Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP3: 319-322

RB Hirekurubar
Assistant Professor, Department of Entomology, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India

Suvarna Patil
Assistant professor, Department of Entomology, RHREC, Kumbapur, Dharwad, Karnataka, India

J Jayappa
Assistant professor, Department of Entomology, College of Horticulture, Bengaluru, Karnataka, India

MH Tatagar
Associate professor, Department of Entomology, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India

DA Masuthi
Assistant professor, Department of Crop improvement and Biotechnology, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India

Correspondence
RB Hirekurubar
Assistant Professor, Department of Entomology, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India

National conference on “Conservation, Cultivation and Utilization of medicinal and Aromatic plants"
(College of Horticulture, Mudigere Karnataka, 2018)

Evaluation of new insecticides and Acaricides against red spider mite (*Tetranychus urticae* Koch) In Ashwagandha (*Withania somnifera* Dunal)

RB Hirekurubar, Suvarna Patil, J Jayappa, MH Tatagar and DA Masuthi

Abstract
A field expriment was conducted at Kittur Rani Channamma College of Horticulture Arabhavi, Karnataka during *kharif* season of 2016 and 2017 to evaluate the bio efficacy of different insecticides and acaricides viz., acetamiprid 20 SP, thiamethoxam 25 WG, spiromesifen 240 SC, difenthiuron 50 WP, azadirachtin 1500 ppm, NSKE 5 per cent, dimethoate 30 EC and dicofal 18.5 EC against red spider mite, *Tetranychus urticae* Koch in Ashwagandha, *Withania somnifera* Dunal ecosystem. The results of study revealed that the acaricide spiromesifen 240 SC @ 1 ml/l was found most effective in reducing mites population (0.92 mites/3leaves/plant) followed by difenthiuron 50 WP @ 0.75 g/l (4.20 mites/3leaves/plant) and dicofal 18.5 EC @ 2.50 ml/l.(6.82 mites/3leaves/plant). The same treatment was found effective and registered highest root and seed yield (5.20 q/ha and 1.40 q/ha, respectively) and was followed by difenthiuron 50 WP @ 0.75 g/l (4.55 q/ha and 1.08 q/ha, respectively).

Keywords: Red spider mite, Ashwagandha, Insecticides, Azadirachtin NSKE, Yield.

Introduction
Ashwagandha (*Withania somnifera*) commonly known as, Gandharva gandha and Vaagi gandha in ayurvedic and winter cherry in English, also known as Indian Ginseng (Ahmad, *et al.* 2005) [1] is an important ancient plant, the roots of which have been employed in Indian traditional systems of medicine, Ayurveda and Unani. All parts of Ashwagandha have medicinal properties and are used in preparation of various drugs (Bhattacharjee, 1998) [3]. Among different pests reported on ashwagandha, red spider mite, *Tetranychus urticae* is an economically important one. It is common in greenhouses and field crops throughout the world. It feeds on more than 3,877 plant species belonging to more than 140 different plant families including species known to produce toxic compounds (Leeuwen *at el* 2010) [5]. The mite inflicts damage by sucking cell sap from leaves and results in yellowing of leaves with stunted growth, ultimately deteriorate the medicinal quality in ashwagandha (Rolania and Sharma, 2007 and Anonymous, 2012) [8, 2]. In this view, it is important to manage the population buildup of mite, so that suitable management strategy can be formulated. Though different conventional insecticides were tried for the control of this mite, the conventional insecticides recommended against this pest gave low to moderate control. Hence there is a need to test newer effective insecticide/acaricides to manage this pest.

Material and Methods
The present investigation was carried out during *Kharif* season of 2016 and 2017 at Kittur Rani Channamma College of Horticulture Arabhavi, Karnataka in medium deep black soil under rainfed conditions. The experiment was laid out in a Randomized block design with nine treatments replicated thrice. The plot size was 5x4 sq.m for each treatment with a spacing of 30 cm x 10 cm. The crop was raised with ‘Poshita’ hybrid by adopting all recommended agronomical practices except plant protection measures. First application of treatments was made with appearance of mites and second spray was given at 15 days after first spray. For recording observations 5 plants were selected randomly from each plot and population of mites per three leaves per plant were recorded at one day before first spraying and 5, 10 and 15 days after each spraying. The root and seed yield was obtained from individual plots, pooled

and converted to quintal per hectare. The data was subjected to analysis of variance (ANOVA) after transforming them to square root. However the data on yield was analysed without any transformation

Results and Discussion

The pre-treatment count of mites activity was uniform and ranged from 20.59 to 27.20 per three leaves per plant during 2016 and there was no significant difference between the treatments including untreated control (Table 1). However significant difference was noticed at 5 days after first application, significantly lower population of 5.60 mites per three leaves per plant was found with treatment Spiromesifen 240SC @ 1 ml/l compared to standard check Dicofal 18.5 EC @ 2.50 ml/l (12.47 mites/3 leaves/ plant) and was on par with Difenthiuron 50 WP @ 0.75 g/l (10.92 mites/3 leaves/ plant) and was followed by aqueous NSKE@5% (13.08 mites/3 leaves/ plant). The highest population of mites was noticed in untreated control (22.40 mites/3 leaves/ plant). Similar trend was observed at 10 days after first spray Spiromesifen 240SC @ 1 ml/l was found to be superior insecticide by registering lowest mites of 3.93 per three leaves per plant. The next best treatments were Difenthiuron 50 WP @ 0.75 g/l and Dicofal 18.5 EC @ 2.50 ml/l (8.72 and 10.49 mites/3 leaves/plant respectively). The remaining treatments were comparatively at par with each other and superior over untreated control. Similar trend was noticed at 15 days though there was increase in mite population in all treatments. However same trend was noticed at 5, 10 and 15 days after second spray also. The Spiromesifen 240SC @ 1 ml/l was found to be excellent and significantly effective in reducing mite population at 5, 10 and 15 days after second spray (3.67, 3.33 and 0.87 mites/3 leaves/ plant respectively). Difenthiuron 50 WP @ 0.75 g/l was next best effective treatment. However significantly highest incidence of mites was observed in untreated control. Same trend of observation was observed during 2017 also, Spiromesifen 240SC @ 1 ml/l was found to be significantly superior in reducing the incidence of mites at 5, 10 and 15 days after first spray and recorded 8.50, 7.43 and 7.93 mites per three leaves per plant respectively. Difenthiuron 50 WP @ 0.75 g/l, Dicofal 18.5 EC @ 2.50 ml/l and aqueous NSKE@5% were found to be next best in reducing the incidence. Similarily, at 5, 10 and 15 days after second spray also significantaly low incidence was observed with the treatment Spiromesifen 240SC @ 1 ml/l (5.37, 3.70 and 0.97 mites/3 leaves/ plant respectively). However Difenthiuron 50 WP @ 0.75 g/l, Dicofal 18.5 EC @ 2.50 ml/l and aqueous NSKE@5% were also effective and stood next best treatments (Table2). However significantly highest incidence of mites was observed in untreated control at 5, 10 and 15 days after second spray (30.47, 30.53 and 32.77 mites/3 leaves/ plant respectively).

Observations of 2016 and 2017 were pooled and analysed. Pooled data of both years revealed same trend. At 5, 10 and 15 days after first spray, lowest population of mites was noticed with treatment spiromesifen 240SC @ 1 ml/l /l (6.62, 5.68 and 7.94 mites/3 leaves/ plant respectively) and was found to be excellent and significantly superior compared to difenthiuron 50 WP @ 0.75 g/l, (13.01,11.06 and 14.97 mites/3 leaves/ plant respectively). Similar trend was noticed at second spray also. The treatment spiromesifen 240SC @ 1 ml/l remained effective and significantly superior compared to difenthiuron 50 WP @ 0.75 g/l by registering lowest number of mites activity (Table 3). This was followed by dicofal 18.5 EC @ 2.50 ml/l and aqueous NSKE@5% However significantly highest number of mites activity was observed in untreated control.

The root yield and seed yield obtained from the different treatments of test chemicals was significantly higher compared to untreated control during 2016. The highest root yield and seed yield of 5.06 q/ha and 1.47 q/ha respectively was obtained from the plot treated with spiromesifen 240SC @ 1 ml/l and it was significantly superior compared to difenthiuron 50 WP @ 0.75 g/l (4.48 q/ha and 1.20 q/ha root and seed yield respectively). It was followed by dicofal 18.5 EC treated plot and rest of the treatments were found to be on par with dicofal18.5EC except untreated control (2.80 q/ha and 0.77 q/ha respectively). Similar trend was noticed during 2017 also spiromesifen 240SC @ 1 ml/l was found excellent acaricide and recorded better root yield (5.34q/ha) and seed yield (1.34q/ha) compared to untreated control (2.99 q/ha and 0.51q/ha respectively).

The pooled observation of both years revealed that spiromesifen 240SC @ 1 ml/l was found effective treatment by registering highest root and seed yield (5.20 q/ha and 1.40 q/ha) was followed by difenthiuron 50 WP @ 0.75 g/l (4.55 q/ha and 1.08 q/ha respectively) which was on par with rest of the treatments including NSKE 5% except untreated control. The present findings are in accordance with the reports of Patel, N.B. and Patel, C.C. (2017)[6] who reported the effectiveness of spiromesifen 240SC@0.02% against *Tetranychus urticae* and recorded the highest fruit yield and cost benefit ratio in brinjal. Ramkewal *et. al* (2011) [7] also reported the effectiveness of spiromesifen 240SC@0.03% against *Tetranychus urticae* in apple. Spiromesifen even at lower cocentration of 0.0003% was found effective against the nymphs of *Oligonychus coffeae* (Chakraborty *et al*. 2006) [4].

Further Spiromesifen dissipated with a half-life of 0.93-1.38 days at the recommended rate of application and 1.04-1.34 days at the double the rate of application, residues of spiromesifen in soil were detectable level (<0.05 mg kg(-1)) after 15 days of treatment and a post harvest interval (PHI) of one day has been recommended on tomato on the basis of data generated under All India Network Project on Pesticide Residues (Sharma *et al*.2014) [10]. The residue levels reached below the maximum residue limit (MRL; 0.02 mg kg^{-1}) within 15–17 days at the standard dose and 24–27 days at the double dose and field soil analyzed at harvest (30 days) was free from spiromesifen residues. (Siddamallaiah L and Mohapatra S 2016) [11]. The DT50 (time to reduce to 50% of initial value) of spiromesifen when applied at recommended doses in tea leaves was found to be 5.0–8.5 days. Ninety-nine percent degradation was found to occur within 33–57 days after application and in soil, no residues of spiromesifen were detectable 10 days after treatment. (Sharma, *et al*., 2007) [9].

Table 1: Bio-efficacy of new insecticides and acaricides against red spider mite (*Tetranychus urticae* Koch) in Ashwagandha (*Withania somnifera* Dunal) (2016)

Tr. No	Treatment detail	No. of mites/3leaves/plant							
		I Spray					II Spray		
		Dose	DBS	5 DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS
T1	Acetamiprid 20 SP	0.25 g/l	23.57 (4.95)	16.45 (4.17)	17.80 (4.34)	22.47 (4.83)	20.10 (4.56)	18.70 (4.43)	18.79 (4.43)
T2	Thiamethoxam 25 WG	0.25 g/l	25.80 (5.17)	15.40 (4.05)	18.13 (4.37)	22.60 (4.83)	20.47 (4.61)	19.17 (4.46)	20.33 (4.59)
T3	Spiromesifen 240SC	1.00 ml/l	24.23 (5.01)	5.60 (2.57)	3.93 (2.16)	9.17 (3.17)	3.67 (2.15)	3.33 (2.05)	0.87 (1.34)
T4	Difenthiuron 50 WP	0.75 g/l	27.20 (5.30)	10.92 (3.43)	8.72 (3.09)	14.57 (3.93)	8.33 (3.03)	7.07 (2.83)	3.87 (2.20)
T5	Azadirachtin 1500 ppm	5.00 ml/ l	25.80 (5.17)	13.37 (3.78)	12.87 (3.70)	21.17 (4.70)	12.27 (3.62)	10.57 (3.37)	8.73 (3.09)
T6	Aqueous NSKE	5%	22.79 (4.84)	13.08 (3.70)	12.57 (3.66)	15.93 (4.11)	11.80 (3.57)	11.10 (3.46)	9.27 (3.18)
T7	Dimethoate 30EC	1.70 ml/l	26.67 (5.25)	15.38 (4.00)	18.40 (4.40)	21.07 (4.67)	19.77 (4.55)	19.10 (4.47)	21.47 (4.69)
T8	Dicofal 18.5EC	2.50 ml/l	25.57 (5.15)	12.47 (3.63)	10.49 (3.37)	15.80 (4.08)	10.07 (3.31)	8.87 (3.13)	4.50 (2.32)
T9	Control	--	20.59 (4.64)	22.40 (4.82)	25.40 (5.13)	25.70 (5.15)	26.33 (5.22)	28.20 (5.40)	30.93 (5.65)
CD @ 5%			NS	0.9	0.8	0.8	0.7	0.8	0.8
SEm ±			0.2	0.3	0.3	0.3	0.2	0.3	0.3
CV (%)			8.2	13.5	11.60	10.7	11.0	11.7	13.5

Note- DBS- Day before Spray; DAS- Days after spray and Figures in the parenthesis are SQRT values

Table 2: Bio-efficacy of new insecticides and acaricides against red spider mite (*Tetranychus urticae* Koch) in Ashwagandha *(Withania somnifera* Dunal) (2017)

Tr. No	Treatment detail	No. of mites/3leaves/plant							
		I Spray					II Spray		
		Dose	DBS	5 DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS
T1	Acetamiprid 20 SP	0.25 g/l	24.57 (5.03)	22.45 (4.83)	23.00 (4.88)	25.80 (5.15)	23.70 (4.94)	24.08 (4.99)	27.77 (5.35)
T2	Thiamethoxam 25 WG	0.25 g/l	25.80 (5.16)	21.21 (4.69)	21.73 (4.76)	24.27 (5.02)	22.83 (4.87)	24.35 (5.02)	26.07 (5.19)
T3	Spiromesifen 240SC	1.00 ml/l	22.71 (4.86)	8.50 (3.04)	7.43 (2.87)	7.93 (2.96)	5.37 (2.46)	3.70 (2.15)	0.97 (1.38)
T4	Difenthiuron 50 WP	0.75 g/l	20.25 (4.58)	15.10 (3.99)	13.40 (3.77)	15.37 (3.96)	11.63 (3.51)	8.57 (3.05)	4.13 (2.26)
T5	Azadirachtin 1500 ppm	5.00 ml/ l	24.20 (5.00)	21.95 (4.77)	21.20 (4.70)	23.77 (4.97)	21.13 (4.69)	18.37 (4.39)	17.63 (4.31)
T6	Aqueous NSKE	5%	26.17 (5.19)	22.10 (4.78)	21.75 (4.76)	22.90 (4.88)	20.67 (4.63)	19.61 (4.53)	16.30 (4.13)
T7	Dimethoate 30EC	1.70 ml/l	27.73 (5.36)	23.50 (4.94)	24.53 (5.05)	25.90 (5.17)	25.90 (5.17)	24.17 (5.00)	26.00 (5.18)
T8	Dicofal 18.5EC	2.50 ml/l	28.83 (5.46)	15.17 (4.01)	14.55 (3.94)	16.40 (4.15)	13.10 (3.72)	9.40 (3.17)	9.13 (3.18)
T9	Control	--	22.87 (4.85)	29.00 (5.47)	30.07 (5.62)	30.13 (5.55)	30.47 (5.59)	30.53 (5.61)	32.77 (5.78)
CD @ 5%			NS	0.9	0.8	0.9	0.9	0.8	0.3
SEm ±			0.3	0.3	0.3	0.3	0.3	0.3	0.8
CV (%)			10.5	11.3	10.0	11.8	12.20	11.6	11.1

Note- DBS- Day before Spray; DAS- Days after spray and Figures in the parenthesis are SQRT values

Table 3: Bio-efficacy of new insecticides and acaricides against red spider mite (*Tetranychus urticae* Koch) in Ashwagandha (*Withania somnifera* Dunal) (pooled)

Tr. No	Treatment detail	No. of mites/3leaves/plant							
		I Spray					II Spray		
		Dose	DBS	5 DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS
T1	Acetamiprid 20 SP	0.25 g/l	24.07 (5.00)	19.45 (4.5)	20.40 (4.62)	24.13 (5.00)	22.23 (4.81)	21.39 (4.72)	23.28 (4.91)
T2	Thiamethoxam 25 WG	0.25 g/l	25.80 (5.16)	18.30 (4.39)	19.93 (4.57)	23.43 (4.93)	21.65 (4.76)	21.76 (4.75)	23.20 (4.91)
T3	Spiromesifen 240SC	1.00 ml/l	23.47 (4.93)	6.62 (2.73)	5.68 (2.54)	7.94 (2.96)	4.52 (2.28)	3.22 (2.02)	0.92 (1.38)
T4	Difenthiuron 50 WP	0.75 g/l	23.72 (4.93)	13.01 (3.73)	11.06 (3.46)	14.97 (3.92)	9.98 (3.30)	7.82 (2.93)	4.20 (2.25)

T5	Azadirachtin 1500 ppm	5.00 ml/ l	25.00 (5.09)	17.66 (4.30)	17.03 (4.23)	22.80 (4.87)	16.70 (4.19)	14.47 (3.93)	13.18 (3.74)
T6	Aqueous NSKE	5%	24.47 (5.04)	17.59 (4.30)	17.16 (4.25)	19.42 (4.51)	16.23 (4.14)	15.22 (4.00)	12.78 (3.68)
T7	Dimethoate 30EC	1.70 ml/l	27.20 (5.30)	19.44 (4.50)	21.47 (4.73)	23.15 (4.90)	22.83 (4.86)	21.63 (4.74)	23.73 (4.95)
T8	Dicofal 18.5EC	2.50 ml/l	27.20 (5.30)	13.82 (3.83)	12.53 (3.64)	16.77 (4.20)	11.58 (3.51)	9.13 (3.18)	6.82 (2.79)
T9	Control	--	21.73 (4.75)	25.70 (5.16)	27.73 (5.34)	27.92 (5.37)	28.40 (5.42)	29.37 (5.51)	31.85 (5.73)
CD @ 5%			NS	0.7	0.7	0.8	0.7	0.8	0.7
SEm ±			0.3	0.2	0.2	0.3	0.2	0.3	0.2
CV (%)			9.0	10.2	10.1	10.0	10.2	11.2	11.1

Note- DBS- Day before Spray; DAS- Days after spray and Figures in the parenthesis are SQRT values

Table 4: Impact of new insecticides and acaricides on root yield and seed yield of Ashwagandha (*Withania somnifera* Dunal)

Tr. No	Treatment detail	Dose	Root yield (q/ha)			Seed yield (q/ha)		
			2016	2017	pooled	2016	2017	pooled
T1	Acetamiprid 20 SP	0.25 g/l	3.36	3.59	3.47	0.87	0.75	0.81
T2	Thiamethoxam 25 WG	0.25 g/l	3.37	3.66	3.51	0.86	0.73	0.80
T3	Spiromesifen 240SC	1.00 ml/l	5.06	5.34	5.20	1.47	1.34	1.40
T4	Difenthiuron 50 WP	0.75 g/l	4.48	4.63	4.55	1.20	0.95	1.08
T5	Azadirachtin 1500 ppm	5.00 ml/ l	3.64	3.85	3.74	0.90	0.74	0.82
T6	Aqueous NSKE	5%	3.73	3.93	3.83	0.93	0.78	0.86
T7	Dimethoate 30EC	1.70 ml/l	3.58	3.70	3.64	0.85	0.72	0.78
T8	Dicofal 18.5EC	2.50 ml/l	4.05	4.30	4.17	1.00	0.89	0.95
T9	Control	--	2.80	2.99	2.89	0.77	0.51	0.64
CD @ 5%			0.5	0.7	0.6	0.2	0.2	0.2
SEm ±			0.2	0.2	0.2	0.1	0.1	0.1
CV (%)			7.5	10.1	8.2	13.6	12.4	10.2

Conclusion

The results of present study clearly revealed that Spiromesifen 240SC @ 1 ml/l is an excellent alternate chemical for management of red spider mite and can be included as one of the strategies in the IPM practices.

References

1. Ahmad M, Saleem S, Ahmad AS, Ansari MA, Yousuf S, Hoda MN. Neuroprotective effects of *Withania somnifera* on Hydroxydopamine induced Parkinsonism in rats. Human and Experimental Toxicology. 2005; 24(3):137-147.
2. Anonymous. Progress Report Network Unit, AINP on Agricultural Acarology Univers ity of Agricultural Sciences, G.K.V.K. Bangalore, 2012, 30-34.
3. Bhattacharjee BS. Hand book of medicinal plants, 1998, 377-378.
4. Chakraborty G, Sahu B, Somachoudhary AK. Efficacy of Spiromesifen 240 SC in the management of tea red spider mite (Oligoonychus coffee Niether) on tea. Environment and Ecology 2006, 24(1). Retrieved from http://d.wan fangdata.com.cn/NSTLQK_NSTL_QK12332409.aspx
5. Leeuwen TV, Vontas J, Tsagkarakou A, Dermauwa W, Tirry L. Acaricide resistance mechanisms in the two-spotted spider mite Tetranychus urticae and other important Acari: A review. Insect Biochem. Mol. Biol. 2010; 40:563-572.
6. Patel NB, Patel CC. Relative Bio-Efficacy of Different Acaricides against Brinjal Mite, *Tetranychus urticae* Koch. Int. J Curr. Microbiol. App. Sci. 2017; 6(7):4353-4363.
7. Ramkewal, Deepak R, Jai Prakash G. Efficacy of spiromesifen against European red spider mite, *Panonychus ulmi* Koch and two spotted spider mite, *Tetranychus urticae* Koch in apple. Pantnagar Journal of Research. 2011; 9(2):158-163.
8. Rolania K, Sharma A. Seasonal abundance of *Tetranychus urticae* Koch on *ashwagandha.* Journal of Acarology. 2007; 16:70-74.
9. Sharma KK, Dubey JK, Deka SC, Chandrasekaran S, Kalpana, Gupta P *et al.* Dissipation kinetics of spiromesifen on tea (*Camellia sinensis*) under tropical conditions. Chemosphere. 2007; 68(4):790-796.
10. Sharma KK, Mukherjee I, Singh B, Mandal K, Sahoo SK, Banerjee H *et al*. Persistence and risk assessment of spiromesifen on tomato in India: a multilocational study Environmental Monitoring and Assessment 2014; 186(12):8453-8461.
11. Siddamallaiah L, Mohapatra S. Residue level and dissipation pattern of spiromesifen in cabbage and soil from 2-year field study Environmental Monitoring and Assessment. 2016; 188:155.