



OPEN ACCESS

Acaricidal Efficacy of Certain Essential Oils against Two Spotted Spider Mite, *Tetranychus urticae* (Koch) On Bhendi *Abelmoschus esculum* L.

V. SATHYASEELAN

Assistant Professor in Entomology, Faculty of Agriculture, Annamalai University, India

ABSTRACT

Bhendi, *Abelmoschus esculum* L. is an important edible vegetable crop in many parts of the world especially in tropical and subtropical region. It is a hardy crop, but it hosts many pests that attack vegetables. Among them more than 1,200 species of spider mites described, *Tetranychus urticae* Koch (Acari: Tetranychidae) (TSSM: Two Spotted Spider Mite) attacks broad range of crops. To evaluate the acaricidal activity of certain essential oils such as clove oil (*Syzygium aromaticum*), peppermint oil (*Mentha piperita*), palmarosa oil (*Cymbopogon martinii*), eucalyptus oil (*Eucalyptus globulus*), tulsi oil (*Ocimum sanctum*), cumin oil (*Cuminum cyminum*) and lavender oil (*Lavandula angustifolia*) under *in-vitro* condition at different concentration using leaf disc method. The results revealed that neem oil exhibits higher acaricidal efficacy against *Tetranychus urticae* followed by eucalyptus oil and tulsi oil. The peppermint oil and lemongrass oil shows an on par effect against the mite. The lavender oil shows moderate effect against mite. The least mortality was recorded in case of mahua oil at 3 percent concentration, respectively. The obtain results indicated that the essential oils exhibited a great potential acaricidal effect against two-spotted spider mite at different concentrations that are not phytotoxic to the host plant.

Keywords: Botanical oils, Two spotted spider mite and Bhendi

INTRODUCTION

Bhendi, *Abelmoschus esculum* L. is an important edible vegetable crop in many parts of the world especially in tropical and subtropical region. It is used as human food due to its high protein contents, vitamins and essential minerals for regular human diet. It is widely grown in Asia, Africa, Central and Southern America and parts of Southern Europe and USA. In India, it is cultivated mainly in tropical and sub tropical tracts of Karnataka, Kerala, Tamilnadu, Maharashtra and Gujarat. It is a cash crop but it hosts many insect pests that attack vegetables. Among them more than 1,200 species of spider mites described so far. The two spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) is the most economically important plant feeding mite pest in the world, it attacks broad range of crops. Due to its wide host range, its high reproductive capacity and its ability to rapidly develop resistance to pesticides, hence *T. urticae* is difficult to control. To reduce these negative effects, alternative methods for the control of *T. urticae* are being tested, including the use of essential oils. Essential oils are promising agents for the control of agricultural pests, as these substances act on the nervous system of the target insect, causing physiological and behavioral responses [8].

MATERIALS AND METHODS

Essential oils were obtained from the extraction unit present in the manufacturing yard at Ooty, they were diluted absolutely for their respective concentration of 3 percent with the universal solvent or acetone. Dilution should do only before the commencement of the experiment. The test mites were reared in the host bhendi plant under pot culture yard of Faculty of Agriculture, Annamalai University.

Leaf disc bioassay technique

The effectiveness of the botanical essential oils against *T. urticae* was done on the excised bhendi leaf disc. For this purpose leaf disc were used from fresh bhendi leaf. The leaf is checked under stereo binocular microscope for mite and other insect. The fresh leaf discs were dipped in the following treatments like clove oil (*Syzygium aromaticum*), peppermint oil (*Mentha piperita*), palmarosa oil (*Cymbopogon martinii*), eucalyptus oil (*Eucalyptus globulus*), tulsi oil (*Ocimum sanctum*), cumin oil (*Cuminum cyminum*) and

lavender oil (*Lavandula angustifolia*) for 15 min after which it was allowed to dry for 5 min at room temperature. Then the leaves were kept on a wet cotton pad in a petridish (10 cm diameter and 1.5 cm in width). The petridish brim was smeared with petrogel or vaseline and firmly bind with rubber band to avoid the escape of test mite, *T. urticae*. The laboratory reared adult female two spotted spider mite, *T. urticae* were transferred to each petridish with the help of a fine camel hair brush. The doses of botanical essential oils, were serially diluted with water. Each petridish was examined under a stereo binocular microscope for 1, 3, 6, 9, 12, 24 and 48 hours after treatment, the mortality of two spotted spider mite was recorded. This experiment was conducted as per the procedure followed by Sathyaseelan and Baskaran [12]. The respective treatments were replicated thrice.

RESULTS AND DISCUSSION

The bio efficacy of essential oils against the mortality of two spotted spider mite, *T. urticae* on bhendi by using leaf disc method under laboratory condition. The results revealed that the essential oils showed a significant variation in the mite mortality was observed 1, 3, 6, 9, 12, 24 and 48 hours after treatment (Table 1).

The maximum mite mortality was recorded in case of eucalyptus oil (8.35%) and palmarosa oil (6.52%) followed by tulasi oil (6.18%). Peppermint oil (5.88%) and lavender oil (5.58%) shows on par results against mite. The clove oil (5.23%) shows moderate efficacy against mite. The least was recorded in case of the cumin oil (4.98%) against two spotted spider mite after one hour of release.

A similar trend was observed in the mite mortality during 3, 6, 9, 12 and 24 hours after treatment. After 48 hours of treatment, the maximum mite mortality was recorded in case of eucalyptus oil (78.12%) and palmarosa oil (72.35%) followed by tulasi oil (66.34%). Peppermint oil (61.18%) and lavender oil (56.32%) shows on par results against mite. The clove oil (51.5%) shows moderate efficacy against mite. The least was recorded in case of the cumin oil (34.69%) against two spotted spider mite.

Overall mean results indicated that the maximum mite mortality was recorded in case of eucalyptus oil (37.21%) and palmarosa oil (34.48%) followed by tulasi oil (31.75%). Peppermint oil (30.93%) and lavender oil (27.72%) shows on par results against mite. The clove oil (25.47%) shows moderate efficacy against mite. The least was recorded in case of the cumin oil (19.24%) against two spotted spider mite on bhendi crop.

Heikal *et al.*[5] reported that the *Lavandula officinalis* have high fumigant and repellent activities against *Tetranychus urticae*, two spotted spider mite and LC₅₀ value were 24.56, 17.27 and 15.31 ml/L after exposure periods of 24, 48 and 72 hour, respectively, this was inline with our study. Motazedin *et al.*,[9] investigated the LC₅₀ values of essential oils of *Mentha lonifolia* and *M.communis* against *T. urticae* were 20.08 and 53.22 µl/L air. Najafabadi [10] observed that the thyme, lavender and eucalyptus had an active acaricidal effect on the *T. urticae*. Afify *et al.* [1] reported that chamomile was the most potent acaricide followed by marjoram and eucalyptus against *Tetranychus urticae* Koch.

Present findings are in accordance with that of Kheradmand *et al.* [6] reported that the Spearmint oil (7.53 µl/L) was effective against two spotted spider mite. Neem oil (74.0%) and citronella oil (71.6%), eucalyptus oil (68.7%) followed by lemon grass oil (62.1%), pungam oil (59.6%), illupai oil (57.2%), clove oil (54.3%) and castor oil (52.2%) against *T. urticae* were reported by Premalatha *et al.* [11].The oil extracted from *Eucalyptus citriodora* have the fumigation toxicity against *T. urticae* [13].

Eswara Reddy and Dolma [3] reported that in fumigant toxicity assay, *Mentha longifolia* showed more toxic to *T. urticae* followed by *M. piperita*, *Cymbopogon* sp and *Chrysopogon* sp. The *Ocotea duckei* and *O. glomerata* were more toxic by fumigation against *T. urticae* reported by Moraes *et al.* [7], *Eucalyptus oleosa* and *E. torquata* [2] was inline with our present study.

Table 1. Bio efficacy of Essential oils against two spotted spider mite, *T. urticae* on bhendi by using leaf disc method

Treatment	Conc(%)	No. of mite released / replication	1 hr	3 hrs	6 hrs	9 hrs	12 hrs	24 hrs	48 hrs	Mean
Palmarosa oil	3	10	6.52 (15.92)	14.23 (22.97)	20.52 (27.64)	32.52 (35.38)	39.75 (39.67)	55.48 (48.72)	72.35 (58.92)	34.48 (36.56)
Lavender oil	3	10	5.58 (14.86)	13.58 (22.45)	18.62 (26.29)	22.58 (29.05)	32.74 (35.51)	44.63 (42.49)	56.32 (49.21)	27.72 (32.41)
Cumin oil	3	10	4.98 (14.18)	9.74 (19.13)	11.42 (20.64)	19.16 (26.68)	28.42 (32.85)	33.3 (35.85)	50.58 (45.91)	22.52 (29.01)
Tulasi oil	3	10	6.18 (15.54)	14.2 (22.95)	20.12 (27.36)	30.68 (34.25)	34.66 (36.67)	50.12 (45.64)	66.34 (55.15)	31.76 (34.91)
Clove oil	3	10	5.23 (14.45)	13.29 (22.21)	17.34 (25.36)	20.12 (27.36)	30.38 (34.07)	40.44 (40.07)	51.5 (46.43)	25.47 (30.96)
Eucalyptus oil	3	10	8.35 (17.80)	15.33 (23.83)	22.12 (28.06)	35.23 (37.01)	42.54 (41.29)	58.83 (50.67)	78.12 (62.81)	37.22 (38.18)

Pepper mint oil	3	10	5.88 (15.21)	13.98 (22.77)	19.98 (26.55)	25.92 (31.25)	34.26 (36.43)	47.22 (43.98)	61.18 (52.05)	29.77 (33.69)
Control	0	10	0 (5.74)	0 (5.74)	0 (0.00)	0 (5.74)	0 (5.74)	0 (5.74)	0 (5.74)	0.00 (5.74)
S Ed			0.10	0.15	0.32	0.45	0.61	0.96	1.12	1.10
CD 0.05			0.22	0.31	0.67	0.94	1.28	2.01	2.36	2.24

REFERENCES

1. Afify, M.R., F.S.Ali and A.F. Turkey. 2012. Control of *Tetranychus urticae* Koch by extracts of three essential oils of chamomile, marjoram and Eucalyptus. *Asian Pacific Journal of Tropical Biomedicine*, **2**(1): 24-30.
2. Ebadollahi, A., J.J. Sendi, M. Maroufpoor and M. R. Nasrabadi. 2017. Acaricidal Potentials of the Terpene- rich Essential Oils of Two Iranian *Eucalyptus* Species against *Tetranychus urticae* Koch. *Journal of Oleo Science*, **66** (3): 307-314.
3. Eswara Reddy,S.G., and S.K. Dolma. 2017. Acaricidal activities of essential oils against two spotted spider mite, *Tetranychus urticae* Koch. *Toxin Reviews*, Early Online: 1–5. DOI: 10.1080/15569543.2017.1320805
4. Gorski, R., K. Sobieralski and M. Siwulski. 2016. The effect of hemp essential oil on mortality *Aulacorthum solani* Kalt. and *Tetranychus urticae* Koch. *Ecol Chem Eng S*, **23**(3): 505-511.
5. Heikal, H. M. M., H.K. Abd-Elhady and N.O. Edrees. 2012. Composition and acaricidal activities of *Lavandula officinalis* essential oil against *Tetranychus urticae* (Acari: Tetranychidae). *Minufiya J. Agric. Res.*, **37**(1): 221 – 230.
6. Kheradmand, K., S. Beynaghi, S. Asgari and A. S. Garjan. 2015. Toxicity and repellency effects of three plant essential oils against two-spotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae) . *J. Agr. Sci. Tech*, **17**: 1223-1232.
7. Moraes, M.M., C.A.G. Camara and M.M.C.Silva. 2017. Comparative toxicity of essential oil and blends of selected terpenes of *Ocotea* species from Pernambuco, Brazil, against *Tetranychus urticae* Koch. *Annals of the Brazilian Academy of Sciences*, **89**(3): 1417-1429.
8. Mossi, A.J., C.A. Zanella, G. Kubiak, L.A. Lerin, R.L. Casian and F.S. Frandoloso. 2013. Essential oil of *Ocotea odorifera*: An alternative against *Sitophilus zeamais*. *Renewable Agriculture and Food Systems*, **29** :161-166.
9. Motazedian, N., S. Ravan and A. R. Bandani. 2012. Toxicity and repellency effects of three essential oils against *Tetranychus urticae* Koch (Acari: Tetranychidae). *J. Agr. Sci. Tech.*, **14**: 275-284.
10. Najafabadi, S.S.M. 2012. Control of *Tetranychus urticae* Koch by Thyme, Lavender and Eucalyptus Essential Oils. *Journal of Medicinal Plants and By-products*, **1**: 43-47.
11. Premalatha, K., C. Chinniah, A. Ravikumar, P. Parthiban and M. Kalyanasundaram. 2016. Evaluation of essential plant oils against two spotted spider mite, *Tetranychus urticae* on Tomato. *Ann. Pl. Protec. Sci.*, **25** (1): 6-11.
12. Sathyaseelan,V. and V. Baskaran. 2016. Phytochemicals an economically cheaper pesticide, In: *Dynamics of agrarian transformation in rural India*. Eds. C.Prabakar and K.Sita Devi, Manibharathi achagam, Chidambaram, pp225.
13. Souza, L.P., H.B. Zago, P. F. Pinheiro, W.R.Valbon, V. Zuim and D. Pratissoli. 2016. Chemical composition and toxicity of Eucalyptus essential oil on two spotted spider mite. *Comunicata Scientiae*, **7**(4): 486-493.