CONTROL OF GREENHOUSE WHITEFLY (*Trialeurodes vaporariorum*) BY THYME AND PEPPERMINT

H. Aroiee[1*], S. Mosapoor and H. Karimzadeh

[1]Horticultural Department, Agriculture Faculty, Ferdwosi University, Mashhad, IRAN

ABSTRACT

The insecticidal activities of the essential oils of two medicinal plants (thyme and peppermint) were investigated for the control of greenhouse whitefly (*Trialeurodes vaporariorum*). The activities of the essential oils were evaluated by fatalities percentage of whitefly after three days of application. The results showed that the most effective essential oils was thyme (*Thymus vulgaris*).

KEYWORDS: Medicinal Plants, White fly, Essential Oils

1. INTRODUCTION

The warm temperatures of the summer bring on a rush of new foliage growth, attracting a wide variety of pests. Whitefly, one of the most difficult pests to control pose a special challenge to gardeners [1]. Whitefly numbers grow dramatically in the heat, most strains are resistant to pesticides, and the pests infect a huge range of hosts including bedding plants, strawberries, tomatoes, and poinsettias. Whitefly is one of the most serious pests of vegetable and ornamental crops. Whiteflies feed on plant juices and, in large numbers, can consume a considerable amount of nutrients, causing plant to pale in color. Like aphids, they also excrete honeydew, attracting black sooty mold fungus. Recently, these pests have been found to spread viruses [1]. Whiteflies began showing resistance to synthetic insecticides early on, and by the 1980s they were a very serious greenhouse pest. Several species of whiteflies attack greenhouse plants, and they typically have a wide host range and resist insecticides. The most common whiteflies on greenhouse crops are the greenhouse whitefly (*Trialeurodes vaporariorum*), sweetpotato whitefly *(Bemisia tabaci*) and the silverleaf whitefly (*Bemisia argentifolii*). The various whitefly species and biotypes look very much alike, but they have subtle physiological differences. These differences can cause them to respond differently to control strategies. Because control measures must be selected according to the type of whitefly present, accurate identification is critical to successful control [2]. Synthetic pesticides are more of a threat to man than the insects it would seem. As each generation of insects become more immune the pesticide, stronger and more potent insecticides are released. In the meantime we humans are absorbing these chemicals as they permeate our homes, gardens and lawns and in turn we are depleting the quality of our health and the health of our pets [3].

Today, people want an organic or natural solution to gardening problems, and few are as natural or effective repellant planting [4]. Using organic methods to control insects damages in garden, greenhouse and field will protect and improve the quality of the crops. Trapping with yellow sticky cards, is essential for a successful whitefly management program [5]. Greenhouse plastics themselves may have significant influence on the initial attraction of insects into greenhouses. A study from the late 1990s showed that silver leaf whiteflies

[*]Corresponding author. E-mail address: aroiee@ferdowsi.um.ac.ir

preferred to enter greenhouses covered with film that transmitted higher levels of ultraviolet light [6]. Biological control is a defined as the reduction of pest populations by natural enemies and typically involves an active human role [7]. The parasitic wasp *encarsia formosa* preys on immature whiteflies and is commonly used for greenhouse whitefly. Sweetpotato and silverleaf whiteflies are control by two other wasp parasites, *Encarsia luteola* and *Eretmocerus californicus* [8-10]. Some microorganisms also control whiteflies. For instance, the fungus *Beauveria bassiana* (trade names Naturalis-O™ and BotaniGard™), is effective against eggs, immature and adult whiteflies. Several least-toxic, or biorational, pesticides have been evaluated for their effectiveness against the different whitefly species. These include neem-based formulations (Neemazad™ and Azatin™ are two registered products), insecticidal soap (M-Pede™), and horticultural oil [11]. Insect growth regulators (IGRs) are another least-toxic pesticide control option. Pyriproxyfen (Knack®) and buprofezin (Applaud®) became available to Arizona cotton growers for control of whitefly, *Bemisia argentifolii* [12]. They have a complex mode of action that precludes insects from rapidly developing resistance [13]. Changing the composition of the atmosphere in the greenhouse by either reducing oxygen or increasing carbon dioxide appears to provide some control of greenhouse whiteflies, especially adults [14]. Throughout history, plant products have been successfully exploited as insecticides, insect repellents, and insect antifeedants. The insecticidal properties of the several *Chrysanthemum* species were known for centuries in Asia. Probably the most successful use of a plant product as an insecticide is that of the pyrethroids; camphene; Nicotine and nornicotine, components of several members of the genus *Nicotiana*; Ryanodine, an alkaloid from the tropical shrub, *Ryania speciosa*; and Physostigmine, an alkaloid from *Physostigma venenosum*. Control of insects can be achieved by means other than causing rapid death. Plants produce many compounds that are insect repellents or act to alter insect feeding behavior, growth and development ecdysis (molting), and behavior during mating and oviposition. Most insect repellents are volatile terpenoids such as terpenen-4-ol [15-20]. The aim of the present study was to evaluate the insecticide activity of essential oils of some medicinal plants against greenhouse whitefly.

2. MATERIALS AND METHODS

The experiment was conducted in greenhouse condition at 2003 crop season. Inodorus melon (*Cucumis melo var. inodoros*) seeds sowed at the conditions that temperature fixed on 24 °C (until germination). When 80% seeds emergenced the temperature regulated on 27 and 20 °C for day and night, respectively. Relative humidity maintenance at 70 %. The plants investigated in this study are listed in Table 1. The commercial and scientific names of the plants are given in Table 1. The essential oils of the plants extracted by Clevenger instrument, via water distillation. The plant material is placed in water, heated to a boil and the steam carrying the essential oil is condensed and collected in a receiver flask and then essential oils separated from water by separator container. The treatments were 0 (water plus detergent as control), 5, and 8 ppm of material that made by essential oils of the medicinal plants that listed at Table 1. The experimental design was RCBD with four replicates. The plants placed in single rows within spacing of 1.20 cm between rows. The solutions given daily via mist system.

3. RESULTS AND DISCUSSION

The essential oils, having insecticide effect, against tested pests (whitefly) (Figures 1 and 2). The water (control) was ineffective. The results shown that the some concentration of essential oils were effective on controlling of whitefly (*Trialeurodes vaporariorum*). Essential oils of thyme and peppermint at 8 ppm concentration, had highest effect on whitefly fatality (100 and 62.78 % respectively).

The investigations of Vandermark [4], Williams and Pat [11], Duke [15-16], Duke and Lydon [17], Duke *et al.* [18-20], Yang and Tang [21], Rice [22], Mandava [23], Gill [24], and Klocke [25] showed that the some of the plants contain different active substances (essential oils or plants extracts) that were most effective on controlling of the pests.

Table 1 Essential oils of plants used the experiments

Common Name	Botanical name	Family	Part used for essential oil extraction
Thyme	*Thymus vulgaris L.*	Lamiaceae	Leaves + Stem
Peppermint	*Mentha piperita*	Lamiaceae	Leaves

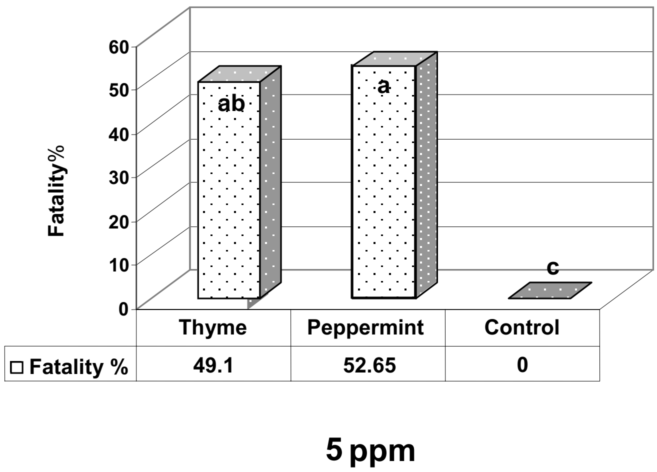

Figure 1 Effects of essential oils at 5 ppm on greenhouse whitefly

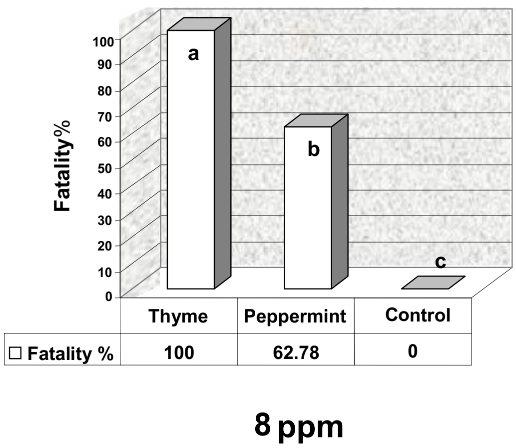

Figure 2 Effects of essential oils at 8 ppm on greenhouse whitefly

REFERENCES

[1] Hamir, A. **2002** Garden Pests and Problems. http//www.tvorganics.com

[2] Gree, L. **2000** Greenhouse IPM: Sustainable Whitefly Control Pests Management Technical Note. NCAT Agriculture Specialist.

[3] Quarles, W. **2005** *Least-Toxic Controls of Plant Diseases*. BBG.

[4] Vandermark, T. **2001** *Gardening Pests Control with Plants*. Page Wise Inc.

[5] McHuge, J. **1991** Monitoring-the First Line of Defence. *Greenhouse Grower*. February. p. 66.

[6] Costa, H.S. and Robb, K.L. **1999** Effects of Ultraviolet-absorbing Greenhouse Plastic Films on Flight Behavior of *Bemisia argentifolii* (Homoptera: Aleyrodidae) and *Frankliniella occidentalis* (Thysanoptera: Thripidae). *Journal of Economic Entomology*, June, pp. 557-562.

[7] Moschetti, R. **2003** Biological Control in Alaska Greenhouses.

[8] Anon **1995(a)** Controlled Atmosphere to Manage Whitefly. The Cut Flower Quarterly, July, pp. 14-16.

[9] Anon **1995(b)** Biological Pest Control. Greenhouse Product News, July, p.17.

[10] Cloyd, R.A. **1999** Know Your Friends: *Delphastus pusillus:* Whitefly Predator. Midwest Biological Control News, October, p. 3.

[11] Williams, G. and Pat. **1995** Oil, Soap, Surfactant, and Garlic vs. Whiteflies on Tomatoes. HortIdeas, May, pp. 55-56.

[12] Agnew, G. K. Frisvold, G.B. and Baker, P. **2000** Use of Inaect Growth Regularors Changing Whitefly Control Costs in Arizona Cotton. National Agricultural Pesticide Impact Assessment Program.

[13] Daughtrey, M. and Casey, C. **1998** In: Grossman, Joel. Ed. **1996** Highlights from SAF's Pest Conference. Grower Talks, April, pp. 44, 46.

[14] Tripp, K. and Peet, M. **1993** New Use for CO_2: Slowing Whiteflies. *American Vegetable Growe*, November, pp. 43-44.

[15] Duke, S.O. **1985** Biosynthesis of Phenolic Compounds-Chemical Manipulation in Higher Plants. *American Chemistry Society Symposium*, *Ser. 268,* pp. 113-131.

[16] Duke, S.O. **1986** Naturally Occurring Chemical Compounds as Herbicides. *Review Weed Science, 2*, 15-44.

[17] Duke, S.O, and Lydon, J. **1987** Herbicides from Natural Compounds. *Weed Technology*, *1*,122-128.

[18] Duke, S.O., Paul, R.N. and Lee, S.M. **1988** Terpenoids from the Genus *Artemisia* as Potential Pesticides. *American Chemistry Society Symposium*, *Ser. 380*, pp. 318-334.

[19] Duke, S.O., Vaughn, KC., Croom, E.M. Jr., and Elsohly, H.N. **1987** Artemisinin, a Constituent of Annual Wormwood (*Artemisia annua*), is a Selective Phytotoxin. *Weed Science*, *35,*499-505.

[20] Duke, S. O. **1990** *Natural Pesticides from Plants*. In: Janick J. and Simon J.E. , Eds. Advances in New Crops. Timber Press, Portland, OR. pp. 511-517.

[21] Yang, R.Z. and Tang, C.S. **1988** Plants Used for Pest Control in China: A Literature Review. *Econ. Bot., 42,* 376-406.

[22] Rice, E.L **1983** *Pest Control with Nature's Chemicals*. University of Oklahoma Press, Norman OK.

[23] Mandava, N.B. **1985** *Handbook of Natural Pesticides: Methods*. Vol. I *Theory Practice, and Detection*. CRC Press, Boca Raton, FL.

[24] Gill, S. **2000** *Pest Control: Whitefly Control for Cut Flower Growers*. The Cut Flower. Quarterly. Vol.12, No. 1. pp. 26-30.

[25] Klocke, J.A. **1987** Natural Plant Compounds Useful in Insect Control. *American Chemistry Soc.*, *Ser. 330*, pp. 396-415.