of several plant-derived and synthetic repellents against *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae). (<http://www.ncbi.nlm.nih.gov/pubmed/22299371>) *J. Econ. Entomol.* 104:2062-2067.
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## Biological Agent-based Products that Repel or Kill Ticks

Active ingredient: Fungus (*Metarhizium brunneum/anisopliae*)

EPA-registered: Yes

Natural source: These fungi grow naturally in soils throughout the world

Kills: Ticks (blacklegged tick), thrips, whiteflies, mites, and weevils

For use on: For use on lawns and gardens

Commercially available: Yes

### References:

- Hornbostel, V.L., R.S. Ostfeld, and M.A. Benjamin. 2005. Effectiveness of *Metarhizium anisopliae* (Deuteromycetes) against *Ixodes scapularis* (Acari: Ixodidae) engorging on *Peromyscus leucopus*. (<http://www.ncbi.nlm.nih.gov/pubmed/16007961>) *J. Vector. Ecol.* 30:91-101.
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