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Effect of Cupressus arizonica Essential Oil on Two Spotted Spider Mite (Tetranychus urticae) on Ficus Benjamin (Ficus benjamina)

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Abstract

Two spotted spider mite (Tetranychus urticae) is one of the most widespread and serious pests of farm and greenhouse plants. Nowadays, the use of plant essentials is considered due to the harmful effects of chemical pesticides. This study was conducted to assess the toxic potential of Arizona cypress (Cupressus arizonica) essential oil as an effective acaricide on Tetranychus urticae on Ficus Benjamin plants (Ficus benjamina). This study was conducted using randomized complete design with 8 treatments (7 treatments and 1 control). The amount of dead mites and burned Benjamin leaves were estimated after 24 hours. LD50 value was measured. The results showed that increasing essential oil concentrations increased the toxic effect of the essential. At the concentration of 2.5 ml* L -1, the essential caused the highest level of mortality of mites. LD50 value was estimated 1.25 ml* L -1. There was no burn on Ficus Benjamin leaves up to concentration of 5 ml* L -1 of essential.

Keywords: Ficus Benjamin, mite, plant essential oil, Arizona cypress

Introduction

Ficus Benjamin (Ficus benjamina) from the Maraceae family, is a widely used ornamental leaf plant that is suitable for indoor and greenhouse applications.The main habitat of this plant is the Himalayas, India and southern China. Benjamin is a massive shrub with hanging branches and oval leaves, two common kinds of Ficus Benjamin, dark green or greenish white, are produced in Iran. This plant tolerates cool temperatures to zero degrees Celsius.

The use of herbal ingredients in pest control of house plants has positive impacts on environment and people health.

The two spotted spider mite (Tetranychus urticae), is one of the most damaging pests in agricultural, horticultural and greenhouse systems. It causes the reduce of chlorophyll content and photosynthesis in the leaf and eventually lead to leaf loss and plant weakness (Gorman et al., 2001).

Large quantities of chemical pesticides are used every year to control the pest, which due to its short shelf life and high reproduction, it is resistant to pesticides, and practically repeated use of chemical pesticides only causes environmental pollution. And the negative effects on non-target beings. (Isman, 1999).Therefore, the use of herbal compounds such as essential oils and extracts has been considered as an alternative method of mite management especially in greenhouse conditions. .(Cavalcanti et al., 2010)

The essential oils of plants are well-known natural ingredients in pests control, as well as the repellent effects of plant essential oils such as peppermint on two-point spider mites (Moayeri et al., 2013).The essential oils are easy to extract and decompose quickly after use and adapt to the environment. In addition, most essential oils

are not toxic to mammals, fish and birds and do not persist in soil and water (Ziaie et al., 2015).
Arizona cypress (Cupressus arizonica) is an evergreen and resistant plant that tolerates a wide range of ecological conditions (Emami et al., 2004) and is abundantly planted on the surface of the landscape.It was found that the essential oil of Arizona cypress has 46 compounds. Limonene (14.44%), ambulolone (13.25%) and alpha-pinene (11%) are the major constituents of this essential oil (Sedaghat et al., 2011) .
Since the cypress trees are pruned every year in urban landscape and their waste is discarded, using this inexpensive and affordable source of the production of pesticides is economical and rational, so this experiment was conducted to evaluate the effect of Arizona cypress essence on two spotted spider mite on Ficus Benjamin plant.

Materials and Methods

Branches and leaves of Arizona cypress were collected from the landscape of Park-e-Shahr of Tehran and transferred to the laboratory of Landscape Research, Education and Counseling Center of District 12 of Tehran Municipality, during autumn 2018 and dried at room temperature.
The essential oil of the plant was prepared by Clevenger apparatus and water and steam distillation from 100 g of cypress leaves in one liter of distilled water for 2 h. The essential oil was stored in dark glass at 4 ° C until testing. To prepare different concentrations of essential oil, stock solution was prepared from 2 cc of essential oil and twin 20 as a 2% emulsion, distilled water to 100 ml volume was added and other concentrations were prepared using different amounts of distilled water.
For the purpose of bioassay of mites, mite infected leaves of Ficus Benjamin were prepared from greenhouse of Landscape Research, Education and Counseling Center of District 12 of Tehran Municipality and transferred to laboratory. The number of mature mites and eggs were counted on infected leaves. Leaf immersion method was used to determine the lethal concentrations of different the essential oil concentrations. The infected leaves were immersed in essential oil solution for 5 seconds at concentrations of 0.15, 0.3, 0.6, 1.25, 2.5, 5 and 10 ml* L -1. The control treatment was considered distilled water. Treated leaves were exposed to air at room temperature to dry and transferred to 9-cm petri dishes with a layer of wet filter paper. The Petri cap was ventilated with a 3 cm diameter pore covered with mesh. Petri dishes were kept at 24±2 ° C with 14 h light. The status of mites was assessed 24 hours later with binoculars and the number of killed mites was counted.
In order to evaluate the degree of burnout of leaves, they were immersed in various concentrations of the essential oil for 5 seconds and then exposed to air at room temperature for 20 to 30 minutes to dry and placed in Petri dish containing a layer of filter paper with a pore diameter of 3 cm. After 24 hours, leaf evaluation was performed and scoring was 0-10, score 0 means no burns and score 10 indicates complete necrosis of leaf tissue.
The experiment was conducted in a completely randomized design with three replications. Data were analyzed using Minitab 16 software and Sigmaplot 11 software.

Results

The results indicate the effect of Arizona cypress essential oil on population decline of two spotted spider mite on Ficus Benjamin leaf.
The mortality rate of mites at different concentrations of essential oil was significantly different ($p \leq 0.01$).
The percentage of mortality at a concentration of 0.3 ml* L -1 was only 1.75% and increased to 0.6 ml* L -1 at 27.5% and resulted in complete death and 100% pest at concentrations of 2.5 ml* L -1 and above (Figure 1).

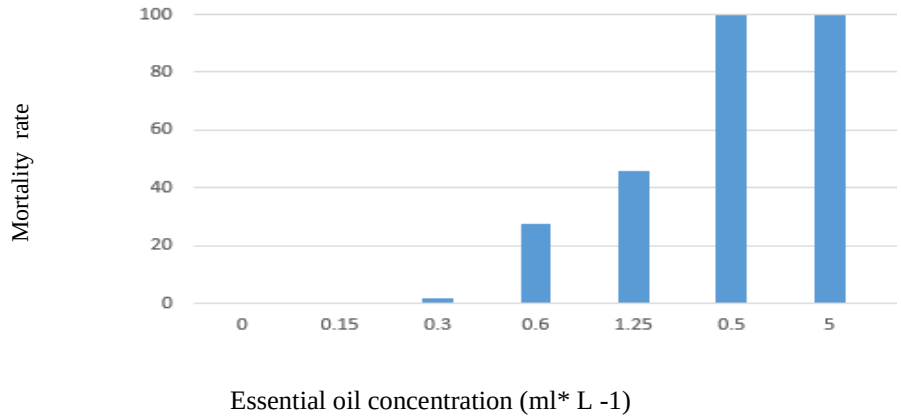

Figure (1). **Effect of Arizona cypress essential oil on mortality rate of two spotted spider mite in Ficus Benjamin plant**

The insecticidal properties of silver cedar essential oil have been proven in several cases (Asgarpoor et al., 2018) The fumigant effect of essential oils of Cumin, Anise, Oregano and Eucalyptus on Aphis gossipii was confirmed (Tunc et al., 1998). Also, the effect of essential oil of three rosemary, peppermint and savory herbs on two spotted spider mite was investigated and confirmed (Moayeri et al., 2013).

Trend changes in mortality rate of different essential oil concentrations by a 3-parameter sigmoidal model [Mortality (%)=100/(1=exp(-(x-1.25)/0.39))] . LD10, LD50 and LD90 values were 0.4, 1.25 and 2.07 ml* L -1, respectively.

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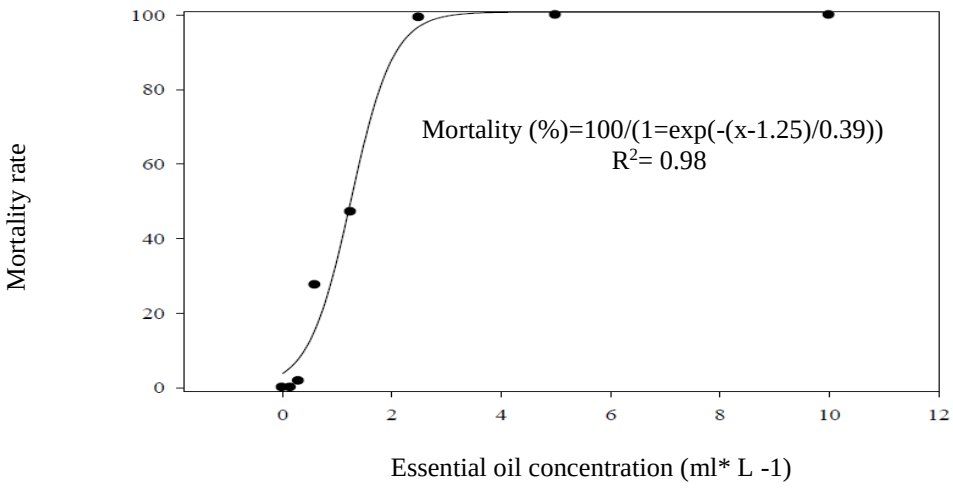

Figure(2). Changes in mortality rate of two spotted spider mite in Benjamin plant at different concentrations of Arizona cypress essential oil

in previous studies, LD50 content of ethanolic extract of bitter olive seed on peach green aphid was calculated to be 15 µl * ml-1, after 24 h(Salari et al., 2011). Evaluation of toxicity of essential oil of some plants of mint family on two spotted spider mite revealed that thyme and peppermint essential oil with the LD50of 419 and 425 mg $*l^{-1}$ had the highest toxicity on two spotted spider mite , respectively(Kaveh et al., 2014).

The results of this study showed that silver cedar extract at concentrations less than 5 ml* L -1 did not cause any burns on Benjamin leaves. At concentrations of 5 and 10 ml* L -1, 11 and 23% of burns were observed, respectively.

In the study of toxicity, the essential oils of 10 specious of mint family on two spotted spider mite at concentrations below 1600 ppm, the essential oils did not cause any burns on the leaves of bean plant (Kaveh et al., 2014).

Due to complete death of ticks at concentrations of 2.5 to 10 ml* L -1 and no signs of burns on Benjamin leaves at 2.5 ml* L -1 and slight burn at 5 ml* L -1, the concentration range 2.5 to 5 ml* L -1 is recommended for the preparation of the pesticide. Essential oils of barley, artemisia and geranium had low germination effects at 12 ppm concentration in greenhouse cucumber (Yarahmadi et al., 2012).

The findings of the present study indicate that Arizona cypress essential oil is can be used as a low risk pesticide to control mites on the Ficus Benjamin plant. Due to the less destructive effects of plant compounds on humans and the environment, the essential oil of this plant is recommended for the manufacture of natural acaricides.

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