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Evaluation of certain botanicals and acaricides on management of *Tetranychus cinnabarinus* in Rose

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Abstract
An investigation on "Evaluation of certain botanicals and acaricides on management of *Tetranychus cinnabarinus* in Rose" were carried out in the experimental farm, Department of Horticulture as well as in the Department of Entomology, Assam Agricultural University, Jorhat during 2012 and 2013. Carmine red spider mite, *Tetranychus cinnabarinus* boisduval was identified as the phytophagous mite in rose infesting the crop throughout the year. Evaluation of acaricides *viz*., profenofos 50EC (250g a.i./ha) and spiromesifen 240 SL (80g a.i./ha) and botanicals *viz*., bionol (10ml/l), pestoneem (3ml/l and 5ml/l) and eliminix (0.2%, 0.3% and 0.4%) were found effective in controlling the rose plants, against the carmine red spider mite, *T. cinnaberinus*, a maximum of 89.44% and 97.63% reduction was observed by the treatment Spiromesifen 240 SL after the 7th day of 1st and 2nd spraying of treatments during 2012-2013 which was at par with profenofos 50 EC (250g a.i./ha), eliminix (0.4%) and pestoneem (5ml/l). On the other hand, bionol (10ml/l) showed the lowest result in reduction of mites which was 40.83% and 46.63% after the 7th day of 1st and 2nd spraying of treatments during 2012 -2013, respectively. While other treatments were at par in controlling the mite population.

Keywords: *Tetranychus urticae*, rose, management

1. Introduction
Rose is a natural beauty and is universally acclaimed as the Queen of Flowers. It is a woody perennial plant under genus *Rosa*, within the family Rosasea. The genus *Rosa* contains about 150 species only 7 have contributed to the development of modern cultivars resulting in a narrow genetic background (Udea, 1994) [9]. They form a group of plants that are erect shrubs, climbing or trailing with stems that are often armed with sharp prickles. It is one of the oldest of fragrant flowers to be cultivated by man which occupies a pre-eminent place amongst the flowers. Rose flowers vary in size and shape and are usually large and showy with different colours. The exquisite shape, different sizes, bewitching colours and most delightful fragrance has made its importance in using it in a varied ways. The various ways in which they are used are cut flowers, garden display, potted plants etc. They can also be used in making perfume and allied products. Rose water is an important commercial product obtained from rose petals. Petals of rose are preserved for direct consumption by making gulkand. It is considered both as tonic and laxative (Rode and Ogale, 1984) [7]. It is also used as a source of vitamin.

The carmine spider mite, *T. cinnabarinus* is an extremely polyphagous plant mite and is described as a serious pest attacking vegetables, flowers, fruits, pulse crops, cotton, jute, tea and ornamental crops. (Cakmak *et al*., 2005) [2]. The mite species is associated with more than 120 host plant species (Biswas *et al.* 2004) [1]. Under favourable conditions Tetranychid mites increase in the population giving rise to outbreaks. Moreover, widespread use of insecticides destroys spider mite predators which are generally more susceptible than their prey. One of the major problem in control of Tetranychid mites is its ability to rapidly develop resistance to many important acaricides after only a few applications. (Nauen *et al*., 2001) [5]. So various natural bioactive products with acaricidal activity (botanicals, microbial pesticide, essential oils, mycopesticides) have become important alternatives to synthetic acaricides (Copping and Duke, 2007) [4]. So, keeping in view the above facts, the present investigate "Evaluation of certain botanicals and acaricides on management of *Tetranychus cinnabarinus* in Rose" was carried out.

2. Materials and Methods

The experiment was carried out in the experimental farm, Department of Horticulture as well as in the Department of Entomology, Assam Agricultural University, Jorhat during 2012 and 2013.

2.1 Evaluation of acaricides and certain botanicals.

The experiment was conducted to assess the efficacy of the different acaricides and botanicals namely profenophos (50 EC), spiromesifen (240 SL), bionol, pestoneem and eliminix
.

2.2 Layout of the experiment

Design : CRD
Variety : Rose: First Red
Number of treatments : 9
Number of replications : 3
Number of pots : 27

2.3 The treatments details

Treatment Symbol	Treatments	Concentration
T_1	Profenofos 50 EC	250g a.i./ha
T_2	Spromesifen 240SL	80g a.i./ha
T_3	Bionol	1.0%
T_4	Pestoneem	0.3%
T_5	Pestoneem	0.5%
T_6	Eliminix	0.2%
T_7	Eliminix	0.3%
T_8	Eliminix	0.4%
T_9	Control	---

The dose of commercial acaricides are taken as gm a.i./ha whereas for botanicals per cent concentration of doses were considered to justify the experimental results with the previous works.

2.4 Application of treatments

All the treatments were applied on the potted plants with hand sprayer. Spraying was properly maintained so as to prevent drift of acaricidal spray to other pots. First spray was done at the first appearance of the symptoms with sufficient number of mites/leaf. The sprayer was washed thoroughly prior to the application of each treatment.

2.5 Sampling and method of observation

To evaluate the effect of foliar spray of various treatments on the population of mites, from each pot 3 randomly selected leaves from the upper, middle and lower canopy were plucked and held in separate polythene bags which were properly labeled and brought to the laboratory for counting mite population under a steriozoom binocular microscope at 4X magnification as shown in Figure 1. The mite population was counted at one day before spraying and 1, 3 and 7 days after spraying (DAS). The data so obtained on mite count were summed up and converted to number of mite per leaf basis. Data so obtained were then statistically analyzed using fisher test so as to compare the effectiveness of acaricides against mite. The yield of ripe fruit of tomato/pot was estimated in kilograms.

2.6 Estimation of reduction or increase in two-spotted mite population

To estimate the reduction or increase in two-spotted mite population, data that were observed on 1, 3, 5 and 7 days after spraying were deducted from the pre-spraying count data and converted into percentage by the following formulae:

Reduction (-)/increase(+)=

$$\frac{\text{Number of mites at pre spraying count - Number mites at 1, 3, 5, 7 DAS}}{\text{Number of mites at pre spraying count}}$$

2.7 Statistical Analysis

All the data were analyzed statistically. Significance of variance due to treatment effect was determined by calculating the respective 'F' values (Panse and Sukhatme, 1995) [6].

The Standard Error (SE) of difference of mean was calculated by using the following formula:

$$SEd\pm = \sqrt{\frac{2 \times \text{Error mean square}}{\text{Number of replications}}}$$

To find out the significance of mean difference amongst the treatments critical difference (CD) was calculated by multiplying the standard error of difference of means with appropriate table value of 't' at 5 per cent level of probability (Panse and Sukhatme, 1995) [6].

CD = SED ± x 't' (at 5%) for error degree of freedom.

3. Results

3.1 Evaluation of acaricides and botanicals against *T. cinnabarinus* attacking rose

Trials were conducted during 2012 and 2013 to evaluate the efficacy of acaricides *viz*., profenofos 50EC (250g a.i./ha) and spiromesifen 240 SL (80g a.i./ha) and botanicals *viz*., bionol (1.0%), pestoneem (0.3% and0.5%) and eliminix (0.2%,0.3% and 0.4%) against the *T. cinnabarinus* in rose. Pre-treatment count of the mite population was made one day before spraying and post treatment counts were made at one, three, five and seven days after the spraying of treatments.

3.1.1 Population count of carmine red spider mite, *T. cinnabarinus* in rose one day before first spraying of treatments, 2012

The highest mean no of mites recorded was 43.33 mites per leaf and the lowest was 31.66 mites per leaf when counted from each potted rose plants, one day before treatment as shown in Table 1 and Figure 2.

3.1.2 Efficacy of acaricides and botanicals on the *T. cinnabarinus* population in rose after first spraying, 2012

Data were recorded and pooled after the first spraying during 2012. The results presented in Table 1 and Figure 3 revealed that the mite population was reduced significantly by the treatments and it differs from the control. Spiromesifen 240 SL (80g a.i./ha) and profenofos 50EC (250g a.i./ha) were at par in reduction of mite population with 29.75 and 28.21 per cent, respectively while the lowest reduction was observed in bionol (1.0%) that recorded only 10.5 per cent mite reduction.

The effect of the treatments were observed in the third day after spraying which revealed that spiromesifen 240 SL (80g a.i./ha) gave the best result reducing 57.63 per cent of the mite population. It was followed by profenofos 50EC (250g a.i./ha) that recorded 46.61 per cent reduction of mites. Eliminix (0.4%) and pestoneem (0.5%) was at par that recorded 35.00 and 29.13 per cent, respectively. The lowest effective treatment was bionol (1.0%) that recorded 19.61 per cent reduction of mite population, Table1.

After five days of treatments significant difference among the treatments were noticed in the reduction of mite population as

presented in Table 1. Spiromesifen 240 SL (80g a.i./ha) remain superior over the other treatments and recorded a reduction of 73.13 per cent. This was followed by profenofos 50EC (250g a.i./ha), reducing 65.49 per cent of mite population, eliminix (0.4%) and also pestoneem (0.5%) that gave a reduction of 52.36 and 47.08 per cent, respectively. While the lowest was recorded by bionol(1.0%) that gave a reduction of 32.91 per cent and was at par with eliminix (0.2%), pestoneem (0.3%) and eliminix (0.3%) that recorded 34.91, 36.52 and 36.42 per cent, respectively.

The perusal of data in Table 1 recorded at the seven days of treatment revealed that all the treatments were found significantly superior over control in reduction of mite population. Spiromesifen 240 SL (80g a.i./ha) maintained its superiority by recording the maximum reduction in mite population of 89.44 per cent and was at par with profenofos 50EC (250g a.i./ha) that recorded 84.6 per cent reduction of mite population. Eliminix (0.4%) stood next to it and was at par with pestoneem(0.5%) with 62.05 and 52.95 per cent, respectively. However bionol (1.0%) stood to be the lowest effective treatment that reduced 40.83 per cent mite population and was also at par with eliminix (0.2%), eliminix (0.3%) and pestoneem (0.3%) that recorded 44.43, 45.52 and 45.43 per cent, respectively.

3.1.3 Population count of carmine red spider mite, *T. cinnabarinus* in rose one day before second spraying of treatment, 2013

One day before treatment, the mites were counted from each potted rose plants and the highest mean no of mites recorded was 57.5 mites per leaf and the lowest was 34.66 mites per leaf, Table 2.

3.1.4 Efficacy of certain acaricides and botanicals on the *T. cinnabarinus* population in rose after second spraying, 2013

After the second spraying of the acaricides and botanicals against the mite population in 2013, it was found that spiromesifen 240 SL (80g a.i./ha) was the most effective in reduction of mite population presented in Table 2 which gave a reduction of 48.88 per cent after one day of spraying of treatments. Profenofos 50EC (250g a.i./ha) resulted in 33.40 per cent reduction in mite population. This was followed by eliminix (0.4%) which was also at par with pestoneem (0.5%) that showed 20.89 and 20.65 per cent, respectively.

The data presented in Table 2 also showed that after three days of second spraying all the treatments were found superior over the control in reduction of mite population. The maximum reduction was observed in spiromesifen 240 SL (80g a.i./ha) that gave 63.53 per cent reduction of mite population followed by profenofos 50EC (250g a.i./ha) with 35.6 percent reduction. Eliminix (0.4%) resulted 33.81 per cent population reduction. On the other hand, bionol (1.0%) showed the lowest reduction of 21.26 per cent and was at par with eliminix (0.3%), eliminix (0.2%) and pestoneem (0.3%) with 21.68, 22.74 and 25.37 per cent reduction, respectively.

Likewise, after five days of the second spraying as presented in Table 2, all the treatments were found superior over control. Spiromesifen 240 SL (80g a.i./ha) maintained its superiority over other treatments in reduction of mite population by 93.61 percent. Then the next effective treatment was profenofos 50EC (250g a.i./ha) that resulted in 61.86 per cent of reduction of mite population. It was also at par with eliminix (0.4%) and pestoneem (0.5%) that resulted in 54.63 and 46.76 per cent reduction of mite population, respectively. However, bionol (1.0%) resulted in 37.01 per cent reduction and was at par with eliminix (0.2%), eliminix (0.3%) and pestoneem (0.3%) that gave 37.77, 39. 99 and 40.08 per cent reduction of mite population.

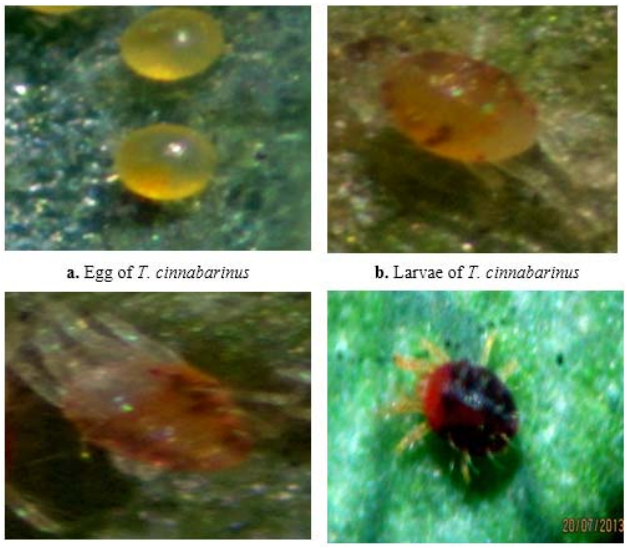
The results presented in Table 2 revealed that after seven days of spraying the treatments, spiromesifen 240 SL (80g a.i./ha) proved to be the most effective treatment which gave 97.63 per cent reduction of mite population. Profenofos 50EC (250g a.i./ha) stood next to spiromesifen and gave 83.47 per cent reduction while eliminix (0.4%) resulted in 67.6 per cent reduction of mite population. The least effective treatment was bionol (1.0%) that gave a reduction of 46.63 per cent and was at par with eliminix (0.2%), eliminix (0.3%) and pestoneem (0.3%) that recorded 47.08, 51.44 and 52.95 per cent reduction of mite population, respectively.

4. Discussion

It was evident from the present investigation that all the acaricides *viz*., profenofos 50EC (250g a.i./ha) and spiromesifen 240 SL (80g a.i./ha) and botanicals *viz*., bionol (1.0%), pestoneem (0.3% and 0.5%) and eliminix (0.2%, 0.3% and 0.4%) were found effective in controlling the *T. cinnabarinus* in rose.

The *T. cinnabarinus* population in rose was also effectively controlled by different treatments and spiromesifen 240 SL (80g a.i./ha) was found to be the most effective treatment in reducing the mite population upto 29.75 57.63 73.13 and 89.44 per cent at 1, 3, 5 and 7 days after first spraying, 2012-2013 respectively and was at par with profenofos 50 EC (250g a.i./ha), eliminix (0.4%) and pestoneem (0.5%).

However, bionol (1.0%) showed the lowest reduction of mites with 10.5, 19.61, 32.91 and 40.83 per cent at 1, 3, 5 and 7 days after first spraying, respectively. This was at par with eliminix (0.2%), pestoneem (0.3%) and eliminix (0.3%). After the second spraying, similar results were observed and spiromesifen 240 SL (80g a.i./ha) was the most effective treatment that gave a reduction of 48.88, 63.53, 93.61 and 97.63 per cent at 1, 3, 5 and 7 days after second spraying, respectively. This was also at par with profenofos 50 EC (250g a.i./ha), eliminix (0.4%) and pestoneem (0.5%). On the other hand, bionol (1.0%) was the lowest effective treatment that recorded reduction of 12.63, 21.26, 37.01 and 46.63 per cent of mite population at 1, 3, 5 and 7 days after second spraying, respectively and was at par with eliminix (0.3%), eliminix (0.2%) and pestoneem (0.3%). Chandawat and Sharma (2003) also found similar findings where reduction of 67.60 to 74.03% in *T. cinnabarinus* were observed with two sprays of azadirachtin 1000 ppm (0.01-0.15%) which were equally effective to chemical pesticides *viz*. dicofol (0.037%), profenofos (0.075%) and ethion (0.075%). Similarly, Venugopal *et al.* (2003) evaluated the efficacy of certain acaricides and reported that the acaricides, abamectin and dicofol were found to be significantly superior to all other treatments followed by flufenoxuron and profenofos. However, in an experiment conducted by Shivakumar *et al*. (1999), to evaluate the effect of selected pesticides on *T. cinnabarinus* population, he recorded that dicofol at 0.1% gave the highest mortality of mites where as nimbicidine treatment recorded the lowest mite mortality.



a. Egg of *T. cinnabarinus* b. Larvae of *T. cinnabarinus*

Fig 1: Different life stages of *Tetranychus cinnabarinus*

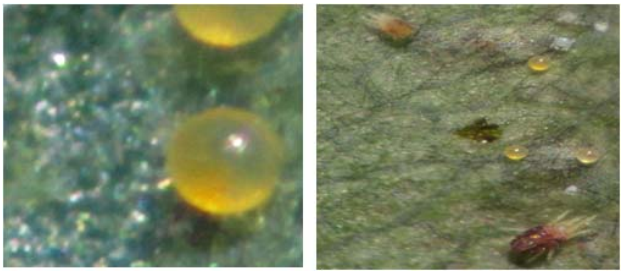


Fig 2: Healthy egg and adult of *T. cinnabarinus* before spraying

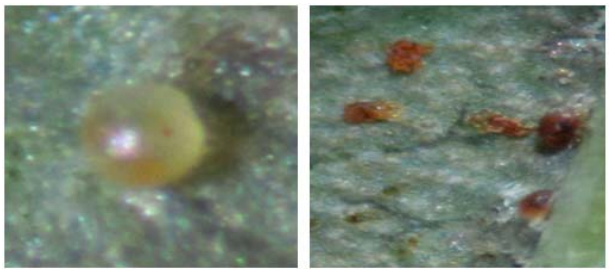


Fig 3: Affected egg and adult of *T. cinnabarinus* due to different treatments after spraying

Table 1: Population reduction of carmine red spider mite spotted mite, *T. cinnaberinus* infesting Rose due to 1ST spray of acaricides and botanicals spray during 2012

Treatment	Dose	Mean number of mites per leaf (Pre-treatment)	Percent reduction of mites per leaf at different days after spraying (post-treatment)			
			1DAS	3DAS	5DAS	7DAS
T_1: Profenophos 50 EC	250 g a.i./ha	31.66	28.21 (32.08)	46.61 (43.05)	65.49 (53.97)	84.6 (66.89)
T_2: Spiromerifen 240SL	80 g a.i./ha	35	29.75 (33.02)	57.63 (49.37)	73.13 (58.76)	89.44 (71.00)
T_2: Bionol	1.0%	30	10.5 (18.91)	19.61 (26.28)	32.91 (35.00)	40.83 (39.70)
T_4: Pestoneem	0.3%	33.33	11.50 (19.82)	24.10 (29.40)	36.42 (37.11)	45.43 (42.36)
T_5: Pestoneem	0.5%	33.33	18.5 (25.48)	29.13 (32.65)	47.08 (43.28)	52.95 (46.66)
T_6: Eliminix	0.2%	36.66	11.80 (20.09)	24.33 (29.53)	34.91 (36.21)	44.43 (41.78)
T_7: Eliminix	0.3%	31.66	11.66 (19.91)	23.19 (28.73)	36.52 (37.17)	45.52 (42.42)
T_8: Eliminix	0.4%	35.83	18.15 (25.18)	35 (36.27)	52.36 (46.32)	62.05 (51.94)
T_9: Control	Water spray	43.33	+6.34 (14.54)	+11.15 (19.46)	+14.88 (22.63)	+17.92 (25.03)
S.Ed(±)		NS	3.41	4.12	5.01	5.88
CD(0.05)		NS	7.17	8.66	10.52	12.35

Data are pooled mean of two years observations
DAS: Days after spray
Figures in the parenthesis are angular transformed values
+ Represents the percent increase and other values represent percent reduction in population

Table 2: Population reduction of carmine red spider mite spotted mite, *T. cinnaberinus* infesting Rose due to 2ND spray of acaricides and botanicals spray during 2013.

Treatment	Dose	Mean number of mites per leaf (Pre-treatment)	Percent reduction of mites per leaf at different days after spraying (post-treatment)			
			1DAS	3DAS	5DAS	7DAS
T_1: Profenophos 50 EC	250 g a.i./ha	34.66	33.40 (35.30)	35.6 (36.69)	61.86 (51.83)	83.47 (65.96)
T_2: Spiromerifen 240SL	80 g a.i./ha	40	48.88 (44.51)	63.53 (52.83)	93.61 (73.35)	97.63 (81.09)
T_2: Bionol	1.0%	40	12.63 (20.79)	21.26 (27.42)	37.01 (37.47)	46.63 (43.05)
T_4: Pestoneem	0.3%	46.5	13.77 (21.72)	25.37 (30.20)	40.80 (39.70)	52.95 (46.66)

T_5: Pestoneem	0.5%	48.16	20.65 (26.99)	28.09 (31.95)	46.63 (43.05)	61.44 (51.59)
T_6: Eliminix	0.2%	53.5	19.3 (26.06)	22.74 (28.45)	39.99 (39.17)	47.08 (43.28)
T_7: Eliminix	0.3%	46.66	13.52 (21.56)	21.68 (27.69)	37.77 (37.88)	51.44 (45.80)
T_8: Eliminix	0.4%	52.66	20.89 (27.13)	33.81 (35.55)	54.63 (47.70)	67.6 (55.30)
T_9: Control	Water spray	57.5	+5.70 (13.81)	+4.99 (12.79)	+11.21 (19.55)	+16.06 (23.58)
S.Ed(±)		NS	4.08	5.90	8.04	6.45
CD(0.05)		NS	8.58	12.41	16.89	13.55

Data are pooled mean of two years observations
DAS: Days after spray
Figures in the parenthesis are angular transformed values
+ Represents the percent increase and other values represent percent reduction in population

5. Conclusion

Due to application of different chemicals, the mite pest has developed resistance against certain acaricides. Therefore, evaluation of newer acaricides and botanicals are essential from time to time. Among the acaricides and botanicals evaluated against *T. cinnabarinus* population where spiromesifen 240 SL (80g a.i./ha) was the best treatment which was also at par with profenofos 50EC (250g a.i./ha), eliminix (0.4%) and pestoneem (0.5%).Therefore, from the present investigation, it can be concluded that organic formulation can be used as an alternative to chemical acaricides and eliminix (0.4%) and pestoneem (0.5%) can be applied as an organic treatment against the mite pest *T. cinnabarinus*.

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