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RESEARCH NOTE

Plant extracts for the management of two spider mite, *Tetranychus urticae* Koch on jasmine (*Jasminum sambac*)

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ABSTRACT: The efficacy of plant extracts against two spotted mite, *Tetranychus urticae* Koch was evaluated under laboratory conditions. Among different extracts tested, Wild sage, *Lantana camara* leaf extracts showed better performance recording 87.23% mortality of the two spotted mites and 85.22% reduction over untreated control.Neem seed kernel extract shows next order of efficacy presenting 82.35% and sweet flag rhizome extract with 80.58 per cent mortality with 79.57 and 77.12% reduction over control. Cashew Nut Shell Liquid (CSNL) extract showed very least efficacy against mites recording only 57.23 per cent mortality.

Keywords: Jasmine, two spotted mites, extract, plant oil, bio-efficacy, mortality, neem oil

Tetranychus urticae Koch, commonly known as red spider mite, is a polyphagous sucking pest. The mites lay their eggs and infests the adaxial side of leaves and cause profuse webbing. Feeding injury causes tiny grey or silvery spots on leaves and plant parts, known as stippling damage, where the green epidermal cells have been destroyed. Although the individual lesions are very small, attack by hundreds or thousands of spider mites can cause thousands of lesions and thus can significantly reduce the photosynthetic capability of plants (Zhang, 2003, Martinez-Ferrer *et al.,* 2006). The rapid developmental rate, short generation time, and high net reproductive rate of *T. urticae* helps them to achieve damaging population levels very quickly when growth conditions are suitable, resulting in a similar decline of host plant quality in a rapid manner. *T. urticae* is extremely polyphagous; it can feed on hundreds of plants. These include most vegetables and food crops and ornamental plants such as roses and Jasmine (Jeppson *et al.*, 1975).

Jasmine (*Jasminum sambac* L.) is one of the oldest fragrant flowers of India, grown for their decorative flowers. They are grown commercially all over the world for the milky white flowers, which are commonly used for making garlands, as a hair ornament for women and for the extraction of essential oil for perfumes. Jasmine is highly priced for their fragrant flowers, which is used for the preparation of perfumes. Recent years, yield levels of jasmine flowers are greatly influenced by pest infestation. Among the various pests, two spotted miteswere reported to be very serious and desap the crop by remaining on the under surface of the leaf causing economic loss to the growers (David, 1958).

The flowering in jasmine commences during March-April and comes to peak in May-July. The hot weather of this period is favorable for multiplication of mite population and hence the population increases quickly. Synthetic pesticides are generally used for two spotted spider mite management. However, their indiscriminate usage adversely affects non-target organisms and leads to resistance build up in pest populations and causes environmental disturbance (Schmutterer, 1990). Globally, spider mites have developed resistance to more than 93 acaricides in more than 105 countries (Whalon *et al.,* 2012). Awareness of these environmental risks has kindled interest in finding alternative pest control methods and products that are as effective as synthetics. In this context plant products and biopesticides are being explored extensively as a feasible alternative to synthetics in protecting cultivated crops from pests (Onnkum, 2012; Praveen *et al.,* 2012; Syahputra, 2013). Natural products are an excellent alternative to synthetic pesticides as a means to reduce negative impacts to human health and the environment. Keeping this in view, laboratory studies were conducted to evaluate the bioefficacy of plant extracts (Table 1) against two spotted spider mite at Department of Entomology, Agricultural college and Research Institute, Madurai, India, during October-November 2015.

Preparation of botanical extracts

Fresh leaf / nutshell / fruit samples of various plants

Table 1. *In-vitro* bio-assay of certain plant extracts against jasmine pests

Common name of Plant	Scientific name	Part used	Conc. (%)	Cumulative mean mortality after 144 HAT	PROC
Neem	*Azadirachtaindica* A. Juss.	Leaf	5	75.29(8.67)^{abcd}	71.40
Neem	*Azadirachtaindica* A. Juss.	Kernel	5	82.35(9.06)^{ab}	79.57
Cashew	*Anacardiumoccidentale*L.	Nut Shell	5	57.23(7.56)^{d}	50.50
Vitex	*Vitexnegundo* Lam.	Leaf	5	77.52(8.76)^{a}	73.98
Adathoda	*Adathodavesica*L.	Leaf	5	65.57(8.09)^{abcd}	60.15
Citrullus	*Citrulluscolocynthis* L.	Fruit	5	64.46(8.02)^{abcd}	58.86
Aloe	*Aloe vera* L.	Leaf	5	74.46(8.62)^{abcd}	70.44
Tulsi	*Ocimum sanctum* L.	Leaf	5	77.51(8.80)^{a}	73.97
Mint	*Menthapiperita* L.	Leaf	5	67.23(8.19)^{abc}	62.08
Coleus	*Coleus aromaticus* L.	Leaf	5	62.29(7.88)^{bcd}	56.36
Sweet Flag	*Acoruscalamus* L.	Rhizome	5	80.58(8.97)^{ab}	77.12
Custard apple	*Annona squamosa* L.	Leaf	5	62.56(7.90)^{cd}	56.66
Custard apple	*Annona squamosa* L.	Seed	5	60.57(7.88)^{cd}	54.36
Wild sage	*Lantana camara*L.	Leaf	5	87.23(9.32)^{ab}	85.22
Wild sage	*Lantana camara* L.	Flower	5	76.13(8.71)^{abc}	72.37
Chrysanthemum	*Chrysanthemum cinerarifolium*L.	Flower	5	73.08(8.53)^{abcd}	68.84
Profenophos 50 EC		-	2 ml l^{-1}	86.96(9.31)^{a}	84.91
Untreated check		-	-	5.63(2.37)^{e}	
SE	CD(0.05)			0.4293 0.8707	

NS - Non significant; Each value is the mean of three replications; Figures in parentheses are square root transformed values.
In a column, means followed by common letter (s) is / are not significantly different by LSD at P=0.05

were collected for the preparation of aqueous extract. The leaves were powdered using pestle and mortar and filtered through 80-mesh sieve. The dried powder was taken and soaked using different organic solvents *viz.,* ethanol/acetone/petroleum ether for 48 h. The extracts were evaporated till dryness in a rotary evaporator under vacuum. Each crude material obtained was weighted and re-dissolved in the same solvent (1g/10ml solvent), to give 10 per cent (W/V).

Bio-assay Method

The toxic effects of the test compounds were evaluated by leaf disc dip technique as suggested by Seigler (1947). The experiment was laid out in a completely randomized design with three replications.Plant derived aqueous solutions were prepared at different concentrations each at 100 ml and placed in a 250 ml conical flask. The leaf discs of 90 mm diameter were prepared from fresh jasmine leaves using a cork borer. The jasmine leaf discs were dipped in each concentration for 5 seconds and shade dried. Then ten adult females of *T. urticae* were transferred to each disc. The discs were then placed on moist cotton pad contained in Petri dishes and kept under controlled conditions of 25 $\pm$ 2^{0}C & 65 $\pm$ 5 % RH. The mortality was observed on 1, 2, 3, 5 and 7 days after treatment. Three replications were maintained for each treatment.

Statistical Analysis: The data were transformed to $\sqrt{x+0.5}$ and analyzed by completely randomized design. The treatment mean values of the experiment were compared using Latin Square Distribution (LSD). The corrected per cent mortality was worked out by using Abbott's correction (Abbot, 1925).

$$\text{Per cent corrected mortality} = \frac{\text{per cent test mortality} - \text{per cent control mortality}}{100 - \text{per cent control mortality}} \times 100$$

The results revealed that the superior effect of extracts in managing two spotted mite, T. *urticae* was noticed in *Lantana camara* leaf extract, showing 87.23 per cent

with 85.22 per cent reduction over control which was on par with the standard chemical check profenophos 50 EC portraying 86.96 per centmortality with 84.91 per cent reduction over control (Table 1). Neem seed kernel extract shows next order of efficacy presenting82.35 percent andsweet flag rhizome extract with 80.58 per cent mortality with 79.57 and 77.12 per cent reduction over control.The order of efficacy follows as *Vitex* leaf extract with 77.52 percent mortality, Tulsi leaf extract with 77.51 per cent, *Lantana camara* flower 76.13 per cent, Neem leaf 75.29 per cent, *Aloe vera* 74.46 per cent witnessing 73.98, 73.97, 72.37, 71.40, 70. 44 per cent reduction over control. The other investigated botanical extracts from mint leaves, Adathoda leaves, *Citrullus* leaves, Coleus leaves, custard apple leaves and fruits displayed 67.23, 65.57, 62.29, 64.46, 62.56 and 60.57 per cent mortality with 62.08, 60.15, 58.86, 56.66, 56.36, 54.36 and 50.50 per cent reduction over control.Cashew Nut Shell Liquid registered least potential recording 57.23 per cent cumulative mortality and 50.50 per cent reduction over control.

The acaricidal effect of certain plant extracts against two spotted mite revealed the superiority of *L. camara* in managing the mite species with 87.23 per cent mortality of the pest in the present study. The results are in line with previous findings of Hind *et al.,* (2019) stating that *Lantana camara* has the potential to manage two spotted spider mite, *T. urticae* in cucumber with a relative efficacy of 70.90%. Ricardo *et al.* (2019) have also mentioned the efficacy of *Lantana camara* against two spotted mites in several crops under laboratory conditions. Neem-based pesticides as a valuable tool to control the two-spotted spider mite, was reported by several researchers (Mansour and Ascher, 1983; Elena et al., 2005; Hussain and Magda, 2005). The present study presented NSKE with yet another superior extract portraying with 82.35 percent mortality with 79.57 per cent reduction over control.The commercial preparations of neem seed kernel extract, Margosan-O and Neem azal-S showed positive response in their deterrent, toxicant and growth inhibitor effect against two spotted mites (Nadia *et al.,* 2009). The efficacy of NSKE in managing two spotted mite was supported also by Hemalatha and Kurian (2009). Neem seed kernel extract NSKE (5%) recorded higher acaricidal and ovicidal action of 96.67 and 90.00 per cent, respectively (Gajalakshmi *et al*., 2020). Sweet flag, *Acorus calamus* have great potential in management of these mites. The present study revealed sweet flag rhizome extract as yet another better solution for mite management with 80.58 per cent mortality and 77.12 per cent reduction over control. In a study by Kitiya and Wanida (2021), fresh rhizomes (10%) caused 73.8% mortality and dried rhizomes caused 91.8% mortality of *T. urticae* adults and fresh rhizomes reduced egg hatch by 96.3% at 5%.

The other extracts with potential in managing *T. urticae* were *Vitex* leaf extract with 77.52 percent mortality, Tulsi leaf extract with 77.51 per cent, *Lantana camara* flower 76.13 per cent, Neem leaf 75.29 per cent, *Aloe vera* 74.46 per cent. Premalatha and Chinniah (2017) experimented the efficacy of various plant extracts on mite management and found *O. sanctum* (10%), *V. negundo* (10%) and *A. calamus* (10%) to be promising with maximum percent reduction of eggs (72.36%, 72.20% and 72.00%) and mites (73.62%, 73.41% and 73.20%) over untreated check., coupled with least mean number of eggs (8.76, 8.81 and 8.88) and mites (7.11, 7.17 and 7.23) respectively, which were statistically on par in their efficacy. The tulsi leaf extract @10 percent recorded 81.15 percent mortality in managing two spotted mites (Raghavendra *et al.*, 2017).

The present study revealed the promising role of *L. camara* leaves at 5 per cent in managing the mite pest to a margin of 87.23 per cent. The study also revealed the importance in identifying several other botanicals such as Neem seed kernel extract, *Vitex* leaf extract, Tulsi leaf, *L. camara* flower extract, neem leaf extract, *Aloe vera* leaf extract as botanical pesticide against mite species.

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