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THE USE OF ESSENTIAL OILS IN ORGANIC FARMING

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Abstract . *Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions, and to defend against attack from predators such as insects, fungi and herbivorous mammals. Aromatic plants are a special kind of plants used for their aroma and flavour. Many of them are also used for medicinal purposes. Aromatic compounds are present in plants in root, wood, bark, foliage, flower, fruit, seed. Essential oils have a long tradition of use in the protection of stored products, based on antimicrobial and antifungic activity. Some chemical constituents of volatile oils interfere with the octopaminergic nervous system in insects. As this target site is not shared with mammals, most essential oil chemicals are relatively non-toxic to mammals and fish in toxicological tests, and meet the criteria for "reduced risk" pesticides.*

Key words *:Essential oils, green pesticides, monoterpenes, terpenoids, antifeedants, repellents, fumigants*

INTRODUCTION

Essential oils are defined as any volatile oils that have strong aromatic components and that give distinctive odour, flavour or scent to a plant. These are the by-products of plant metabolism and are commonly referred to as volatile plant secondary metabolites. Essential oils are found in glandular hairs or secretory cavities of plant-cell wall and are present as droplets of fluid in the leaves, stems, bark, flowers, roots and/or fruits in different plants. The aromatic characteristics of essential oils provide various functions for the plants including : attracting or repelling insects, protecting themselves from heat or cold and utilizing chemical constituents in the oil as defence materials. Terpenes and terpenoids are the primary constituents of the essential oils of many types of plants and flowers. Terpenes are a large and diverse class of organic compounds, produced by a variety of plants, though also by some insects such as termites or swallowtail butterflies, which emit terpenes from their osmeteria[1]. They are often strong-smelling. They may protect the plants that produce them by deterring herbivores and by attracting predators and parasites of herbivores.[2] Many terpenes are aromatic hydrocarbons and thus may have had a protective function.[3] The difference between terpenes and terpenoids is that terpenes are hydrocarbons, whereas terpenoids contain additional functional groups. The recent researches are focused on finding and applying new highly selective and biodegradable pesticides to solve the problem of long term toxicity to mammals and environmental friendly. Natural products are an excellent alternative to synthetic pesticides as a means to reduce negative impacts to human health and the environment. The move toward green chemistry processes and the continuing need for developing new crop protection tools with novel modes of action makes discovery and commercialization of natural products as green pesticides an attractive and profitable must be in attention[4].

MATERIALS AND METHODS

Essential oils are obtained by steam distillation of aromatic plants, specifically those used as fragrances and flavourings in the perfume and food industries, respectively, and nowadays for aromatherapy and as herbal medicines.

The amount of essential oil found in most plants is 1 to 2%, but can contain amounts ranging from 0.01 to 10%. Characterization of essential oils by GC-MS analysis releave a great number of compounds 30-70, but few are prelevant. In *Ocimum basilicum* (basil), methyl chavicol makes up 75% of the oil, β-asarone amounts to 70–80% in *Acorus calamus* rhizomes, linalool , in the range of 50– 60%, occurs in coriander seed and leaf oils procured from different locations at different time intervals and is by far the most predominant constituent followed by *p*-cymene, terpinene, camphor and limonene.

RESULTS AND DISCUSSION

The oils are generally composed of complex mixtures of monoterpenes, biogenetically related phenols, and sesquiterpenes.

Examples include 1,8-cineole, the major constituent of oils from rosemary and eucalyptus; eugenol from clove oil; thymol from garden thyme; menthol from various species of mint; asarones from calamus; and carvacrol and linalool from many plant species. The rapid action against some pests is indicative of a neurotoxic mode of action, and there is evidence for interference with theneuromodulator octopamine (KOSTYUKOVSKY 2002) by some oils and with GABA-gated chloride channels by others (PRIESTLEY., 2003). The purified terpenoid constituents of essential oils are moderately toxic to mammals (Table 1), but, with few exceptions, the oils themselves or products basedon oils are mostly nontoxic to mammals, birds, and fish therefore, justifying their placement under "green pesticides".Table 2 present essential oils of different species and their action in management of pests control.

Table 1.

Mammalian toxicity of some essential oil compounds

Compound	**Animal tested**	**Route**	**LD50 (mg/kg)**
2-Acetonaphthone	Mice	Oral	599
Apiol	Dogs	Intravenous	500
Anisaldehyde	Rats	Oral	1510
trans-Anethole	Rats	Oral	2090
(+) Carvone	Rats	Oral	1640
1,8-Cineole	Rats	Oral	2480
Cinnamaldehyde	Guinea pigs	Oral	1160
	Rats	Oral	2220
Citral	Rats	Oral	4960
Dillapiol	Rats	Oral	1000–1500
Eugenol	Rats	Oral	2680
3-Isothujone	Mice	Subcutaneous	442.2
d-Limonene	Rats	Oral	4600
Linalool	Rats	Oral	> 1000
Maltol	Rats	Oral	2330
Menthol	Rats	Oral	3180
2-Methoxyphenol	Rats	Oral	725

Methyl chavicol	Rats	Oral	1820
Methyl eugenol	Rats	Oral	1179
Myrcene	Rats	Oral	5000
Pulegone	Mice	Intraperitoneal	150
γ-terpinene	Rats	Oral	1680
Terpinen-4-ol	Rats	Oral	4300
Thujone	Mice	Subcutaneous	87.5
Thymol	Mice Rats	Oral Oral	1800 980

Table 2.

Essential oils and their action

Essential oils of/ active compoud	**Action**
Peppermint (*Mentha piperita*)	repels ants, flies, lice and moths
Pennyroyal (*Mentha pulegium*)	Wards of fleas, ants, lice, mosquitoes, ticks and moths
Spearmint (*Mentha spicata*)	warding off flies
Basil (*Ocimum basilicum*)	warding off flies
Citronella *Cymbopogon nardus/* citronellal	an insect and an animal repellent, larvicidal
Catnip (*Nepeta cateria*)/ nepetalactone	repelling mosquitoes, bees and other flying insects
Ocimum sanctum. Satoreja hortensis, Thymusserpyllum and *Origanum creticum*	larvicidal *S. litura* larvae
Lippia alba	induces growth inhibition induces growth inhibition
Anethum sowa/carvone, dillapiole	insecticide synergistic properties
Tumernic *Curcuma longa/* α-phellandrene	Growth inhibition and larval mortality against *Spilosoma obliqua*
Curcumene and ginger	inhibition of the mycelial growth of *Rhizoctonia solani*
Thymol, citronellal and α-terpineol	feeding deterrent against tobacco cutworm, *S. litura*
Carvacrol, carveol, geraniol, linalool, menthol, terpineol, thymol, verbenol, carvones, fenchone, menthone, pulegone, thujone, verbenone, cinnamaldehyde, citral, citronellal, and cinnamic acid	Oviposition Inhibitors and Ovicides
Lemon *Citrus limonum*/ Geraniol and eugenol	attract thrips, fungus gnats, mealybugs
Thymol and carvacrol	Antifungal
Ageratum conyzoides, Callistemon lanceolatus, Carum copticum, Ocimum sanctum and *Peperomia pellucida*	Antiviral agents against cowpea mosaic virus(CPMV), mung bean mosaic virus (MBMV), bean commonil mosaic virus (BCMV) and southern bean mosaic virus (SBMV)

CONCLUSIONS

Essential oil constituents are primarily lipophilic compounds that act as toxins, feeding deterrents and oviposition deterrents to a wide variety of insect pests.

Pesticides based on plant essential oils or their constituents have demonstrated efficacy against a range of stored product pests, domestic pests, blood feeding pests and certain soft-bodied agricultural pests, as well as against some plant pathogenic fungi responsible for pre- and post-harvest diseases.

Collective assessment of essential oil efficacy as green pesticides suggests that some oils are significantly more active than others.

Essential oils require greater application rates (as high as 1% active ingredient) and may require frequent reapplication when used out-of-doors or insert of mix aromatic plant in culture.

Due to their volatile nature, there is a much lower level of risk to the environment than with current synthetic pesticides.

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