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Suvash Chandra Bala
AINP on Agril. Acarology,
Directorate of Research,
B.C.K.V. Kalyani, Nadia,
West Bengal, India

Correspondence
Suvash Chandra Bala
AINP on Agril. Acarology,
Directorate of Research,
B.C.K.V. Kalyani, Nadia,
West Bengal, India

Population fluctuation of yellow mite, *Polyphagotarsonemus latus*, (Bank) (Acari: Tarsonemidae) infesting chilli and its management in West Bengal

Suvash Chandra Bala

Abstract
The present study was conducted to find out the comparative bio-efficacy of combine product against *Polyphagotarsonemus latus* (Bank) and distribution pattern of yellow mite in chilli at 'D' Block Farm of BCKV, Kalyani, Nadia, West Bengal for consecutive two years 2015-16 to 2016-17 during *Rabi* season. The treatments schedules diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600 g/ha was found the best for controlling yellow mite though, it is statistically at par with the same product when applied @ 500 g/ha. The height yield (4.82 t/ha) was obtained from T_3 i.e. diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600 g/ha followed by its next lower dose (T_2 = diafenthiuron 40.5% + acetamiprid 3.9% WP) @ 500 g/ha (4.83t/ha). Population of yellow mite *Polyphagotarsonemus latus* (Bank) showed positive correlation with maximum temperature and maximum relative humidity whereas; minimum temperature, minimum relative humidity, rainfall and sunshine hour were showed negative correlation.

Keywords: Chilli, yellow mite, population fluctuation, management, diafenthiuron 40.5% + acetamiprid 3.9% WP.

1. Introduction
Among all the different spices crops, chilli (*Capsicum annum* L.) is one of the important crops grown in India and the largest chilli producer country in the world [12, 4]. However, in West Bengal, the leading chilli growing districts are north and south 24 Parganas, Howrah, Hooghly, Nadia, Murshridabad, Malda, Jalpaiguri and Cooch Behar [5]. It is considered as one of the remunerative cash crops to the farmers. But, this crop is infested by a number of pests like yellow mite, *Polyphagotarsonemus latus (*Banks), thrips, *Scirtothrips dorsalis* Hood and aphid, *Myzus persicae* causing extensive yield loss [13]. Observing the damaging scenario in chilli yellow mite *Polyphagotarsonemus latus (*Banks), considered the most notorious and one of the major limiting factors for successful chilli cultivation in West Bengal. Due to infestation can reduce 50-60% yield loss in Indian condition [15, 4, 2]. It may also cause cent percent yield loss under greenhouse condition. Peak population of mite is found November to February [15] and mite population build up at high temperature, lower humidity and less rainfall condition [11]. The mites attack young apical leaves, flower buds and cause curling and crumpling of young developing plant parts resulting shedding of flower buds, flowers and developing fruits [8]. Symptom developed by this mite is prominently distinct as cause typical downward leaf curling of leaf. Keeping in view, the present investigation was carried out to understand the incidence pattern of yellow mite in chilli and bio efficacy of combine molecules against yellow mite under West Bengal condition.

2. Materials and Methods
To study the population fluctuation of yellow mite *Polyphagotarsonemus latus (*Banks), in chilli, seedling was transplanted in the main field during *Rabi* season with the spacing of 30X30 cm at 'D' Block Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal ($22^0$58'52" N; $88^0$26'30"E, 10 m above sea level). One of the popular varieties Suryamukhi was selected for whole experiment. Standard Agronomic practices were followed as per recommendation were followed. Total mite population per leaf was taken five randomly selected plants was recorded at seven days interval (Standard Meteorological Week) during tomato growing season. Data obtained from the experiment have been presented in graphical form and correlation was worked out with mite population and important weather parameters

during the period of investigation. So far as to evaluate the bio-efficacy of combine product Diafenthiuron 40.5% + Acetamiprid 3.9% WP against yellow mite, field was laid out with 21 plots each of measuring 5 x 5 sq. m and chilli seedling were transplanting in experimental field maintaining row to row and plant to plant distance of 30X30 cm and to follow standard agronomic practice. Altogether, there were seven treatments viz.T_1= Diafenthiuron 40.5% + Acetamiprid 3.9% WP@ 400 g/ha, T_2 = Diafenthiuron 40.5% + Acetamiprid 3.9% WP @ 500 g/ha, T_3 = Diafenthiuron 40.5% + Acetamiprid 3.9% WP@ 600 g/ha, T_4= Diafenthiuron @ 600 g/ha, T_5 = Acetamiprid 20 SP @ 100g/ha, T_6= Fenpropathrin 30EC @ 340ml/ha, and T_7= Untreated control. The Diafenthiuron 40.5% + Acetamiprid 3.9% WP was applied at three different doses in two times each at 15 days interval during dawn and dusk by using 500 litres of spray solution per hectare with high volume knapsack sprayer. Each of the treatments was replicated thrice. The first round spray was initiated when mite population crossed the ETL and subsequent sprays were done at 15 days interval. The data of target pests were recorded from randomly selected five plants in each plot. First count was taken one day before first spray and post treatment counts were recorded on 5, 10 and 15 days after spray. For counting mite population per leaves, the leave samples were brought to the laboratory and observation was taken under stereo zoom binocular microscope. The data were subject to analysis after making necessary transformation and expressed on the basis of percent reduction of mite population.

2.1 Statistical Analysis

The data of two years experiments were analyzed by using SPSS Software for analysis of variance following randomized block design with least significant difference (p=0.05) as test criterion.

3. Results and Discussion

3.1. Role of abiotic factors on population fluctuation of *Polyphagotarsonemus latus* (Bank):

Population dynamics: Population of yellow mite *Polyphagotarsonemus latus* first notice in the experimental field during 46th standard metrological week, subsequently the population gradually increased and reached its peak during 9th SMW i, e 05.3.2017 and maintained same trend population up to 12th SMW (Table-1). Correlation between various abiotic factors viz. maximum temperature (r=0.87), maximum relative humidity (r=0.53) were positive correlated with mite *Polyphagotarsonemus latus* whereas, minimum temperature (r=-0.76), minimum relative humidity (r= -0.33), rainfall (r= -0.57), and sunshine hour (r= -0.4) were established negative correlation with mite population (Table-1). However, the activity of mite population in chilli enhanced with the rising of high temperature. However, maximum temperature was significantly correlated with the fluctuation of mite population. The present findings are support the result of earlier investigation [6, 9, 10], they found that a positive correlation was found with maximum temperature and negative correlation was established with minimum temperature, rainfall and sunshine hour.

3.2. Efficacy study against yellow mite (*Polyphagotarsonemus latus*):

Chilli yellow mite, *P. latus* in chilli is considered one of the most notorious pest causing extensive damage throughout the year. It is very difficult to manage due to its capability of rapid multiplication. However, the result obtained from the experiment has been presented in the table 2-3 where showed that the pre-count mite population per leaf was statistically nonsignificant and uniform distribution. Efficacy of diafenthiuron 40.5% + acetamiprid 3.9% WP was noticed after spraying at three different doses viz. 400g, 500g and 600g/ha. Maximum mortality of mite was recorded from diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600g/ha (90.14%) which was statistically at par with diafenthiuron 40.5% + acetamiprid 3.9% WP @ 500g/ha was registered 88.58% mortality at 5 days after spray. The treatment diafenthiuron 40.5% + acetamiprid 3.9% WP @ 400 g/ha was the next best and fenpropathrin 30EC @ 340ml/ha and acetamiprid 20 SP @ 100g/ha revealed comparatively less effective against mite recorded 61.60% and 63.68% mortality respectively at five days after spraying. On the 10th days of spray, less mortality was noticed from fenpropathrin 30EC @ 340ml/ha (41.70%) treated plot which was statistically at with the treatment T_5 i.e acetamiprid 20 SP @ 100g/ha. Whereas, the maximum mortality was found with combine product diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600g/ha (71.81%) followed by same product when applied at the rate of 500g/ha (70.10%) which was statistically at par with each other. A minor decrease in the efficacy of these insecticides was observed at 15 days aftertreatment as compared to 5 and 10 days. However, 15 days after spray, maximum mortality was observed from the treatmentT_3= diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600g/ha (61.07%) followed by diafenthiuron 40.5% + acetamiprid 3.9% WP @ 500g/ha (58.11%) whereas, the less mortality was found from fenpropathrin 30EC @ 340ml/ha (20.03%) treated plots followed by acetamiprid 20 SP @ 100g/ha (23.09%) treated plots. However, the result indicate that the combination product diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600g/ha (74.34%) recorded maximum mean mite mortality followed by same the product when applied @ 500g/ha (72.26%) and @ 400 g/ha (56.05%). During second spray, diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600g/ha was found significantly superior in reducing mite population (83.69%) which was statistically at par with the treatment T_2 i. e diafenthiuron 40.5% + acetamiprid 3.9% WP @ 500g/ha (82.21%) at 5 DAS. Similar result was recorded at 10 and 15 days after spray and result of same trend has been found in case of second year experiment (Table-3). Hence, this product could be considered as most effective acaricide against yellow mite.The finding in accordance with authors [3, 14] they found that diafenthiuron 50 WP was effective against yellow mite and reduced the population bellow the damage level.

3.3. Green chilli yield

The data on green chilli yield revealed that all the treatments were significantly superior over untreated control (Table-4). However, highest mean green chilli yield was harvested from diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600 g/ha (4.82 t/ha) which was statistically at par with diafenthiuron 40.5% + acetamiprid 3.9% WP @ 500 g/ha (4.69 t/ha). The next best yield was obtained from diafenthiuron 40.5% + acetamiprid 3.9% WP @ 400 g/ha (4.08 t/ha) followed by diafenthiuron @ 600g/ha (4.06 t/ha). The treatment acetamiprip 20 SP (3.78 t/ha), fenpropathrin (3.35 t/ha) along with untreated control (2.91 t/ha) were recorded relatively lower yield. Diafenthiuron (0.75g/lt) gave the height yield (6.90 q/ha) in case of chilli [7] this finding support the present investigation.

Table 1: Correlation coefficient among yellow mite population in chilli with weather factors

Weather factors	Correlation (r)	Regression coefficient by (x)
Maximum Temperature (°C)	0.87	0.33
Minimum Temperature (°C)	-0.76	-0.36
Maximum Relative humidity (%)	0.53	0.07
Minimum Relative humidity (%)	0.33	0.54
Bright sunshine(hours)	-0.4	-0.18
Rainfall (mm)	-0.57	-0.01

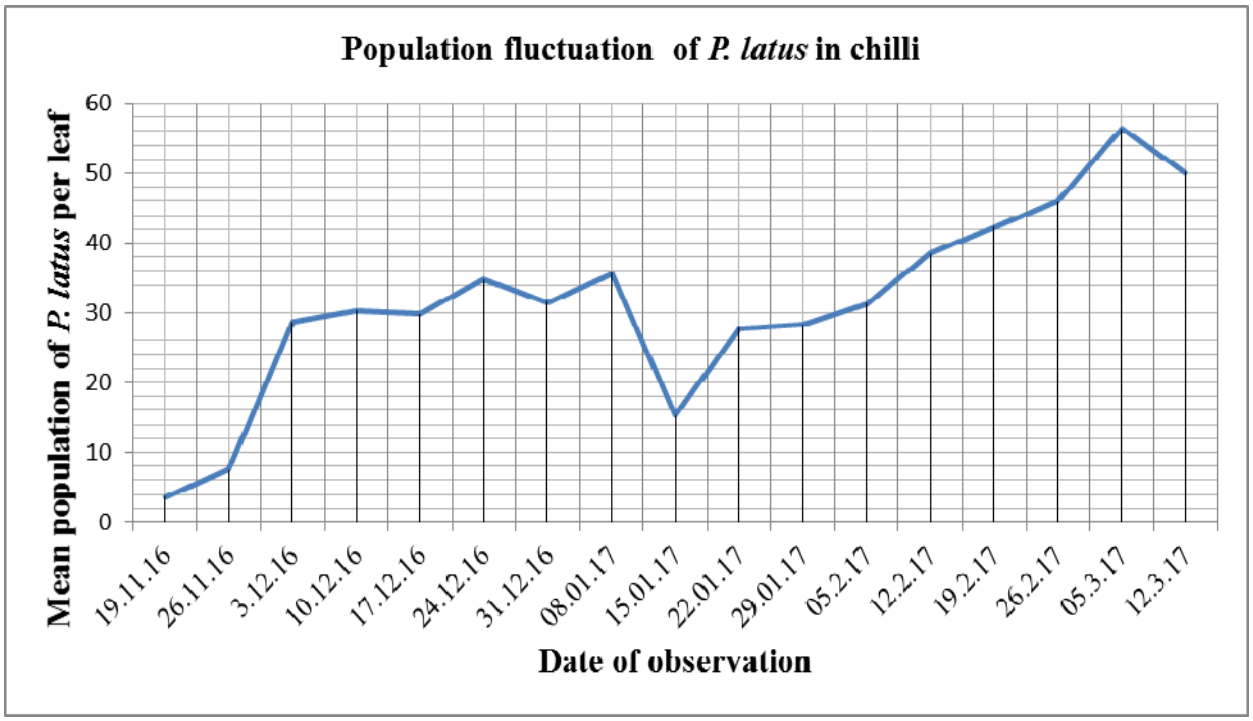

Fig 1: Population fluctuation of *Polyphagotarsonemus latus* (Banks) in chilli

Table 2: Efficacy of Diafenthiuron 40.5% + Acetamiprid 3.9% WP against yellow mites in chilli during first year experiment (2015-16).

Treatment	Dosage g or ml/ha	Pretreated population/leaf	% mortality of mite after 1st round spray				% mortality of mite after 2nd round spray			
			5 DAS	10 DAS	15 DAS	Mean mortality	5 DAS	10 DAS	15 DAS	Mean mortality
T1= Diafenthiuron 40.5% + Acetamiprid 3.9% WP	400	10.67	76.99 (61.68)*	55.04 (48.18)	35.12 (36.64)	56.05	71.43 (58.01)*	64.05 (53.46)	37.43 (38.01)	57.63
T2= Diafenthiuron 40.5% + Acetamiprid 3.9% WP	500	11.33	88.58 (70.70)	70.10 (58.43)	58.26 (49.96)	72.93	82.21 (65.43)	75.68 (60.79)	61.76 (52.10)	73.21
T3= Diafenthiuron 40.5% + Acetamiprid 3.9% WP	600	11.27	90.14 (72.19)	71.81 (58.25)	61.07 (51.69)	74.34	83.69 (66.57)	75.75 (60.84)	63.43 (53.09)	74.29
T4= Diafenthurion 50WP	600	10.53	67.44 (55.51)	47.35 (43.77)	29.42 (33.16)	48.07	70.06 (57.14)	57.24 (49.45)	34.94 (36.63)	54.08
T5= Acetamiprid 20SP	100	10.93	63.68 (53.24)	44.78 (42.29)	23.09 (29.06)	43.85	61.70 (52.06)	49.88 (45.22)	29.69 (33.33)	47.09
T6= Fenpropathrin 30EC	340	10.67	61.60 (52.00)	41.70 (40.52)	20.03 (26.94)	41.11	58.14 (49.98)	43.04 (41.29)	32.56 (35.10)	44.58
T7= Untreated control	---	10.87	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00
S. Em. ±			1.25	1.48	2.21	--	0.64	0.90	1.97	--
CD (0.05)			3.85	4.55	6.81		1.98	2.78	6.06	
CV (%)			0.56	0.86	1.65		0.29	0.49	1.35	

Table 3: Efficacy of Diafenthiuron 40.5% + Acetamiprid 3.9% WP against yellow mites in chilli during second year experiment (2016-17)

Treatments	Dosage (g or ml/ha)	Pretreatment population/leaf	% mortality of mite after 1st round spray				% mortality of mite after 2nd round spray			
			5 DAS	10 DAS	15 DAS	Mean	5 DAS	10 DAS	15 DAS	Mean
T_1 = Diafenthiuron 40.5% + Acetamiprid 3.9% WP	400	14.53	75.04 (60.36)*	61.11 (51.71)	59.41 (50.72)	65.18	73.70 (59.48)*	57.57 (49.64)	45.37 (42.63)	58.88
T_2= Diafenthiuron 40.5% + Acetamiprid 3.9% WP	500	13.93	89.73 (71.78)	72.68 (58.81)	66.79 (55.12)	76.4	88.55 (70.68)	74.06 (59.71)	60.12 (51.13)	74.24
T_3= Diafenthiuron 40.5% + Acetamiprid 3.9% WP	600	15.07	91.43 (73.49)	74.98 (60.32)	69.76 (56.95)	78.72	90.09 (72.14)a	76.31 (61.21)	64.37 (53.65)	76.92
T_4= Diafenthurion 50 WP	600	14.20	76.96 (61.66)	64.71 (53.85)	49.03 (44.73)	62.90	74.74 (60.16)	58.02 (49391)	45.78 (42.87)	58.84
T_5=Acetamiprid 20 SP	100	13.53	55.09 (48.21)	53.01 (47.01)	24.97 (30.31)	44.35	47.86 (44.06)	40.95 (40.08)	27.62 (32.02)	38.81
T_6= Fenpropathrin 30EC	340	14.80	66.34 (54.84)	58.63 (50.26)	41.85 (40.60)	55.60	64.97 (54.01)	50.55 (45.60)	33.75 (35.82)	46.75
T_7= Untreated control	---	15.13	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.0	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.0
S. Em. ±	---	NS	0.63	0.85	0.96	-	1.13	0.98	1.29	-
CD (0.05)	---		1.71	2.63	2.96	-	3.48	3.01	3.96	-
CV (%)	---		0.25	0.45	0.58	-	0.51	0.54	0.84	-

* Values in the parentheses are angular transformed, DAS: Days after spray

Table 4: Cumulative yield of green chilli in t/ha in different treatments (2015-16 &2016-17)

Treatments	Dosage (g or ml /ha)	Yield of green chilli in 1st year t/ha	Yield of green chilli in 2nd year t/ha	Mean of two years green chilli yield
T_1 = Diafenthiuron 40.5% + Acetamiprid 3.9% WP	400	4.18	3.98	4.08
T_2 = Diafenthiuron 40.5% + Acetamiprid 3.9% WP	500	4.83	4.55	4.69
T_3 = Diafenthiuron 40.5% + Acetamiprid 3.9% WP	600	4.85	4.80	4.82
T_4 = Diafenthurion 50 WP	600	4.12	4.00	4.06
T_5 =Acetamiprid 20 SP	100	3.67	3.90	3.78
T_6 = Fenpropathrin 30EC	340	3.28	3.42	3.35
T_7 = Untreated control	---	2.90	2.93	2.91
CD (0.05)		0.35	0.48	-
S. Em. ±		0.12	0.15	
CV (%)		0.66	0.99	

4. Conclusion

These findings indicated that population of yellow mite *Polyphagotarsonemus latus* was first time observed in the experimental field during 46th standard metrological week and reached its peak during 9th SMW i, e 05.3.2017. Correlation between maximum temperature, maximum relative humidity was positively correlated whereas; minimum temperature, minimum relative humidity, rainfall, and sunshine hour were negatively correlated with this mite population. So far as management aspect, the treatments diafenthiuron 40.5% + acetamiprid 3.9% WP @ 600 g/ha was found the best for managing yellow mite population though, it is statistically at par with the same product when applied @ 500 g/ha.

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