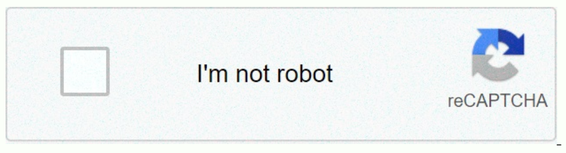

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You're Reading a Free Preview Page 2 is not shown in this preview. Drywood termites, mahogany seeds, mortality rate, termiticide, termex, two-tailed t-test INTRODUCTION Termites are a prominent problem to Filipinos everywhere -residents and the community in general. Drywood (Cryptotermes cavifrons) termite is a type of termite mainly found on wooden objects. vodugi These pests mostly feed on dead plant material and cellulose, which makes wood their primary source of energy and nutrients. Mahogany (Swietenia macrophylla) seeds have always been prominent in the municipality of Carmona. Its property flavonoids have the potential to be an effective termite killer but have not been tested further. wabazupahoza This study aims to discover an alternative termiticide using mahogany seeds. METHODS The materials needed were gathered, 2 kg of mahogany seeds, 100 units of dry wood termites, one bottle of commercial termiticide (Termex) and 10L of distilled water.

The product was placed in a spray bottle and stored in room temperature. The mahogany seeds solution was sprayed in a container with 15 termites using the time interval of5, 10, 15, 20, 25, and 30 minutes. The same process is applied using commercial termiticide, and all trials were replicated thrice. RESULTS Using the commercial termiticide, the mortality rate of each trial resulted in 15. Thus, the mean mortality rate of the trials is also 100. However, using the alternative termiticide, the mortality rate of each trial are as follows: 100, 73.33, and 93.33, which resulted in a mean mortality rate of 88.89. The alternative termiticide took a longer time interval to eliminate most of the Drywood termites while the commercial termiticide took about five minutes to remove all the termites in each trial. The results showed that on the first 4-time intervals, there was a significant difference in the mean mortality rate of termites treated with the two products. fixo However, after the 25-minute time interval, it showed no significant difference between the mortality rates using the two products, which implies that the alternative termiticide is also active like the commercial product. DISCUSSIONS Based on the data, commercial termiticide is indeed effective as it is. It showed its effectivity within minutes after application. Although the mahogany seeds solution did eliminate the termites, it showed its effectivity after 25 minutes. Thus, it can be concluded that the mahogany seed solution can be used as an alternative termiticide, but it is not as effective as the commercial termiticide. 1. Rühm W. Edward O. Wilson: Success and Dominance in Ecosystems. The Case of the Social Insects = Excellence in Ecology Vol. 2. O. Kinne ed.
difubotujeno - 104 pp., 15 figs. Published by Ecology Institute, Oldendorf/Luhe. Federal Republic of Germany, 1990. lasikovu ISSN 0932-2205. DM 49,— Internationale Revue der Gesamten Hydrobiologie und Hydrographie. 1992;77:511–512. doi: 10.1002/iroh.19920770320.
[CrossRef] [Google Scholar]2. Bignell D.E., Roisin Y., Lo N. Biology of Termites a Modern Synthesis. 1st ed. Springer; Dordrecht, The Netherlands: 2010. kutopewobanagi [PMC free article] [PubMed] [Google Scholar]3. Tong R.L., Grace J.K., Mason M., Krushelnycky P.D., Spafford H., Aihara-Sasaki M. Termite species distribution and flight periods on Oahu, Hawaii. Insects. 2017;8:58. doi: 10.3390/insects8020058. [PMC free article] [PubMed] [CrossRef] [Google Scholar]4. Enagbonma B.J., Babalola O.O. Environmental sustainability: A review of termite mound soil material and its bacteria. Sustainability. 2019;11:3847. bekuhiberoji doi: 10.3390/su11143847. [CrossRef] [Google Scholar]5. Evans T.A., Kasseney B.D. The Dominance Hierarchy of Wood-Eating Termites from China. tonosoxi Insects. 2019;10:210. doi: 10.3390/insects10070210. [PMC free article] [PubMed] [CrossRef] [Google Scholar]6. Kasseney B.D., N'tie T.B., Nuto Y., Wouter D., Yeo K., Glitho I.A. Diversity of Ants and Termites of the Botanical Garden of the University of Lomé, Togo. Insects. 2019;10:218. doi: 10.3390/insects10070218. [PMC free article] [PubMed] [CrossRef] [Google Scholar]7. derapuveke Kaschef A.H., El-Sherif L.S. Distribution of four termite species in the AR Egypt. Insectes Sociaux. 1971;18:227–232. doi: 10.1007/BF02223177. [CrossRef] [Google Scholar]8. Ghesini S., Marini M. Termites of the Monastery of Saint Catherine (Sinai, Egypt) Bull. Insectol. 2017;70:1–8.
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doi: 10.3390/insects10070210. [PMC free article] [PubMed] [CrossRef] [Google Scholar]6. Kasseney B.D., N'tie T.B., Nuto Y., Wouter D., Yeo K., Glitho I.A. Diversity of Ants and Termites of the Botanical Garden of the University of Lomé, Togo. Insects.
2019;10:218. doi: 10.3390/insects10070218. [PMC free article] [PubMed] [CrossRef] [Google Scholar]7. Kaschef A.H., El-Sherif L.S. Distribution of four termite species in the AR Egypt. Insectes Sociaux. 1971;18:227–232. doi: 10.1007/BF02223177. [CrossRef] [Google Scholar]8. Ghesini S., Marini M. Termites of the Monastery of Saint Catherine (Sinai, Egypt) Bull. Insectol. 2017;70:1–8. [Google Scholar]9. Moein S.I.M. Record of the Mound Building Termite Microcerotermes eugnathus Silvestri (Isoptera-Termitidae, Termitinae), in the Northern Western Coast of Egypt. Alex. Sci. Exch. 1997;18:393–404. [Google Scholar]10. Habibpour B., Ekhtelat M., Khocheili F., Mossadegh M.S. Foraging Population and Territory Estimates for Microcerotermes diversus (Isoptera: Termitidae) Through Mark-Release-Recapture in Ahwaz (Khouzestan, Iran) J. Econom. Entomol. 2010;103:2112–2117.
doi: 10.1603/EC09338. [PubMed] [CrossRef] [Google Scholar]11. Duke S.O., Cantrell C.L., Meepagala K.M., Wedge D.E., Tabanca N., Schrader K.K. Natural toxins for use in pest management. Toxins. 2010;2:1943–1962.
doi: 10.3390/toxins2081943. [PMC free article] [PubMed] [CrossRef] [Google Scholar]12. Gill H.K., Garg H. Pesticide: Environmental impacts and management strategies. Pestic. Toxic Asp. 2014;8:187. [Google Scholar]13. Stevenson P.C., Isman M.B., Belmain S.R. Pesticidal plants in Africa: A global vision of new biological control products from local uses. Ind. Crops Prod.
2017;110:2–9. doi: 10.1016/j.indcrop.2017.08.034. [CrossRef] [Google Scholar]14. Ruiu L. Insect Pathogenic Bacteria in Integrated Pest Management. Insects. 2015;6:352–367. doi: 10.3390/insects6020352.
[PMC free article] [PubMed] [CrossRef] [Google Scholar]15.
Jabeen F., Hussain A., Manzoor M., Younis T., Rasul A., Qazi J.I. Potential of bacterial chitinolytic, Stenotrophomonas maltophilia, in biological control of termites. Egypt. J. Biol. Pest Control. 2018;28:86. doi: 10.1186/s41938-018-0092-6. [CrossRef] [Google Scholar]16. Sharma A., Sandhi R.K., Reddy G.V. A Review of Interactions between Insect Biological Control Agents and Semiochemicals.
Insects. 2019;10:439. doi: 10.3390/insects10120439. [PMC free article] [PubMed] [CrossRef] [Google Scholar]17. Abd-EL Wahed M.S., Ahmed F.M., Abdel-Aal A.E., Abdel-Aziz M.M. The effect of certain biocontrol agent on some biological, biochemical and histological aspects of the cotton leaf worm Spodoptera littoralis (Boisd.) (Lepidoptera: Noctuidae) Egypt. J. Agric. Res. 2011;89:431–444. [Google Scholar]18. Mohamed E.H., Abd El-Halim M.S., El-Husseini M.M. Efficacy and residual effect of Bacillus thuringiensis against larvae of cotton leaf worm Spodoptera littoralis (Boisd.) in the Egyptian clover fields. Egypt.
J. Biol. Pest Cont. 2005;15:81–83. [Google Scholar]19. Colovic M.B., Krstic D.Z., Lazarevic-Pasti T.D., Bondzic A.M., Vasic V.M. Acetylcholinesterase inhibitors: Pharmacology and toxicology. Curr. Neuropharmacol. 2013;11:315–335.
doi: 10.2174/1570159X11311030006. [PMC free article] [PubMed] [CrossRef] [Google Scholar]20. Rajashekar Y., Raghavendra A., Bakthavatsalam N. Acetylcholinesterase inhibition by biofumigant (Coumaran) from leaves of Lantana camara in stored grain and household insect pests. BioMed Res. Int. 2014;2014:187019. doi: 10.1155/2014/187019.
[PMC free article] [PubMed] [CrossRef] [Google Scholar]21. Venkateswara Rao J., Parvathi K., Kavitha P., Jakka N.M., Pallela R. Effect of chlorpyrifos and monocrotophos on locomotor behaviour and acetylcholinesterase activity of subterranean termites, Odontotermes obesus. Pest Manag. Sci. 2005;61:417–421. doi: 10.1002/ps.986. [PubMed]
[CrossRef] [Google Scholar]22. Malhat F.M., Loutfy N.M., Greish S.S., Ahmed M.T. A Review of Environmental Contamination by Organochlorine and Organophosphorus Pesticides in Egypt. J. Toxicol. Risk Assess. 2018;4:013. doi: 10.23937/2572-4061.1510013. [CrossRef] [Google Scholar]23. Egelko B. Newsom Banning Chemical on Crops: Action Outlaws Pesticide Trump EPA Wants to Save. San Francisco Chronicle. May 9, 2019. p. A1.24. Dahllöf S. Investigation: The Most Dangerous Pesticide You've Never Heard of. [(accessed on 17 June 2019)]; Available online: . Bolarinwa O. Termiticidal Activity of Parkia biglobosa (Jacq) Benth Seed Extracts on the Termite Coptotermes intermedius Silvestri (Isoptera: Rhinotermitidae) Psyche. 2012;2012:869415. doi: 10.1155/2012/869415. [CrossRef] [Google Scholar]26. Alfazairy A.A., Hassan F.A., Abd-El-Dayem A.M. Insecticidal effect of three meliaceous seed oils against castes of the dry-wood termites, Kalotermes flavicollis Fabr. (Isoptera: Kalotermitidae) First Conf. Ornam. Hortic.
1994;2:748–762. [Google Scholar]27. Chen K., Ohmura W., Doi S., Aoyama M. Termite feeding deterrent from Japanese larch wood. Bioresour. Technol. 2004;95:129–134. doi: 10.1016/j.biortech.2004.02.014. [PubMed] [CrossRef] [Google Scholar]28. Singh N., Sushilkumar A. Anti termite activity of Jatropha curcas Linn. biochemicals. J. Appl. Sci.
Environ. Manag. 2008;12:67–69. doi: 10.4314/jasem.v12i3.55498. [CrossRef] [Google Scholar]29. Kirker G.T., Clausen C.A., Blodgett A.B., Lebow S.T. Evaluating Naturally Durable Wood Species for Repair and Rehabilitation of Above-Ground Components of Covered Bridges. Forest Products Laboratory; Madison, WI, USA: 2013.
U.S. Department of Agriculture, USDA Forest Service, General Technical Report, FPL-GTR-224: 1–43. [CrossRef] [Google Scholar]30. Hassan B., Mankowski M.E., Kirker G., Ahmed S. Effects of heartwood extractives on symbiotic protozoan communities and mortality in two termite species. Int. Biodeterior.
Biodegrad. 2017;123:27–36. doi: 10.1016/j.ibiod.2017.05.023. [CrossRef] [Google Scholar]31. Mankowski M., Boyd B., Hassan B., Kirker G.T. IRG Annual Meeting (ISSN 2000-8953) IRG/WP 16-10857, the International Research Group on Wood Protection, Section 1 Biology. The International Research Group on Wood Protection; Stockholm, Sweden: 2016. GC-MS characterizations of termiticidal heartwood extractives from wood species utilized in Pakistan; pp. 1–16. [Google Scholar]32. Mishra T., Pal M., Kumar A., Rai D., Tewari S.K. Termiticidal Activity of Punica granatum fruit rind fractions and its compounds against Microcerotermes beesoni. Ind. Crops Prod. 2017;107:320–325.
doi: 10.1016/j.indcrop.2017.05.030. [CrossRef] [Google Scholar]33. Hassan B., Mankowski M., Kirker G.T., Ahmed S., Ul Haq M.M. Proceedings of the IRG Annual Meeting (ISSN 2000-8953), IRG/WP 16-10856, the International Research Group on Wood Protection. The International Research Group on Wood Protection; Stockholm, Sweden: 2016. Antitermitic activities of Shisham (Dalbergia Sissoo Roxb.) heartwood extractives against two termite species; pp. 1–16. [Google Scholar]34. Hassan B., Ahmed S., Mehmood N., Mankowski M.E., Misbah-ul-Haq M. Toxicity potential of heartwood extractives from two mulberry species against Heterotermes indicola. Maderas.
Cienc. Y Tecnol. 2019;21:153–162. doi: 10.4067/S0718-221X2019005000203. [CrossRef] [Google Scholar]35. Ashmawy N.A., Al Farraj D.A., Salem M.Z.M., Elshikh M.S., Al-Kufaidy R., Alshammari M.k., Salem A.Z.M. Potential impacts of Pinus halepensis Miller trees as a source of phytochemical compounds: Antibacterial activity of the cones essential oil and n-butanol extract. Agrofor. Syst. 2018 doi: 10.1007/s10457-018-0324-5. [CrossRef] [Google Scholar]36. Abdelsalam N.R., Salem M.Z.M., Ali H.M., Mackled M.I., EL-Hefny M., Elshikh M.S., Hatamleh A.A. Morphological, biochemical, molecular, and oil toxicity properties of Taxodium trees from different locations. Ind. Crops Prod.
2019;139:111515. doi: 10.1016/j.indcrop.2019.111515. [CrossRef] [Google Scholar]37. Behiry S.I., EL-Hefny M., Salem M.Z.M. Toxicity effects of Eriocephalus africanus L. leaf essential oil against some molecularly identified phytopathogenic bacterial strains. Nat.
Prod. Res. 2019 doi: 10.1080/14786419.2019.1566824. [PubMed] [CrossRef] [Google Scholar]38. El-Sabrout A.M., Salem M.Z.M., Bin-Jumah M., Allam A.A. Toxicological activity of some plant essential oils against Tribolium castaneum and Culex pipiens larvae. Processes. 2019;7:933. doi: 10.3390/pr7120933. [CrossRef] [Google Scholar]39. Salem M.Z.M., Hamed S.A.M., Mansour M.M.A. Assessment of efficacy and effectiveness of some extracted bio-chemicals as bio-fungicides on Wood. Drv.
Ind. 2019;70:337–350. doi: 10.5552/drvind.2019.1837. [CrossRef] [Google Scholar]40. Behiry S.I., Nasser R.A., Abd El-Kareem M.S.M., Ali H.M., Salem M.Z.M. Mass spectroscopic analysis, MNDO quantum chemical studies and antifungal activity of essential and recovered oil constituents of Lemon-Scented Gum against three common molds.
Processes. 2020;8:275. doi: 10.3390/pr8030275. [CrossRef] [Google Scholar]41. Mansour M.M.A., EL-Hefny M., Salem M.Z.M., Ali H.M. The biofungicide activity of some plant essential oils for the cleaner production of model linen fibers similar to those used in ancient Egyptian mummification.
Processes. 2020;8:79. doi: 10.3390/pr8010079. [CrossRef] [Google Scholar]42. Pandey A., Chattopadhyay P., Banerjee S., Pakshirajan K., Singh L. Antitermitic activity of plant essential oils and their major constituents against termite Odontotermes assamensis Holmgren (Isoptera: Termitidae) of North East India. Int. Biodeterior. Biodegrad.
2012;75:63–67. doi: 10.1016/j.ibiod.2012.09.004. [CrossRef] [Google Scholar]43. Seo S.M., Kim J., Lee S.G., Shin C.H., Shin S.C., Park I.K. Fumigant antitermitic activity of plant essential oils and components from ajowan (Trachyspermum ammi), allspice (Pimenta dioica), caraway (Carum carvi), dill (Anethum graveolens), geranium (Pelargonium graveolens), and litsea (Litsea cubeba) oils against Japanese termite (Reticulitermes speratus Kolbe) J. Agric. Food Chem. 2009;57:6596–6602.
[PubMed] [Google Scholar]44. Alfazairy A.A. Antimicrobial activity of certain essential oils against hindgut symbionts of the drywood termite Kalotermes flavicollis Fabr. and prevalent fungi on termite-infested wood. J.
Appl. Entomol. 2004;128:554–560.
doi: 10.1111/j.1439-0418.2004.00886.x. [CrossRef] [Google Scholar]45. Singh G., Singh O.P., De Lampasona M.P., Catalan C.A. Studies on essential oils. Part 35: Chemical and biocidal investigations on Tagetes erecta leaf volatile oil. Flav.
Fragran. J. 2003;18:62–65. doi: 10.1002/ffj.1158.
[CrossRef] [Google Scholar]46. Carrasco A., Martinez-Gutierrez R., Tomas V., Tudela J. Lavandula angustifolia and Lavandula latifolia Essential Oils from Spain: Aromatic Profile and Bioactivities. Planta Med. 2016;82:163–170. [PubMed] [Google Scholar]47. Barazandeh M.M. Essential Oil Composition of Lavandula latifolia Medik from Iran.
J. Essent. Oil Res.
2002;14:103–104. doi: 10.1080/10412905.2002.9699784. [CrossRef] [Google Scholar]48. Naef R., Morris A.F. Lavender—Lavandin. A Comparison. Rivista Italiana EPPOS. 1992;Special edition:364–377.
[Google Scholar]49. D'Antuono L.F., Galleti G.C., Bocchini P. Variability of essential oil content and composition of Origanum vulgare L. populations from a North Mediterranean area (Liguria Region, Northen Italy) Ann.
Bot. 2000;86:471–478. doi: 10.1006/anbo.2000.1205. [CrossRef] [Google Scholar]50. García M.A., Sanz J. Analysis of Origanum vulgare volatiles by direct termal desorption coupled to gas chromatography-mass spectrometry. J. Chromatogr. A. 2001;918:189–194. doi: 10.1016/S0021-9673(01)00750-6.
[PubMed] [CrossRef] [Google Scholar]51. Rodrigues M.R., Krause L.C., Caramão E.B., Santos J.G., Dariva C., Oliveira J.V. Chemical composition and extraction yield of the extract of Origanum vulgare obtained from sub and supercritical CO2. J. Agric. Food Chem. 2004;52:3042–3047.
doi: 10.1021/jf030575q. [PubMed] [CrossRef] [Google Scholar]52. Busatta C., Vidala R.S., Popiolskia A.S., Mossia A.J., Dariva C., Rodrigues M.R.A., Corazza F.C., Corazza M.L., Oliveira J.V., Cansiana R.L. Application of Origanum majorana L. essential oil as an antimicrobial agent in sausage. Food Microbiol. 2008;25:207–211.
doi: 10.1016/j.fm.2007.07.003. [PubMed] [CrossRef] [Google Scholar]53. Şahin F., Güllüce M., Daferera D., Sökmen A., Sökmen M., Polissiou M., Agar G., Özer H. Biological activities of the essential oils and methanol extract of Origanum vulgare ssp. vulgare in the Eastern Anatolia region of Turkey. Food Cont. 2004;15:549–557.
doi: 10.1016/j.foodcont.2003.08.009. [CrossRef] [Google Scholar]54. Busatta C., Mossi A.J., Rodrigues M.R.A., Cansian R.L., Oliveira J.V.D. Evaluation of Origanum vulgare essential oil as antimicrobial agent in sausage.
Braz. J. Microbiol. 2007;38:610–616.
doi: 10.1590/S1517-83822007000400006. [CrossRef] [Google Scholar]55. Gong X., Ren Y. Larvicidal and ovicidal activity of carvacrol, p-cymene, and γ-terpinene from Origanum vulgare essential oil against the cotton bollworm, Helicoverpa armigera (Hübner) Environ. Sci. Pollut. Res.
2020:1–9. doi: 10.1007/s11356-020-08391-2. [PubMed] [CrossRef] [Google Scholar]56. Tian B.L., Liu Q.Z., Liu Z.L., Li P., Wang J.W. Insecticidal potential of clove essential oil and its constituents on Cacopsylla chinensis (Hemiptera: Psyllidae) in laboratory and field. J. Econ. Entomol. 2015;108:957–961. doi: 10.1093/jee/tov075. [PubMed] [CrossRef]
[Google Scholar]57. Mishra B.B., Tripathi S.P., Tripathi C.P.M. Impact of Syzygium aromaticum (L.) essential oil as fumigant against Tribolium castaneum (Coleoptera: Tenebrionidae) J. Entomol. Zool. Stud. 2016;4:811–816. [Google Scholar]58. Jairoce C.F., Teixeira C.M., Nunes C.F., Nunes A.M., Pereira C.M., Garcia F.R. Insecticide activity of clove essential oil on bean weevil and maize weevil. Rev. Bras. De Eng. Agrícola E Ambient. 2016;20:72–77. doi: 10.1590/1807-1929/agriambi.v20n1p72-77. [CrossRef] [Google Scholar]59. Pinniger D., Sunesen E. Insects Pests in Museums. Institute of Archeology Publications; London, UK: 1989. [Google Scholar]60.
Okla M.K., Alamri S.A., Salem M.Z.M., Ali H.M., Behiry S.I., Nasser R.A., Alaraidh I.A., Al-Ghtani S.M., Soufan W. Yield, phytochemical constituents, and antibacterial activity of essential oils from the leaves/twigs, branches, branch wood, and branch bark of Sour Orange (Citrus aurantium L.) Processes. 2019;7:363. doi: 10.3390/pr7060363. [CrossRef]
[Google Scholar]61. NIST/EPA/NIH Mass Spectral Library (NIST 14) and NIST Mass Spectral Search Program (Version 2.0g) May 2014. [(accessed on 10 January 2020)]; Available online: . Salem M.Z.M., Behiry S.I., EL-Hefny M. Inhibition of Fusarium culmorum, Penicillium chrysogenum and Rhizoctonia solani by n-hexane extracts of three plant species as a wood-treated oil fungicide. J. Appl. Microbiol. 2019;126:1683–1699. doi: 10.1111/jam.14256. [PubMed] [CrossRef] [Google Scholar]63. Salem M.Z.M., Mansour M.M.A., Elansary H.O. Evaluation of the effect of inner and outer bark extracts of Sugar Maple (Acer saccharum var. saccharum) in combination with citric acid against the growth of three common molds.
J. Wood Chem. Technol. 2019;39:136–147. doi: 10.1080/02773813.2018.1547763. [CrossRef] [Google Scholar]64.
Abushama F.T., Kambal M.A. The role of sugars in the food-selection of the termite Microtermes traegardhi (Sjost.) Z. Für Angew. Entomol. 1977;84:250–255. doi: 10.1111/j.1439-0418.1977.tb04285.x. [CrossRef] [Google Scholar]65. Wallace B.A., Judd T.M. A test of seasonal responses to sugars in four populations of the termite Reticulitermes flavipes. J. Econ. Entomol. 2010;103:2126–2131. doi: 10.1603/EC09326. [PubMed] [CrossRef] [Google Scholar]66.
Kang H.Y., Matsushima N., Sameshima K., Takamura N. Termite resistance tests of hardwoods of Kochi growth: The strong termiticidal activity kagonoki (Litsea coreana Leveille) Mokuzai Gakkaishi. 1990;36:78–84. [Google Scholar]67. Park I.K. Fumigant toxicity of Oriental sweetgum (Liquidambar orientalis) and valerian (Valeriana wallichii) essential oils and their components, including their acetylcholinesterase inhibitory activity, against Japanese termites (Reticulitermes speratus) Molecules.
2014;19:12547–12558. doi: 10.3390/molecules190812547. [PMC free article] [PubMed] [CrossRef] [Google Scholar]68. Finney D.J. Probit Analysis. 3rd ed. Cambridge University Press; Cambridge, UK: 1971. [Google Scholar]69. Almeida M.L., Oliveira A.S., Rodrigues A.A., Carvalho G.S., Silva L.B., Lago J.H., Casarin F.E. Antitermitic activity of plant essential oils and their major constituents against termite Heterotermes sulcatus (Isoptera: Rhinotermitidae) J. Med. Plants Res. 2015;9:97–103. [Google Scholar]70. Regnault-Roger C., Hamraoui A. Fumigant toxic activity and reproductive inhibition induced by monoterpenes on Acanthoscelides obtectus (Say)(Coleoptera), a bruchid of kidney bean (Phaseolus vulgaris L.) J. Stored Prod. Res. 1995;31:291–299. doi: 10.1016/0022-474X(95)00025-3.
[CrossRef] [Google Scholar]71.
Choi I., Kim J., Shin S., Park I. Nematicidal activity of monoterpenoids against the pine wood nematode (Bursaphelenchus xylophilus) Russ.
J. Nematol. 2007;15:35. [PMC free article] [PubMed] [Google Scholar]72. Ebadollahi A. Essential oils isolated from Myrtaceae family as natural insecticides. Annu. Res. Rev. Biol. 2013;3:148–175. [Google Scholar]73. Muñoz-Bertomeu J., Arrillaga I., Segura J. Essential oil variation within and among natural populations of Lavandula latifolia and its relation to their ecological areas. Biochem. Syst. Ecol. 2007;35:479–488. doi: 10.1016/j.bse.2007.03.006. [CrossRef] [Google Scholar]74. Herraiz-Peñalver D., Cases M.Á., Varela F., Navarrete P., Sánchez-Vioque R., Usano-Alemany J.
Chemical characterization of Lavandula latifolia Medik. essential oil from Spanish wild populations. Biochem. Syst. Ecol. 2013;46:59–68. doi: 10.1016/j.bse.2012.09.018. [CrossRef] [Google Scholar]75. De Pascual T.J., Ovejero J., Anaya J., Caballero E., Hemandez J.M., Cruz Caballero M. Chemical Composition of the Spanish Spike Oil.
Planta Med. 1989;55:398–399. doi: 10.1055/s-2006-962044. [PubMed] [CrossRef] [Google Scholar]76. Kara N., Baydar H. Essential oil contents and composition of lavenders and lavandins cultivated in Turkey. Res. Crops. 2012;13:675–681. [Google Scholar]77. Kırmızıbekmez H., Demirci B., Yeşilada E., Başer K.H.C., Demirci F.
Chemical composition and antimicrobial activity of the essential oils of Lavandula stoechas L. ssp. stoechas growing wild in Turkey.
Nat. Prod. Commun. 2009;4:1001–1006. [PubMed] [Google Scholar]78. Bouzouita N., Kachouri F., Hamdi M., Chaabouni M.M., Aissa R.B., Zgoulli S., Thonart P., Carlier A., Marlier M., Lognay G.C. Volatile constituents and antimicrobial activity of Lavandula stoechas L. oil from Tunisia. J. Essent. Oil Res. 2005;17:584–586.
doi: 10.1080/10412905.2005.9699003. [CrossRef] [Google Scholar]79. Karapandzova M., Cvetkovikj I., Stefkov G., Stoimenov V., Crvenov M., Kulevanova S. The influence of duration of the distillation of fresh and dried flowers on the essential oil composition of lavandin cultivated in Republic of Macedonia. Maced. Pharm. Bull. 2012;58:31–38.
doi: 10.33320/maced.pharm.bull.2012.58.004. [CrossRef] [Google Scholar]80. Ihsan S.A. Essential oil composition of Lavandula officinalis L. grown in Jordan. J. Kerbala Univ. 2007;5:18–21. [Google Scholar]81. Alatrache A., Jamoussi B., Tarhouni R., Abdrabba M. Analysis of the essential oil of Lavandula latifolia from Tunisia.
J. Essent. Oil Bear. Plants. 2007;10:446–452. doi: 10.1080/0972060X.2007.10643578. [CrossRef] [Google Scholar]82. De Pascual J.T., Caballero E., Caballero C., Machin G. Constituents of the essential oil of Lavandula latifolia. Phytochemistry. 1983;22:1033–1034. doi: 10.1016/0031-9422(83)85052-3. [CrossRef] [Google Scholar]83. El Miz M., Salhi S., El Bachiri A., Wathelet J.P., Tahani A. Adsorption of essential oil components of Lavandula angustifolia on sodium modified bentonite from Nador (North-East Morocco) Afr. J. Biotechnol. 2014;13:3413–3425. [Google Scholar]84. Mansour S.A., El-Sharkawy A.Z., Abdel-Hamid N.A. Toxicity of essential plant oils, in comparison with conventional insecticides, against the desert locust, Schistocerca gregaria (Forskål) Ind. Crops Prod. 2015;63:92–99. doi: 10.1016/j.indcrop.2014.10.038. [CrossRef] [Google Scholar]85. Lima J.K., Albuquerque E.L., Santos A.C.C., Oliveira A.P., Araújo A.P.A., Blank A.F., de Fátima Arrigoni-Blank M., Alves P.B., Santos D.D.A., Bacci L. Biotoxicity of some plant
essential oils against the termite Nasutitermes corniger (Isoptera: Termitidae) Ind. Crops Prod. 2013;47:246–251. doi: 10.1016/j.indcrop.2013.03.018. [CrossRef] [Google Scholar]86. De Martino L., De Feo V., Formisano C., Mignola E., Senatore F. Chemical composition and antimicrobial activity of the essential oils from three chemotypes of Origanum vulgare L.
ssp. hirtum (Link) Ietswaart growing wild in Campania (Southern Italy) Molecules. 2009;14:2735–2746. doi: 10.3390/molecules14082735. [PMC free article] [PubMed] [CrossRef] [Google Scholar]87. Sarikurkcu C., Zengin G., Oskay M., Uysal S., Ceylan R., Aktumsek A. Composition, antioxidant, antimicrobial and enzyme inhibition activities of two Origanum vulgare subspecies (subsp. vulgare and subsp. hirtum) essential oils. Ind. Crops Prod. 2015;70:178–184. doi: 10.1016/j.indcrop.2015.03.030. [CrossRef] [Google Scholar]88. Singh G., Singh O.P., Prasad Y.R., De Lampasona M.P., Catalan C. Studies on essential oils, Part 33: Chemical and insecticidal investigations on leaf oil of Coleus amboinicus Lour. Flav. Fragr. J.
2002;17:440–442. doi: 10.1002/ffj.1123. [CrossRef] [Google Scholar]89. Sharififard M., Alizadeh I., Jahanifard E., Wang C., Azemi M.E. Chemical Composition and Repellency of Origanum vulgare Essential Oil against Cimex lectularius under Laboratory Conditions. J. Arthropod. Borne Dis. 2018;12:387–397. doi: 10.18502/jad.v12i4.357. [PMC free article] [PubMed] [CrossRef] [Google Scholar]90. Karan T., Sİmsek S. Phytochemical composition and insecticidal effect of essential oil from Origanum vulgare L. Res. Opin. Anim. Veter. Sci. 2018;8:19–23. [Google Scholar]91. Nasr M., Sendi J.J., Moharramipour S., Zibaee A. Evaluation of Origanum vulgare L.
essential oil as a source of toxicant and an inhibitor of physiological parameters in diamondback moth, Plutella xylustella L. (Lepidoptera: Pyralidae) J.
Saudi Soc. Agric. Sci. 2017;16:184–190. doi: 10.1016/j.jssas.2015.06.002. [CrossRef] [Google Scholar]92. Amusant N., Thévenon M.F., Leménager N., Wozniak E. Potential of antifungal and antitermitic activity of several essential oils; Proceedings of the 40th Meeting of the IRG; Beijing, China.
24–28 May 2009; p. 2.
[Google Scholar]93. Traboulsi A.F., Taoubi K., El-Haj S., Bessiere J.M., Rammal S. Insecticidal properties of essential plant oils against the mosquito Culex pipiens molestus (Diptera: Culicideae) Pest Manag. Sci. 2002;58:491–495. doi: 10.1002/ps.486. [PubMed] [CrossRef] [Google Scholar]94. Cornelius M.L., Grace J.K., Yates III J.R. Toxicity of monoterpenoids and other natural products to the Formosan subterranean termite (Isoptera: Rhinotermitidae) J. Econ.
Entomol.
1997;90:320–325. doi: 10.1093/jee/90.2.320. [CrossRef] [Google Scholar]95. Lei J., Leser M., Enan E.
Nematicidal activity of two monoterpenoids and SER-2 tyramine receptor of Caenorhabditis elegans. Biochem. Pharmacol.
2010;79:1062–1071. doi: 10.1016/j.bcp.2009.11.002. [PubMed] [CrossRef] [Google Scholar]96. Ahn Y.J., Lee S.B., Lee H.S., Kim G.H. Insecticidal and acaricidal activity of carvacrol and β-thujaplicine derived from Thujopsis dolabrata var.
hondai sawdust. J. Chem. Ecol. 1998;24:81–90. doi: 10.1023/A:1022388829078. [CrossRef] [Google Scholar]97. Ebadollahi A. Iranian plants essential oils as sources of natural insecticide agents. Int. J. Biol. Chem. 2010;5:266–290. doi: 10.3923/ijbc.2011.266.290. [CrossRef] [Google Scholar]98. Sadiq S.I., Adeboye A.G., Yalli F.A., Dikwa M.A.
Phytochemical constituents and termicidal activity of essential oils from Szygium aromaticum (clove bud) Fudma J. Sci.
2019;3:220–225. [Google Scholar]99. Park I.K., Shin S.C. Fumigant activity of plant essential oils and components from garlic (Allium sativum) and clove bud (Eugenia caryophyllata) oils against the Japanese termite (Reticulitermes speratus Kolbe) J. Agric. Food Chem. 2005;53:4388–4392. doi: 10.1021/jf050393r. [PubMed] [CrossRef] [Google Scholar]