ACARICIDAL ACTIVITY OF CERTAIN PLANT DERIVED ESSENTIAL OILS ON *Tetranychus urticae* (Acari : Tetranychidae)

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Abstract: There are large numbers of studies already carried out on various plants to find out a potential Biopesticide. But except Neem all other Biopesticides did not have major effect in pest control. However a study to find out a potential pesticide is yet valid in the present scenario especially in a place like Kerala, where chemical pesticides make havoc. So here attempt was made in the laboratory to find out some essential oils with acaricidal property especially mortality in the laboratory. The outcome of the study will give a light for the further development of a potential pesticide against *Tetranychus urticae.*

Index terms - Essential oils, mite, Kerala, acaricidal.

1. Introduction

Mites are small arthropods belonging to the subclass Acari and the class Arachnida. Mites are among the most diverse and successful of all the invertebrate groups. They have exploited an incredible array of habitats, and because of their smaller size go largely unnoticed. Many live freely in the soil or water, but there are also a large number of species that live as parasites on plants, animals and some that feed on mold. It is estimated that four8,200 species of mites have been described. From these mites spider mites are common pest problems on many plants injury caused as they feed, bruising the cells with their small, whip like mouth parts and ingesting the sap. Damaged areas typically appear marked with many small, light flecks, giving the plant a somewhat speckled appearance. Under severe infestations leaves become discoloured, producing an unthrifty gray or bronze look to the plant. Leaves and needles may ultimately become scorched and drop prematurely. Spider mites frequently kill plant or cause serious stress to them. The two spotted mite (Tetranychus urticae) causes much anxiety for farmers it feeds on an astonishingly large number of plants because it withstands the toxins that plant produce. This in itself is an amazing feat. However amongarthropods, the spider mite hold first place in the number of pesticides it is resistant too. Many synthetic pesticides used for controlling insect pests have developed pesticide resistance. Control using essential oil helps the environment in keeping the biotic balance since it does not interrupt the other organisms. So the essential oils can be used as an effective strategy in insect pest management. The present study was conducted after analyzing the efficacy of plant essential oils to be a potent regular of pest attack. Moreover recent investigations indicated that some chemical constituents of these oils interfere the octopaminergic nervous system in insects, a target site not shared with mammals making them relatively non toxic to mammals and fish (Koul, o., 2008). So they meet the criteria for “reduced risk” pesticides. Insecticide resistance and concomitant field failure to control *T. urticae* had made it a serious threat to cultivators. In this context, essential oils can be an excellent method to control it. In the present study an attempt was made to suggest biological control of this pest using certain easily available essential oils. Based on

the laboratory results, a field experiment using Black seed oil is highly recommended. Since many studies are available on the combined effect of essential oils as synergists on insect pests (Oparaeke et.al., 2005, Meshah et.al., 2006), a laboratory study followed by a field experiment using combinations of essential oils is also recommended on the light of this laboratory experiments against *T. urticae*.

2. Materials and methods:

investigations on the contemplated objectives were carried out during the period from December 2011 to 2012 at the department of zoology, Malabar Christian college, Kozhikode, kerala, india. Eight plant derived essential oils was evaluated against the adults of the two spotted spider mite, *Tetranychus urticae* (Koch) under laboratory conditions. . The tested essential oils were: Rosemary oil, Tea tree oil, Thyme oil, Oregano oil, Basil oil, Cinnamon oil, Lemon grass oil, and Neem oil. Plant essential oils were supplied by Falcon essentials, Bangalore, were used for the experiment. The screening was performed using leaf discs placed on a moist cotton pad on a petridish, surrounded by Vaseline to prevent the escape of mites.

1. Maintenance of egg and adult

Field collected adults were placed in a petriplate with mulberry leaf and kept in a laboratory to obtain population. After 2 days adults female laid straw coloured eggs on the under suface of mulberry leaf discs. Eggs laid in groups (50 to 100 eggs in each leaf discs). The eggs were attached to fine silk webbing. After an incubation period of 3-four days protonymph emerged from the eggs. The protonymph were pale yellow colored but thereafter it became light red color. It fed by penetrating the plant tissue with their mouth parts resulted in yellow spots on leaf. Mite completed their development in 5 days. Adult mites spun fine silky webs on leaves. The culture was maintained in the ambient conditions of the laboratory temperature. Damaged leaves were replaced with healthy leaves. Moisture in the cotton wool maintained regularly by adding water.

2. Preparation of leaf discs

Collected fresh uninfected mulberry leaves from the self cultivated plants. Cleaned the leaves with distilled water and cut leaf disc of 1fourmm diameter using scissor & placed upside down over moist strip of cotton wool (7×3 cm) in petriplates(3.5” dia). Based on the number of replicates, leaf discs were placed in each Petri plates and marked T1,T2,T3…. Accordingly . scanned these plate under binocular steriozoom microscope to check for any living material. Moisture in the cotton wool was regularly maintained by adding water. Care should be taken to avoid excess water in the petriplate that may flood leaf discs. To these plates released 10 spider mites per each leaf disc using single hair brush.

3. **Preparation of ethanol based natural oil formulation:** Plant essential oils were supplied by Falcon essentials, Bangalore, were used for the experiment. Plant essential oils were diluted in ethanol and water (1 ml oil+1 ml ethanol+98 ml water).
4. **Screening of essential oils:** Test solutions were applied according to spraying method. spraying the plates with leaf discs was done using glass atomizer from a distance of 30 cm. care was taken to spray equal volume of test solution to all the plates. The mortality was measured every 24 hours up to 5 days after treatment.
5. **Statistical analysis**

The corrected mortality was calculated using the following method.

$$Pt \quad \frac{Po - Pc}{100 - Pc} \; 100$$

Where Pt - corrected percent mortality

Po - Observed mortality in treatment

Pc - Observed mortality in check

Probit analysis was worked out based on the method developed by inney (19six four) to determine lethal concentration.

3. Result and discussions: essential oil constitutes are primarily lipophilic that act as toxins to a wide variety of insect pests (Koul, et al., 2008). Once in the brain the essential oil interfere it either by blocking certain molecules or even stimulating them. The complex combination of behavioral and physiological actions contained in these plant compounds makes it difficult for insect to evolve resistance to them(rice, M., 1993).

The essential oils, when given along with food (mulberry leaf disc) resulted in mortality. The essential oils showed considerable differences in their toxicity to TSSM. In the initial screening with 1% plant extract, Cinnamon was found to be more toxic to mites compared to other 7 oils. After 5 days, Cinnamon proved to be superior in its effect by recording 79.59% mortality followed by rosemary oil (six5.31%). Basil oil has got six1.22% mortality where as other oils such as Tea tree oil, Neem oil, & Oregano oil recorded mortality at a rate of above 50% only. Least mortality recorded for Lemon graas oil when compared to all other. From these results it is proved that Cinnamon oil have significant effect on T.urticae. Hence this oil was taken for final stage screening.

When the mites were exposed to different concentrations (0.50, 0.75, 1, 1.25 & 1.50) of Cinnamon essential oil, after 120 hours as expected there was observed significant mortality. Mortality rate increased according to the concentration of essential oil. At high concentration highest mortality rate was observed. This analysis confirmed the action of Cinnamon oil against the adults of T. urticae. LC_{50} value calculated for this oil on T.urticae was 0.80four ml/L (Table 2.)

Table 2. effect of essential oil on T.urticae at different intervals

Essential oil	Corrected mortality in percentage				
	24 hrs	48 hrs.	72 hrs.	96 hrs.	120 hrs.
Rosemary oil	20.41	28.57	34. 69	57.14	65.31
Tea tree oil	22.45	28.57	38.78	51.02	55.10
Thyme oil	12.24	20.41	22.45	34. 69	40.82
Oregano oil	22.45	26.43	34. 69	51.02	57.14
Basil oil	18.37	30. 61	34. 69	34. 69	61.22
Cinnamon oil	48.98	55.10	59.18	69.39	79.59
Lemongrass oil	10.20	16.33	22.45	28.57	38.78
Neem oil	18.37	22.45	26.53	48.98	59.18

Table 2. Probit analysis of the toxicity of cinnamon oil to *T. urticae*

Essential oil	LC_{50}	Intercept ± SE	Slope ± SE	X2 value (df=3)
Cinnamon oil	0.804	0.186 ± 0.185	1.961 ± 1.09	0.902

Among different plant product evaluated in general, there was increase in adult mortality with increase in concentration and also period of exposure. Cinnamon oil was found to be the most potent toxicant to T. urticae with LD_{50} value of 0.804 ml/L.

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