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Evaluation of Newer Acaricides and biorationals against eriophyid mite, *Aceria jasmini* (Chann.) on Hadagali Jasmine

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ABSTRACT: The jasmine having good economic importance and flowers are used in south India especially for making garlands, floral decoration of the wedding ceremony, for religious offerings. The flowers are also used for the production of perfumes and attars. Therefore, the present study was carried out to know the efficacy of newer acaricides and biorationals at Agricultural Extension Education centre, UAS, Raichur during the year 2017-18. Among the various acaricides and biorationals tested against eriophyid mite, the lowest per cent reduction of erenial growth of 54.11 was recorded in spiromecifen 240 SC at 1.0 ml per litre with highest flower yield of 6903.67 kg/ha followed by diafenthiuron 50 WP at 1.0 gm/l recorded 49.93 per cent reduction of erenial growth over control with flower yield of 6856.33 kg/ha. Which was followed by fenazaquin 10 EC at 1.0 ml/l, and fenpyroximate 5 EC at 1 ml/l. The application of neem cake at 200 kg/ac also proved better over spraying of commercial neem at 3.0 ml/l and recorded the 4041 per cent reduction of eranial growth and flower yield of 3635.33 kg/ha. The *Hirsutella thompsonii* (1×10^8) at 1.0 ml/l was the next best treatment recorded the 31.06 per cent leaves with erenial growth.

Keywords: Jasmine, eriophyid mite, per cent reduction, erenial growth, flower yield.

INTRODUCTION

The "Queen of fragrance", jasmine (*Jasminum* spp.) is one of the most marketable traditional flowers of India. It is exquisitely scented to soothe and refresh, and one of the oldest fragrant flowers cultivated by man. The genus *Jasminum* which belongs to the family Oleaceae comprises of more than 200 species and is mostly tropical in distribution (Khader and Kumar, 1995). It is one of the most sought after flowers in all religious, social and cultural ceremonies (Thakur *et al.,* 2014). In south India, large quantities of jasmine flowers are used by women folk for adorning their hairs, making garlands, floral decoration of the wedding ceremony and for religious offerings. The flowers are also used for the production of perfumes and attars (Arumugam *et al.,* 2002). Apart from flower, other parts of jasmine like leaf, stem, bark and root are also used for medicinal purposes (Bose and Yadav, 1989). India exports jasmine flowers to the neighboring countries like Sri Lanka, Singapore, Malaysia and Gulf.

Jasmine flower is native to India cultivated over an area of 25,530 hectares with a production of 1,87,190 tonnes of loose flowers and 10,710 tonnes of cut flowers in 2017-18 (Annon., 2017). The largest area under jasmine cultivation lies in Tamil Nadu and Karnataka from where it is distributed to metropolitan cities. Karnataka is the second highest producer of jasmine flowers with a production of 43,600 tonnes from an area of 6,600 hectares (Anon., 2017). The major jasmine growing districts in Karnataka are Bengaluru, Belagavi, Ballari, Bidar, Bijapur, Chitradurga, Dhakshina Kannada, Dharwad, Kolar, Hassan, Kodagu, Shivamogga, Mandya, Mysuru and Tumkur.

The Hadagli jasmine is one of the important flower crop of this area due to its GI tag and special flower characters and farmers are resorting to high input cultivation. Over the years this has resulted in increased biotic stresses in the form of insect and mite pests. They form a major suppression factor and their management assumes an important task, as these cause considerable direct damage to the crop in general and flower in particular. Jasmine is being attacked by more than twenty insect pests and mites. Among these, the bud borer (*Hendecasis duplifascialis* Hompson), blossom midge (*Contarinia maculipennis* Felt.), eriophyid mite,

(*Aceria jasmini*), red spider mite (*Tetranychus urticae*) and bud and shoot web worm (*Elasmopalpus jasminophagus* Hampson) cause heavy damage to flowers which are the commercial products (Reddy *et al*., 1978).

Among these pests the eriophyid mite, *Aceria jasmini* Chann (Acari: Eriophyidae) is one of the serious pest attacking jasmine commercially grown in many parts of south India. The feeding by this mite results in severe malformation of vegetative and floral parts of the plant, leading to serious damage to the crop coupled with heavy yield loss. It causes reduction of flower yield to an extent of 24.17 per cent (Devi *et al*., 2017, Devi and Umapathy, 2014).

At present very little or no information is available on the pest management of Hadagali jasmine and farmers are clueless about the existing pest problem in Hadagali jasmine. As a result, they are following non-scientific mode of pest management practices. This has not only resulted in exorbitant cost on plant protection but also leading to reduction in the quality of the flower. Hence, keeping the above views, the present study was carried for effective management of this mite.

MATERIALS AND METHODS

Field experiment was laid out in Randomized Block Design (RBD) with a plot size of 8' × 8' consisting of four plants in each plot. The experiment was conducted in two cropping seasons during the year 2017 and 2018 at Agricultural Extension Education Centre, Hadagali, Bellary District of Krnataka. Four bushes of Five to six year old *J. auriculatum* were selected for imposing the treatment in farmer's field at Hadagali. The efficacy of 11 treatments inclusive of untreated control was replicated thrice.

After pruning of the bushes during the first fortnight of January and on new flesh came during February, the 200 kilograms of neem cake was applied in shallow circular trenches around the bushes and covered with soil properly. The selected chemicals and bio input treatments were imposed with hand operated knapsack sprayer for two times in a cropping season. These treatments were imposed when a peak infestation of eranial growth was observed. The second spray was taken at 30 days after first spray.

Observations recorded. The incidence of eriophyid mite was recorded regularly on four randomly selected bushes in each plot. The per cent infested leaves with erenial growth was calculated taking the count of the total number of leaves and leaves showing erenial growth in fifteen centimeter length of tagged shoots. The observation of per cent leaves with erenial growth was taken from the top in all four directions. The observations were recorded at one day before and at 3, 7, 12, 15, 20, 25 and 30 days after the imposition of treatments. Similar methodology was followed before and after the treatment during the second season during 2018 also. The data on per cent infestation were subjected to statistical analysis.

RESULTS AND DISCUSSION

The results of the field experiment on evaluation of newer acaricides and biorationals against jasmine eriophyid mite, *A. jasmini* are presented here.

Pooled results of first season 2017: The pooled results of first and second spray of first season conducted during the year 2017 proved that, minimum mean per cent eranial growth was recorded in spiromesifen 240 SC at1.0 ml/l with highest per cent reduction over control (52.38). This was followed by diafenthiuron 50 WP at 1.0 g/l with 48.34 per cent reduction over control. The next best treatment was fenazaquin 10 EC (45.42 % reduction over control) followed by fenpyroximate 5 SC (42.81 %). Among botanicals, neem cake recorded 38.43 per cent reduction followed by commercial neem (34.67 %) over control. The bio agent, *Hirsutella thompsoni* at 1 ml/l proved better (29.28 %) over wettable sulphur (28.88 %) and commercial neem (Table 1, Fig. 1).

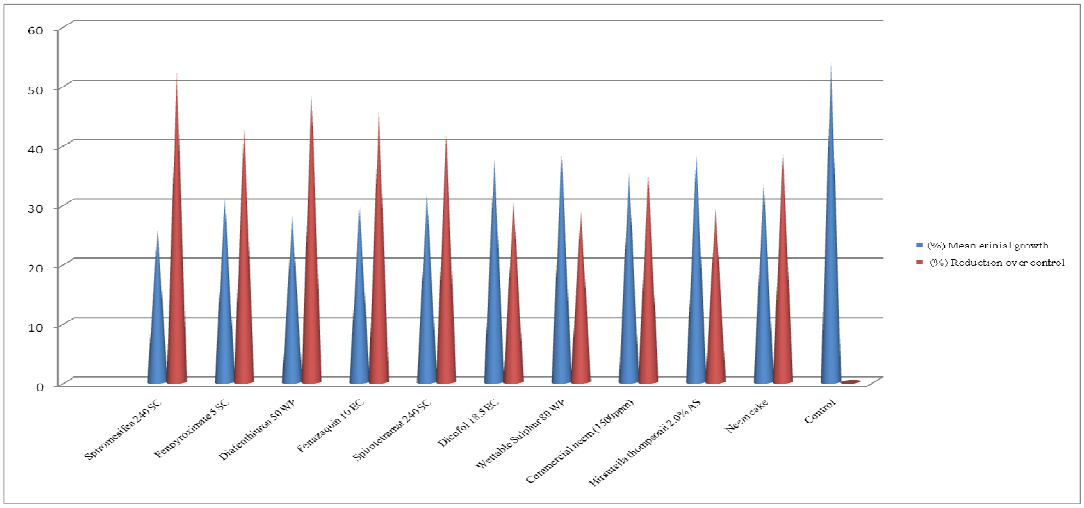

Fig. 1. Management of Eriophyid mite, *Aceria jasmine* on Hadagali jasmine during 2017 (I Season pooled).

Table 1: Management of jasmine eriophyid mite, *Aceria jasmine* on Hadagali jasmine during 2017 (I Season pooled).

Tr. No.	Treatment	Dosage/ litre	Per cent erinial growth								Mean	% Reduction over control
			1 DBS	3 DAS	7 DAS	12 DAS	15 DAS	20 DAS	25 DAS	30 DAS		
T1	Spiromesifen 24 SC	1.0 ml	56.26 (48.60)^{a}	42.94 (40.94)^{b}	31.49 (34.14)^{a}	26.03 (30.68)^{a}	21.45 (27.59)^{a}	11.17 (19.52)^{a}	7.08 (15.44)^{a}	9.43 (17.88)^{a}	25.73	52.38
T2	Fenpyroximate 5 SC	1.0 ml	53.97 (47.28)^{a}	44.29 (41.72)^{bc}	37.26 (37.62)^{bcde}	30.61 (33.59)^{bcd}	26.41 (30.92)^{bc}	24.22 (29.48)^{d}	14.23 (22.16)^{b}	16.22 (23.75)^{b}	30.90	42.81
T3	Diafenthiuron 50 WP	1.0 g	55.27 (48.03)^{a}	44.51 (41.85)^{bc}	33.27 (35.23)^{ab}	27.15 (31.40)^{ab}	21.29 (29.86)^{a}	15.31 (23.04)^{b}	13.39 (21.46)^{b}	13.13 (21.24)^{b}	27.91	48.34
T4	Fenazaquin 10 EC	2.0 ml	52.00 (46.15)^{a}	47.69 (43.67)^{c}	35.84 (36.78)^{abcd}	28.51 (32.27)^{abcd}	24.79 (29.86)^{ab}	18.18 (25.24)^{bc}	12.89 (21.04)^{b}	16.04 (23.61)^{b}	29.49	45.42
T5	Spirotetramat 20 SC	1.0 ml	51.79 (46.03)^{a}	46.22 (42.83)^{bc}	39.00 (38.65)^{cdef}	27.92 (31.89)^{abc}	25.89 (30.58)^{ab}	21.50 (27.62)^{cd}	19.27 (26.04)^{c}	21.41 (27.56)^{c}	31.62	41.48
T6	Dicofol 18.5 EC	2.5 ml	53.01 (46.73)^{a}	46.26 (42.86)^{bc}	39.73 (39.07)^{def}	34.88 (36.20)^{ef}	36.20 (36.99)^{d}	28.54 (32.29)^{e}	27.92 (31.89)^{e}	34.58 (36.02)^{e}	37.64	30.34
T7	Wettable Sulphur 80 WP	3.0 g	54.68 (47.68)^{a}	44.48 (41.83)^{bc}	39.06 (38.68)^{cdef}	36.66 (37.26)^{f}	35.66 (36.67)^{d}	32.16 (34.55)^{f}	30.16 (33.31)^{e}	34.58 (36.02)^{e}	38.43	28.88
T8	Commercial neem (1500 ppm)	3.0 ml	52.44 (46.40)^{a}	46.58 (43.04)^{bc}	41.21 (39.93)^{ef}	32.40 (34.69)^{de}	29.01 (32.59)^{bc}	24.01 (29.34)^{d}	22.40 (28.24)^{cd}	34.38 (35.90)^{e}	35.30	34.67
T9	*Hirsutella thompsonii* 2x10^{8}	1.0 ml	52.52 (46.44)^{a}	47.10 (43.34)^{c}	43.71 (41.39)^{f}	38.60 (38.41)^{f}	36.67 (37.27)^{d}	28.80 (32.46)^{ef}	30.09 (33.27)^{e}	28.23 (32.09)^{d}	38.22	29.28
T10	Neem cake	200 kg/ ac	51.14 (45.65)^{a}	35.09 (36.33)^{a}	34.54 (36.00)^{abc}	31.88 (34.37)^{cde}	30.95 (33.80)^{c}	25.11 (30.08)^{d}	25.83 (30.55)^{de}	31.61 (34.21)^{de}	33.27	38.43
T11	Control	--	52.46 (46.41)^{a}	53.27 (46.88)^{d}	56.93 (48.98)^{g}	54.22 (47.42)^{g}	52.86 (46.64)^{e}	54.95 (47.84)^{g}	52.63 (46.50)^{f}	54.98 (47.86)^{f}	54.04	0.00
	C V (%)		**10.57**	**9.99**	**11.02**	**10.17**	**9.40**	**13.72**	**12.27**	**9.62**		
	C D at 5%		**NS**	**3.23**	**3.93**	**3.43**	**4.16**	**3.21**	**4.07**	**3.29**		
	S. Em. ±		**1.97**	**1.11**	**1.35**	**1.17**	**1.42**	**1.10**	**1.39**	**1.13**		

Note: DBS- Day Before Spray, DAS- Days After Spray
Figures in the parentheses are arcsine transformed values
Mean in the columns followed by the same alphabets do not differ significantly by DMRT (P=0.05)

Pooled results of second season 2018: Pooled results of second season conducted during 2018 (Table 2) proved that, the lowest mean per cent infested leaves were noticed in spiromesifen 240 SC at 1.0 ml/l (26.75) followed by diafenthiuron 50 WP at1.0 gm/l (28.18), fenazaquin 10 EC at 1.0 ml/l (29.12), fenpyroximate 5 EC 1.00 ml/l (31.04) and spirotetramat 20 SC (31.31). However, neem products were on par with each other followed by *H. thompsoni* (37.14 %) and highest mean per cent infested leaves noticed in untreated control (53.99). Among all the treatments, the highest per cent reduction over control registered in spiromesifen 240 SC (50.44) followed by diafenthiuron 50 WP (47.81), fenazaquin 10 EC (46.07) and fenpyroximate 5 EC (42.50) and spirotetramat 20 SC (42.01) compared to rest of the treatments (Fig. 2).

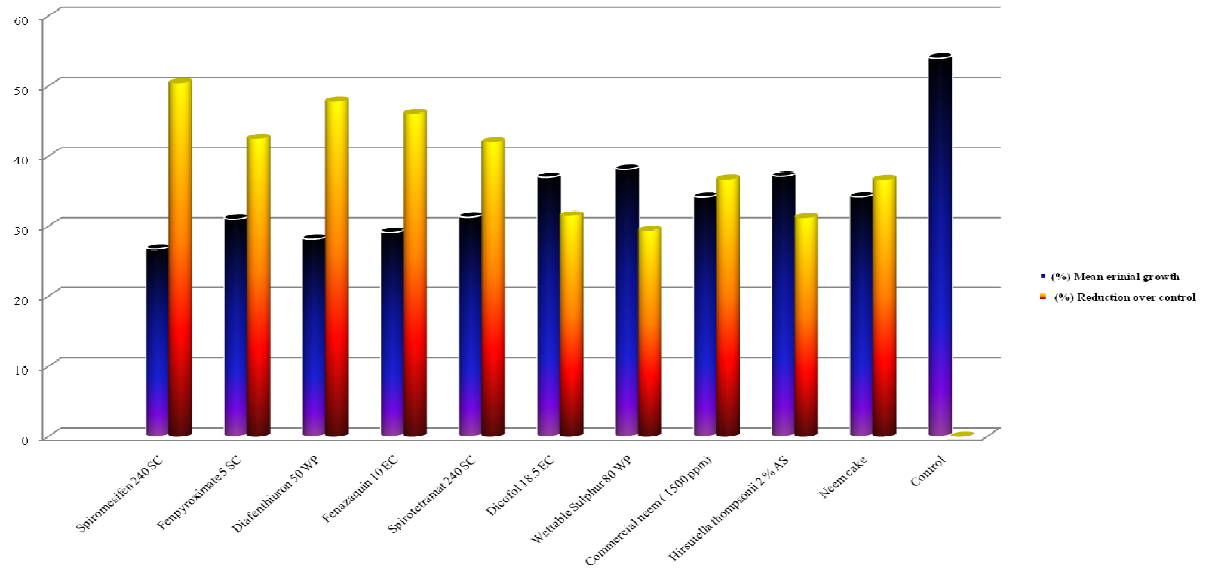

Fig. 2. Management of Eriophyid mite, *Aceria jasmine* on Hadagali jasmine during 20018 (II Season pooled).

Table 2: Management of jasmine eriophyid mite, *Aceria jasmine* on Hadagali jasmine 20018 (II Season pooled).

Tr. No.	Treatment	Dosage/ litre	Per cent erinial growth								Mean	% Reduction over control
			1 DBS	3 DAS	7 DAS	12 DAS	15 DAS	20 DAS	25 DAS	30 DAS		
T1	Spiromesifen 24 SC	1.0 ml	53.31 (46.90)^{a}	50.38 (45.22)^{a}	42.30 (40.57)^{a}	24.40 (29.60)^{a}	19.81 (26.43)^{a}	9.61 (18.06)^{a}	5.60 (13.69)^{a}	8.66 (17.11)^{a}	26.76	50.44
T2	Fenpyroximate 5 SC	1.0 ml	51.02 (45.58)^{a}	49.69 (44.82)^{a}	43.21 (41.10)^{a}	28.98 (32.57)^{abc}	24.77 (29.85)^{abc}	22.66 (28.43)^{de}	12.75 (20.92)^{b}	15.28 (23.01)^{b}	31.04	42.50
T3	Diafenthiuron 50 WP	1.0 g	52.32 (46.33)^{a}	49.02 (44.44)^{a}	41.23 (39.95)^{a}	25.51 (30.34)^{ab}	19.66 (26.32)^{a}	13.76 (21.77)^{ab}	11.90 (20.18)^{b}	12.02 (20.29)^{ab}	28.18	47.81
T4	Fenazaquin 10 EC	2.0 ml	49.05 (44.46)^{a}	49.24 (44.56)^{a}	41.48 (40.09)^{a}	26.88 (31.23)^{ab}	23.16 (28.76)^{ab}	16.62 (24.06)^{bc}	11.40 (19.74)^{b}	15.10 (22.87)^{b}	29.12	46.07
T5	Spirotetramat 20 SC	1.0 ml	48.84 (44.34)^{a}	49.08 (44.47)^{a}	43.84 (41.46)^{a}	26.28 (30.84)^{ab}	24.25 (29.50)^{abc}	19.95 (26.53)^{cd}	17.79 (24.95)^{c}	20.47 (26.90)^{c}	31.31	42.01
T6	Dicofol 18.5 EC	2.5 ml	50.06 (45.03)^{a}	48.45 (44.11)^{a}	42.58 (40.73)^{a}	33.24 (35.21)^{cde}	34.56 (36.01)^{de}	26.99 (31.30)^{ef}	26.43 (30.94)^{e}	33.65 (35.45)^{e}	36.99	31.48
T7	Wettable Sulphur 80 WP	3.0 g	51.73 (45.99)^{a}	48.69 (44.25)^{a}	42.68 (40.79)^{a}	35.02 (36.29)^{de}	34.02 (35.68)^{de}	30.60 (33.59)^{f}	28.67 (32.38)^{e}	33.65 (35.45)^{e}	38.13	29.38
T8	Commercial neem (1500 ppm)	3.0 ml	49.49 (44.71)^{a}	46.63 (43.07)^{a}	42.38 (40.62)^{a}	30.76 (33.69)^{bcd}	27.38 (31.55)^{bc}	22.46 (28.29)^{de}	20.91 (27.21)^{cd}	33.44 (35.33)^{e}	34.18	36.69
T9	*Hirsutella thompsonii* 2x10^{8}	1.0 ml	49.57 (44.75)^{a}	49.35 (44.63)^{a}	43.06 (41.01)^{a}	36.97 (37.45)^{e}	35.03 (36.29)^{e}	27.25 (31.47)^{ef}	28.61 (32.34)^{e}	27.29 (31.49)^{d}	37.14	31.21
T10	Neem cake	200 kg/ ac	48.19 (43.96)^{a}	45.93 (42.66)^{a}	41.49 (40.10)^{a}	30.24 (33.36)^{bcd}	29.31 (32.78)^{cd}	23.56 (29.04)^{de}	24.35 (29.57)^{de}	30.68 (33.63)^{de}	34.22	36.63
T11	Control	—	52.12 (46.22)^{a}	53.63 (47.08)^{a}	55.20 (47.98)^{b}	54.12 (47.36)^{f}	53.03 (46.74)^{f}	55.17 (47.97)^{g}	53.48 (46.99)^{f}	55.18 (47.98)^{f}	53.99	0.00
	C V (%)		**9.91**	**9.11**	**10.67**	**12.78**	**15.16**	**13.97**	**14.32**	**9.31**	—	—
	C D at 5%		**NS**	**6.37**	**5.39**	**4.01**	**4.28**	**3.82**	**3.24**	**3.44**	—	—
	S. Em. ±		**1.95**	**2.18**	**1.85**	**1.37**	**1.47**	**1.31**	**1.11**	**1.18**	—	—

Note: DBS- Day Before Spray, DAS- Days After Spray

Figures in the parentheses are arcsine transformed values; Mean in the columns followed by the same alphabets do not differ significantly by DMRT (P=0.05)

First spray pooled (Two seasons): The pooled analysis of first spray of 2017 and 2018 cropping season (Two seasons) revealed that, among the chemicals spiromesifen 240 SC at 1.0 ml/l performed better at all the spray intervals and confirmed very low mean per cent leaves with eranial growth (24.98) which was was followed by diafenthiuron 50 WP at1.0 gm/l (27.67), fenazaquin 10 EC at 1.0 ml/l (28.60), fenpyroximate 5 EC 1.00 ml/l (29.35) and spirotetramat 20 SC (30.37). Among the botanicals, neem cake (30.86 %) was found better compard to commercial neem (32.44 %) and these were followed by *H. thompsoni* (35.05 %). Again with respect to highest per cent reduction over control spiromesifen 240 SC at 1.0 ml/l (51.54) proved superior followed by rest of the treatments. Highest mean per cent infestation of 51.54 was registered in control (Table 3).

Table 3: Management of jasmine eriophyid mite, *Aceria jasmine* on Hadagali jasmine during 2017 & 2018 (I spray pooled).

Tr. No.	Treatment	Dosage/ litre	Per cent erinial growth								Mean	% Reduction over control
			1 DBS	3 DAS	7 DAS	12 DAS	15 DAS	20 DAS	25 DAS	30 DAS		
T1	Spiromesifen 24 SC	1.0 ml	50.38 (45.22)^{a}	44.53 (41.86)^{a}	28.36 (32.18)^{a}	24.01 (29.34)^{a}	20.57 (26.97)^{a}	11.99 (20.26)^{a}	7.57 (15.97)^{a}	12.40 (20.62)^{a}	24.98	51.54
T2	Fenpyroximate 5 SC	1.0 ml	47.40 (43.51)^{a}	42.95 (40.94)^{a}	31.78 (34.31)^{ab}	29.18 (32.69)^{c}	23.93 (29.28)^{ab}	23.82 (29.21)^{c}	16.22 (23.75)^{bc}	19.57 (26.25)^{b}	29.35	43.05
T3	Diafenthiuron 50 WP	1.0 g	51.43 (45.82)^{a}	43.23 (41.11)^{a}	29.24 (32.73)^{ab}	26.18 (30.77)^{abc}	22.26 (28.15)^{a}	18.40 (25.40)^{b}	14.97 (22.76)^{b}	15.67 (23.32)^{a}	27.67	46.31
T4	Fenazaquin 10 EC	2.0 ml	45.70 (42.53)^{a}	46.07 (42.75)^{a}	30.55 (33.55)^{ab}	27.40 (31.57)^{abc}	23.09 (28.72)^{a}	20.28 (26.76)^{b}	16.15 (23.70)^{bc}	19.52 (26.22)^{b}	28.60	44.52
T5	Spirotetramat 20 SC	1.0 ml	44.76 (41.99)^{a}	45.24 (42.27)^{a}	34.76 (36.13)^{b}	25.05 (30.03)^{ab}	24.24 (29.49)^{ab}	24.76 (29.84)^{cd}	18.20 (25.25)^{c}	25.98 (30.65)^{c}	30.37	41.07
T6	Dicofol 18.5 EC	2.5 ml	49.01 (44.53)^{a}	45.78 (42.58)^{a}	34.05 (35.70)^{ab}	29.65 (32.99)^{c}	33.20 (35.18)^{c}	28.20 (32.07)^{e}	24.86 (29.91)^{d}	32.34 (34.66)^{d}	34.64	32.80
T7	Wettable Sulphur 80 WP	3.0 g	50.57 (45.33)^{a}	44.49 (41.84)^{a}	32.47 (34.74)^{ab}	29.86 (33.12)^{c}	34.34 (35.87)^{c}	32.70 (34.88)^{f}	27.99 (31.94)^{e}	31.92 (34.40)^{d}	35.54	31.04
T8	Commercial neem (1500 ppm)	3.0 ml	47.34 (43.48)^{a}	43.23 (41.11)^{a}	33.13 (35.14)^{ab}	29.24 (32.73)^{c}	28.09 (32.01)^{b}	23.40 (28.93)^{c}	18.51 (25.48)^{c}	36.61 (37.23)^{e}	32.44	37.05
T9	*Hirsutella thompsonii* 2x10^{8}	1.0 ml	47.70 (43.68)^{a}	47.26 (43.43)^{a}	34.68 (36.08)^{b}	30.09 (33.27)^{c}	33.93 (35.62)^{c}	27.47 (31.61)^{de}	31.88 (34.38)^{f}	27.44 (31.59)^{c}	35.05	31.99
T10	Neem cake	200 kg/ ac	45.68 (42.58)^{a}	42.95 (40.96)^{a}	32.28 (34.62)^{ab}	28.61 (32.34)^{bc}	28.15 (32.05)^{b}	24.86 (29.91)^{cd}	18.30 (25.33)^{c}	26.09 (30.71)^{c}	30.86	40.12
T11	Control	—	47.75 (43.71)^{a}	50.06 (45.03)^{a}	53.32 (46.91)^{c}	51.04 (45.60)^{d}	51.35 (45.77)^{d}	51.96 (46.12)^{g}	52.74 (46.57)^{g}	54.10 (47.35)^{f}	51.54	—
	C V (%)		**7.67**	**8.62**	**9.52**	**7.41**	**9.33**	**6.23**	**7.79**	**7.81**	—	—
	C D at 5%		**NS**	**5.54**	**4.62**	**3.17**	**3.91**	**2.33**	**2.50**	**3.05**	—	—
	S. Em. ±		**1.80**	**1.90**	**1.58**	**1.09**	**1.34**	**0.80**	**0.86**	**1.05**		

Note: DBS- Day Before Spray, DAS- Days After Spray

Figures in the parentheses are arcsine transformed values

Mean in the columns followed by the same alphabets do not differ significantly by DMRT (P=0.05)

Second spray pooled (Two seasons): The results of second spray of two cropping seasons (2017 and 2018) confirmed the similar trend as in case of first spray. Lowest mean per cent leaves with eranial growth (24.69) recorded in Spiromesifen 24 SC at 1.0 ml/l which was followed by Diafenthiuron 50 WP at1.0 gm/l (26.52), fenazaquin 10 EC at 1.0 ml/l (28.58), fenpyroximate 5 EC 1.00 ml/l (30.86) and spirotetramat 20 SC (31.06). In case of botanicals, neem cake (33.64 %) proved to be better compard to commercial neem (33.15 %) and these were followed by *H. thompsoni* (39.57 %). Highest per cent reduction over control was seen in spiromesifen 240 SC at1.0 ml/l (62.11) followed by rest of the treatments. Highest mean per cent infestation of 56.70 was registered in control (Table 4).

Table 4: Management of jasmine eriophyid mite, *Aceria jasmine* on Hadagali jasmine during 2017 & 2018 (II spray pooled).

Tr. No.	Treatment	Dosage/ litre	Per cent erinial growth								Mean	% Reduction over control
			1 DBS	3 DAS	7 DAS	12 DAS	15 DAS	20 DAS	25 DAS	30 DAS		
T1	Spiromesifen 24 SC	1.0 ml	59.19 (50.29)^{a}	39.20 (38.76)^{b}	32.47 (34.74)^{a}	26.42 (30.93)^{a}	20.69 (27.06)^{a}	8.79 (17.25)^{a}	5.11 (13.07)^{a}	5.68 (13.79)^{a}	24.69	62.11
T2	Fenpyroximate 5 SC	1.0 ml	57.58 (49.36)^{a}	45.28 (42.29)^{c}	40.59 (39.58)^{bcd}	30.42 (33.47)^{bc}	27.25 (31.47)^{bc}	23.60 (28.70)^{d}	10.76 (19.15)^{b}	11.93 (20.21)^{b}	30.86	50.14
T3	Diafenthiuron 50 WP	1.0 g	56.17 (48.54)^{a}	45.24 (42.27)^{c}	35.15 (36.36)^{ab}	26.48 (30.97)^{a}	18.69 (35.61)^{a}	10.67 (19.06)^{ab}	10.32 (18.74)^{b}	9.48 (17.92)^{b}	26.52	58.55
T4	Fenazaquin 10 EC	2.0 ml	55.35 (48.07)^{a}	47.15 (43.37)^{c}	38.99 (38.64)^{abc}	27.98 (31.94)^{ab}	24.86 (29.91)^{b}	14.52 (22.40)^{bc}	8.13 (16.57)^{ab}	11.62 (19.93)^{b}	28.58	54.57
T5	Spirotetramite 20 SC	1.0 ml	55.88 (48.37)^{a}	45.05 (42.16)^{c}	41.09 (39.87)^{bcd}	29.15 (32.68)^{ab}	25.90 (30.59)^{bc}	16.69 (24.11)^{c}	18.86 (25.74)^{c}	15.89 (23.49)^{c}	31.06	49.75
T6	Dicofol 18.5 EC	2.5 ml	54.06 (47.33)^{a}	44.59 (41.90)^{bc}	43.26 (41.13)^{cd}	38.46 (38.33)^{e}	37.57 (37.80)^{e}	27.33 (31.52)^{de}	29.49 (32.89)^{ef}	34.89 (36.81)^{e}	38.83	34.68
T7	Wettable Sulphur 80 WP	3.0 g	55.83 (48.35)^{a}	42.32 (40.58)^{bc}	43.51 (41.27)^{cd}	41.82 (40.29)^{f}	35.34 (36.47)^{e}	30.06 (33.25)^{e}	30.84 (33.74)^{ef}	36.31 (37.05)^{e}	39.50	33.37
T8	Commercial neem (1500 ppm)	3.0 ml	54.58 (47.63)^{a}	46.20 (42.82)^{c}	47.13 (43.36)^{de}	33.92 (35.62)^{d}	28.29 (32.14)^{c}	23.06 (28.70)^{d}	24.80 (29.87)^{d}	31.20 (33.96)^{d}	36.15	39.88
T9	*Hirsutella thimpsoni* 2×10^{8}	1.0 ml	54.40 (47.52)^{a}	44.80 (42.02)^{bc}	50.59 (45.34)^{e}	45.48 (42.41)^{g}	27.77 (37.92)^{e}	28.58 (32.32)^{e}	26.82 (31.19)^{de}	28.08 (32.00)^{d}	39.57	32.25
T10	Neem cake	200 kg/ ac	53.65 (47.09)^{a}	23.30 (28.86)^{a}	34.65 (36.06)^{ab}	33.51 (35.37)^{cd}	32.11 (34.52)^{d}	23.81 (29.21)^{d}	31.88 (34.38)^{f}	26.20 (36.99)^{e}	33.64	44.75
T11	Control	--	56.84 (48.93)^{a}	57.23 (49.16)^{d}	60.13 (50.85)^{f}	57.30 (49.20)^{h}	54.54 (44.61)^{f}	58.17 (49.70)^{f}	53.36 (46.93)^{g}	56.06 (48.48)^{f}	56.70	--
	C.V. (%)		**7.47**	**6.11**	**7.63**	**6.13**	**5.97**	**11.07**	**11.51**	**8.29**	--	--
	CD at 5%		**NS**	**3.08**	**4.62**	**3.11**	**2.65**	**3.80**	**3.74**	**2.99**	--	--
	S. Em. ±		**2.04**	**1.30**	**1.58**	**1.06**	**0.91**	**1.30**	**1.29**	**1.03**		

Note: DBS- Day Before Spray, DAS- Days After Spray
Figures in the parentheses are arcsine transformed values
Mean in the columns followed by the same alphabets do not differ significantly by DMRT (P=0.05)

Pool of first and second sprays (Two seasons): Pooled results of first and second spray of two seasons conducted during the year 2017 and 2018 (Table 35) proved that, the lowest mean per cent infested leaves was noticed in spiromesifen 240 SC at1.0 ml/l (24.84) followed by diafenthiuron 50 WP at1.0 g/l (27.10), fenazaquin 10 EC at 1.0 ml/l (28.59), fenpyroximate 5 EC 1.00 ml/l (30.11) and spirotetramat 20 SC (30.72) whereas, standard check dicofol 18.5 EC at 2.5 ml/l found less effective (36.73 %) among all acaricides. Among botanicals, neem cake proved effective (32.25 %) to that of commercial neem (34.30 %) which was followed by *H. thompsoni* (37.31%)and in untreated control (54.12). The highest per cent reduction over control was recorded in spiromesifen 240 SC at 1.0 ml/l (54.11) followed by diafenthiuron (49.93), fenazaquin (47.18) and fenpyroximate (44.37) and spirotetramat (43.24) (Table 5, Fig. 3).

Yield of flower: Due to its long harvesting nature the yield of flowers in different treatments was taken for the whole flowering season to know the possible effect of these acaricides and biorationals on the flower yield. Impact of acaricides and bio-rationals application on flower yield of jasmine revealed that, all the treatments were significantly superior over the untreated check (Table 5). The highest yield was recorded in spiromesifen 240 SC (6903.67 kg/ha) followed diafenthiuron 50 WP at 1.0 g/l (6856.33 kg/ha), fenazaquin 10 EC at 1.0 ml/l (6353.35 kg/ha), fenpyroximate 5 EC 1.00 ml/l (6124.32 kg/ha) and spirotetramat 20 SC (5428.33 kg/ha) whereas, standard check dicofol 18.5 EC at 2.5 ml/l was found less effective (4654.67 kg/ha). However, lowest yield of 2647.67 kg/ha was recorded in untreated control (Fig 3).

Table 5: Management of jasmine eriophyid mite, *Aceria jasmine* on Hadagali jasmine during 2017 and 2018 (Pooled*).

Tr. No.	Treatment	Dosage/ litre	Per cent erinial growth								Mean	% Reduction over control	Flower Yield (Kg/ha)
			1 DBS	3 DAS	7 DAS	12 DAS	15 DAS	20 DAS	25 DAS	30 DAS			
T1	Spiromesifen 24 SC	1.0 ml	54.79 (47.75)^{a}	41.86 (40.32)^{b}	30.41 (33.47)^{a}	25.22 (30.14)^{a}	20.63 (27.01)^{a}	10.39 (18.80)^{a}	6.34 (14.59)^{a}	9.04 (17.50)^{a}	24.84	54.11	6903.67
T2	Fenpyroximate 5 SC	1.0 ml	52.49 (46.43)^{a}	44.11 (41.62)^{b}	36.19 (36.98)^{bcde}	29.80 (33.08)^{bc}	25.59 (30.39)^{bc}	23.44 (28.96)^{cd}	13.49 (21.55)^{b}	15.75 (23.38)^{c}	30.11	44.37	6124.33
T3	Diafenthiuron 50 WP	1.0 g	53.80 (47.18)^{a}	44.23 (41.69)^{b}	32.20 (34.57)^{ab}	26.33 (30.87)^{a}	20.47 (26.90)^{a}	14.54 (22.41)^{b}	12.64 (20.83)^{b}	12.57 (20.77)^{b}	27.10	49.93	6856.33
T4	Fenazaquin 10 EC	2.0 ml	50.53 (45.30)^{a}	46.61 (43.06)^{b}	34.77 (36.13)^{abcd}	27.69 (31.75)^{ab}	23.97 (29.32)^{b}	17.40 (24.65)^{b}	12.14 (20.39)^{b}	15.57 (23.24)^{c}	28.59	47.18	6353.33
T5	Spirotetramat 20 SC	1.0 ml	50.32 (45.18)^{a}	45.14 (42.21)^{b}	37.93 (38.01)^{cdef}	27.10 (31.37)^{a}	25.07 (30.04)^{b}	20.72 (27.08)^{c}	18.53 (25.50)^{c}	20.94 (27.23)^{d}	30.72	43.24	5428.33
T6	Dicofol 18.5 EC	2.5 ml	51.54 (45.88)^{a}	45.19 (42.24)^{b}	38.65 (38.44)^{def}	34.06 (35.70)^{d}	35.38 (36.50)^{e}	27.76 (31.80)^{e}	27.18 (31.42)^{de}	34.11 (35.74)^{f}	36.73	32.13	4654.67
T7	Wettable Sulphur 80 WP	3.0 g	53.20 (46.84)^{a}	43.40 (41.21)^{b}	37.99 (38.05)^{cdef}	35.84 (36.77)^{de}	34.84 (36.17)^{e}	31.38 (34.07)^{f}	29.41 (32.84)^{e}	34.11 (35.74)^{f}	37.52	30.67	4524.33
T8	Commercial neem (1500 ppm)	3.0 ml	50.96 (45.55)^{a}	44.71 (41.96)^{b}	40.13 (39.31)^{ef}	31.58 (34.19)^{c}	28.19 (32.07)^{cd}	23.23 (28.82)^{cd}	21.65 (27.73)^{c}	33.91 (35.61)^{f}	34.30	36.63	4325.33
T9	*Hirsutella thompsonii* 1X10^{8}	1.0 ml	51.05 (45.60)^{a}	46.03 (42.72)^{b}	42.63 (40.76)^{f}	37.79 (37.93)^{e}	35.85 (36.78)^{e}	28.02 (31.96)^{e}	29.35 (32.80)^{e}	27.76 (31.79)^{e}	37.31	31.06	4137.67
T10	Neem cake	200 kg/ ac	49.66 (44.81)^{a}	33.12 (35.14)^{a}	33.47 (35.35)^{abc}	31.06 (33.87)^{c}	30.13 (33.29)^{d}	24.34 (29.56)^{d}	25.09 (30.06)^{d}	31.15 (33.92)^{f}	32.25	40.41	3635.33
T11	Control	—	52.29 (46.31)^{a}	53.64 (47.09)^{c}	56.73 (48.87)^{g}	54.17 (47.39)^{f}	52.95 (46.69)^{f}	55.06 (47.90)^{g}	53.05 (46.75)^{f}	55.08 (47.92)^{g}	54.12	—	2647.67
	C V (%)		**8.28**	**10.25**	**9.31**	**14.68**	**11.82**	**13.06**	**9.81**	**12.41**			**9.46**
	C D at 5%		**NS**	**3.32**	**3.44**	**2.19**	**2.52**	**2.53**	**2.84**	**2.41**			**682.03**
	S. Em. (±		**1.34**	**1.14**	**1.18**	**0.75**	**0.86**	**0.87**	**0.97**	**0.83**			**233.66**

Note: DBS- Day Before Spray, DAS- Days After Spray
Figures in the parentheses are arcsine transformed values
Mean in the columns followed by the same alphabets do not differ significantly by DMRT (P=0.05), *Mean of four sprays.

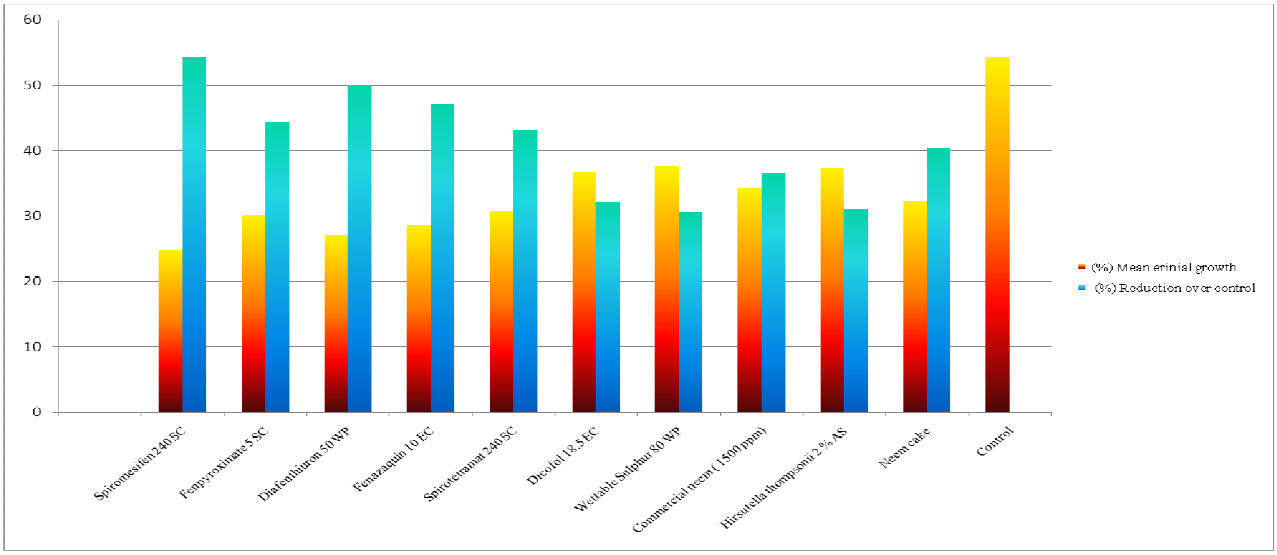

Fig. 3. Management of Eriophyid mite, *Aceria jasmine* on Hadagali jasmine during 2017 and 2018 (Two seasons Pooled).

These findings of effectiveness of acaricides are in close confirmatory with results of Vinoth *et al.* (2009) who reported the foliar application of profenophos at 2 ml/l recorded the higher per cent reduction of eggs of mites (77.52) and mites (80.52) and was closely followed by spiromesifen at 0.7 ml/l which recorded the per cent reduction of eggs (77.38) and mites (80.38), respectively. Apart from these two chemicals the jasmine eriophyid mite population was effectively controlled by the application of newer acaricides *viz.*, diafenthiuron (0.1 %) and bromoprophylate (0.1 %) to the extent of 85 and 70 per cent, respectively. This clearly shows that, chemicals namely spiromesifen and diafenthiuron are very effective in controlling of eriophyid mite in jasmine.

Similarly, Selvaraj *et al*. (2018) reported that abamectin and spiromesifen can be recommended along with other acaricides namely fenpyroximate and hexythiazox on rotation basis under high infestation for effective management and to delay resistance development of *A. jasmini* in field condition. Whereas, Mallapur and Kubsad (2000) confirmed that more than 90 per cent of jasmine branches were affected with eriophyid mite under untreated control, whereas, in protected condition only 50 per cent of branches were infested with eriophyid mite.

In the present study, on the performance of botanicals like neem cake (at 200 kg /ac) and commercial neem were comparatively better than dicofol and wettable sulphur. These findings are in close confirmation with the reports of Rani and Mohan (1994) who stated that, soil application of neem cake at 100 gram per plant and spraying of neem oil at 2 per cent significantly checked the damage of gall mite, *A. jasmini* on *J. auriculatum.* Similarly, Umapathy and Rajendran (1999) reported the application of granular insecticides and neem cake @ 250 kg with neem oil 3 per cent foliar spray controlled *A. jasmini* on jasmine *J. auriculatum.* Further, soil application of neem cake at 250 kg per hectare combined with foliar application of NSKE 10 per cent was as effective as granular insecticides applied at their higher dose (2.0 kg a.i./ha). Also Devi *et al*. (2015) reported that propargite at 0.5 ml/l effectively reduced the mites population followed by abamectin at 0.3 ml / l and neem oil at 30 ml /l. Therefore, neem oil is also working well in the field against eriophyid mite.

Similarly, Devi *et al*. (2015) studied the efficacy of newer insecticides with neem oil against *A jasmini* in *J auriculatum* by spraying two times at fifteen days intervals. Amongst the treatments in first spray, the propargite at 0.5 ml/l effectively reduced the mites population preceded by abamectin at 0.3 ml/l and neem oil at 30 ml/l. In second spray abamectin at 0.3 ml/l followed by neem oil at 30 ml/l and propargite at 0.5 ml/l effectively reduced the mite population.

In conclusion the experimental results with respect to the experiment conducted, among the various acaricides and biorationals tested against eriophyid mite, spiromecifen 240 SC at 1.0 ml per litre provided better control of mite with highest flower yield of 6903.67 kg/ ha followed by diafenthiuron 50 WP at 1.0 gm/l, fenazaquin 10 EC at 1.0 ml/l, and fenpyroximate 5 EC at 1 ml/l.

(a) Infestation in field (b) Infestation on shoots

(c) Infestation on leaves (d) Infestation on terminal shoots

Plate 1. Incidence of eriophyid mite, *A. jasmini on* jasmine.

CONCLUSION

In conclusion the experimental results with respect to the experiment conducted, among the various acaricides and biorationals tested against eriophyid mite, spiromecifen 240 SC at 1.0 ml per litre provided better control of mite with highest flower yield of 6903.67 kg/ ha followed by diafenthiuron 50 WP at 1.0 gm/l, fenazaquin 10 EC at 1.0 ml/l, and fenpyroximate 5 EC at 1 ml/l.

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Conflict of Interest. Nil.

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