Journal of Crop and Weed, 14(1): 195-200 (2018)

Performance evaluation and dose standardization of a new acaricide, Pyridaben 20% WP against red spider mite, *Oligonychus coffeae* Nietener infesting tea under Terai region of West Bengal

B.TUDU, M. CHATTERJEE, [1]S. BASKEY AND [2]G. CHAKRABORTY

Department of Agricultural Entomology, [1] Department of Plant Pathology, Uttar BangaKrishiViswavidyalaya,Pundibari, Cooch Behar, West Bengal,[2] Department of Agricultural Entomology, Bidhan Chandra KrishiViswavidyalaya, Mohanpur-741252, Nadia, West Bengal.

Received : 18-05-2017 ; Revised : 14-03-2018 ; Accepted : 18-03-2018

ABSTRACT

Dooars and Terai regions of West Bengal are famous for its lustrous tea gardens. In these gardens, Oligonychus coffeae Nietner (Acari: Tetranychidae), the red spider mite (RSM), is a major pest of tea (Camellia sinensis) causing menace among the tea growers. Under present situation, RSM can only be satisfactorily managed by the application of acaricides. A new world class acaricide, pyridaben 20 %WP was evaluated against red spider mite (RSM)Oligonychus coffeae Nietner on tea for the first time under terai region of West Bengal along with other standard acaricides viz. propargite and fenpyroximate. Pyridaben 20% WP at the rate of 500 and 625 g ha^{-1} was effective in controlling RSM during two peak seasons (September-October and January-March). The efficacy of Pyridaben 20% WP was significantly superior to the tested standard acaricides, propargite 57 EC @ 1000 ml ha^{-1}) and Fenpyroximate 5 EC (@ 400 ml ha^{-1}). Pyridaben 20 % WP was also found to be relatively safe to natural enemies and was also non-phytotoxic to tea.

***Keywords*:** *Oligonychuscoffeae*, pyridaben 20% WP, tea mite

*Oligonychuscoffeae*Nietner (Acari: Tetranychidae), the red spider mite (RSM), is a major pest of tea (*Camellia sinensis*) in most tea-producing countries. It is one of the most destructive pests in all the tea growing regions of north east India and also a menace to tea production in dooars region of north Bengal. In India, loss in tea yield due to red spider mite may be as high as 75 per cent (Subramaniyam, 1995). It is considered as a dry weather pest. *Oligonychuscoffeae* normally infests the upper surface of mature tea leaves and when the severity of infestation increases they move even to the lower surface of older leaves as well as tender tea shoots. Severe infestation of RSM ultimately leads to defoliation (Selvasundaram and Muraleedharan, 2003). This species breeds throughout the year in northeast India and is considered as a dry weather pest. Now a day, RSM cannot be satisfactorily managed without the application of acaricides. Use of conventional insecticides has led to problems like insecticide induced resistance, and pest resurgence. Keeping in view the severity of the pest, there is a need to evaluate and use relatively safe and effective new world class acaricides for the management of red spider mite in tea. In the present study, pyridaben 20% WP, a new acaricide in India was evaluated to demonstrate its effectiveness and utility against RSM in field conditions in the tea growing regions of North Bengal. Pyridaben (2-tert-Butyl-5-(4-tert-butylbenzylthio) 4 - chlorpyridazin-3(2H)-on) belongs to pyridazionone group of insecticide and have non systemic acaricidal and insecticidal properties with rapid knock down and long residual effect. It shows excellent activity against all developing stages of wide range of phytophagous mites. Biochemically, it inhibits mitochondrial electron transport of complex I. It also found to be compatible with many entomopathogenic fungi like *Beauveria bassiana* when applied for the management of red mite, *Panonychus citri* (Kodandaram *et al*., 2010).

MATERIALS AND METHODS

The experiment was conducted at Coochbehar Tea Estate under terai region of northern part of West Bengal, India during peak incidence of RSM. Randomized Block Design was followed with three replications and seven treatments (Table:1-3).Each replication contains 50 bushes and the shade status was poor in the garden. Mixed Assam clones grown in single hedge planting were sprayed with the test chemical for two seasons, viz. September- October 2013 and April - May, 2014. In both the seasons, two foliar applications of pesticides were done at 25 days interval with knapsack sprayer fitted with hollow-cone nozzle. Pyridaben 20% WP (supplied by M/s. Godrej Agrovet Limited) was evaluated against RSM at four doses *i.e*. 50,75,100 and 125 g a.i ha^{-1}along with standard acaricides *viz*., propargite 57 EC (570 g a.iha^{-1}), fenpyroximate 5 EC (20 g a.i ha^{-1}) as check and untreated control. The fluid was applied with a hand operated knapsack sprayer using a spray volume of 500l ha^{-1}. Water spray was kept as untreated control. Observations on the incidence of the red spider mite were based on the number of motile stages of the mite on ten leaves selected from each of the ten bushes selected

Email: moulitachatterjee@rediffmail.com

previously at random. Observations on pest incidence were taken on 1st, 3rd, 5th, 10th, 15th, 20th and 25th day after application. The data on the pest incidence were then subjected to analysis of variance after transformation wherever needed.

The percent reduction of predatory population (*Amblyseius* sp., *Agistemus* sp.) was worked out based on their number on 10 leaves selected randomly from each of the ten bushes previously selected at random. Observations on the incidence of predators were recorded at 15th days after application. The data on the incidence of predator were then subjected to analysis of variance after transformation wherever needed.

For studying the phytotoxicity, ten bushes were selected at random from each of 50 bushes and the number of leaves showing visual phytotoxicity symptoms (epinasty, hyponasty, leaf tip injury, wilting and vein clearing *etc*.), if any, were recorded. The extent of phytotoxicity was recorded in 0-10 scale.

RESULTS AND DISCUSSION

A. Season I (Post *kharif*: September- October 2013)

1. Bioefficacy(Table -1): In terai region of west Bengal, mite population is found to flourish two times in a year. The first season study was undertaken during post kharif period when mite population reached its ETL. All the insecticide treated plots gave significantly better control of red spider mite compared to the untreated check. The results of this season indicated that pyridaben 20 % WP in all doses were effective in controlling RSM. Pyridaben 20 % WP when applied @ 100 and 125 ga.iha^{-1}showed significant population reduction of RSM even at 25 days after spraying due to its advantageous level of residual effect. The test chemical was significantly superior to the other two conventional acaricidesi. epropargite 57% EC @ 570 g.a.i ha^{-1}and fenpyroximate 5% EC @ 20 g a.iha^{-1}. However the maximum efficacy was recorded in the plots treated with pyridaben 20 % WP @ 125 g a.i ha^{-1} which gave a population reduction of 98.60% at 1DAS, 100% at 3, 5 and 10 DAS, 99.82% at 15 DAS, 96.58% at 20DAS and 97.76% at 25 DAS.

2. Effect on predatory mites (Table -3): Predatory mites found in association with red spider mite of tea were mainly considered for this study. Population of *Amblyseius* sp. and *Agistemus* sp were recorded throughout the entire treatment period. It was observed that pyridaben was relatively safe to all the predatory mites. The percent reduction of their population varied between 5.46- 8.36% whereas it was more than 25% and more than 13% in case of propargite 57% E.C and fenpyroximate 5% EC respectively.

3. Phytotoxicity:No phytotoxic symptoms were found on leaves or any other plant parts in any of the treated plots.

B. Season II (Pre *kharif*: April - May 2014)

1. Bioefficacy(Table-2): The second season or summer season experiment result reveals that pyridaben 20 % WP @ 100g a.iha^{-1}and 125 g a.iha^{-1}had given spectacular reduction in mite population throughout the experimental period and was found to give more than 95% population reduction even after 25days of spraying. Other doses of pyridaben 20% WP also showed good control of mite pest as compared to check molecules propargite 57% EC and fenpyroximate 5 % EC. However most effective result was obtained from experimental plots treated with pyridaben 20% WP @ 125g a.i ha^{-1}. Next day after spraying of pyridaben @ 125g a.i ha^{-1}, 99.60% population reduction was recorded which later increased to 100 % and remain consistent in performance even up to 10 days after spraying (DAS). Even at 25 DAS, pyridaben @125g a.i ha^{-1}was most effective giving 97.79% reduction in mite population followed by 95.37% reduction in case of pyridaben @ 100g a.i ha^{-1}. This was due to the desirable level of residual activity of the test chemical. Propargite 57%EC@ 570 g a.i ha^{-1}and fenpyroximate 5% EC @ 20 g a.iha^{-1}exhibited 35.93% and 59.31% reduction in mite population respectively after 25 DAS .

2. Effect on predatory mites (Table - 4): The predatory mites, *Amblyseius sp.*and *Agistemus sp.* were taken into consideration. The most effective dose of the test chemical i.e pyridaben 20% WP@ 125 g a.i ha^{-1}was recorded to cause 13.23% mortality in case of *Amblyseius sp*.and 13.93% mortality in case of *Agistemus sp*. These mortality percentages were quite low as compared to conventional acaricide propargite 57% EC (> 28 % mortality).

3.Phytotoxicity: No phytotoxic symptoms were found on leaves or any other plant parts in any of the treated plots.

As the test molecule is new in India, availability of literature regarding its use in agriculture as well as horticultural crops are wanting. However, Radhakrishnan *et al*. (2015) evaluated this new acaricide, against red spider mite (RSM) *Oligonychus coffeae* Nietener in the southern tea growing parts of India along with standard acaricides propargite and fenpyroximate. Their experiment result was at per with the present one as pyridaben 20 WP @of 500 and 625 g ha^{-1} was found as most effective in controlling RSM on tea. Previously, Chen XueFen *et al.* (1993) have evaluated the efficacy of this test chemical on tea mite under laboratory condition and have showed that 15% pyridaben gave

Table1: Effect of pyridaben 20% WP against red spider mite *O.coffeae* on tea during September- October,2013

Sl. No.	Treatment	Dose ha^{-1}		Pre-application count of no. of motile stage leaf^{-1}	Reduction of population over control at various days after application (%)						
		g. a.i.	Formulation (gm ha^{-1})		1st	3rd	5th	10th	15th	20th	25th
1.	Pyridaben 20% WP	50.0	250	4.83	92.70	90.18	81.97	76.90	67.65	66.76	57.63
					(74.47)	(72.09)	(64.92)	(61.40)	(55.35)	(54.80)	(49.40)
2.	Pyridaben 20% WP	75.0	375	3.89	96.49	97.28	92.61	81.91	79.57	62.97	55.89
					(80.01)	(81.04)	(74.40)	(64.87)	(63.17)	(52.54)	(48.39)
3.	Pyridaben 20% WP	100.0	500	5.00	99.16	100.00	100.00	100.00	98.61	97.75	95.95
					(84.40)	(85.95)	(85.95)	(85.95)	(83.38)	(81.62)	(79.24)
4.	Pyridaben 20% WP	125.0	625	4.10	98.60	100.00	100.00	100.00	99.82	96.58	97.76
					(82.80)	(85.95)	(85.95)	(85.95)	(85.95)	(79.70)	(81.80)
5.	Propargite 57% EC	570.0	1000	3.76	98.88	98.34	96.65	84.82	75.13	53.69	33.69
					(84.17)	(82.66)	(80.21)	(67.08)	(60.14)	(47.12)	(35.46)
6	Fenpyroximate 5% EC	20.0	400	5.10	97.47	99.53	97.73	91.93	83.83	71.08	55.68
					(81.46)	(85.37)	(81.93)	(73.64)	(66.33)	(57.49)	(48.27)
7.	Control (Untreated Check)	-	-	5.83	-	-	-	-	-	-	-
	SEm(±)			**–**	**2.01**	**1.53**	**1.74**	**1.37**	**1.15**	**1.53**	**1.81**
	LSD(0.05)				**6.20**	**4.73**	**5.36**	**4.21**	**3.53**	**4.72**	**5.57**

Note : Figures in the parenthesis are angular transformed values.

Table 2: Effect of pyridaben 20% WP on red spider mite *O.coffeae* of tea during April- May, 2014

Sl. No.	Treatment	Dose ha^{-1}		Pre-application count of no. of motile stage leaf^{-1}	Reduction of population over control at various days after application (%)						
		g. a.i.	Formulation (gm ha^{-1})		1st	3rd	5th	10th	15th	20th	25th
1.	Pyridaben 20% WP	50.0	250	4.33	93.13	92.99	81.67	77.98	68.39	66.69	59.57
					(75.30)	(75.60)	(64.84)	(62.03)	(55.83)	(54.77)	(50.54)
2.	Pyridaben 20% WP	75.0	375	5.66	97.29	97.63	93.69	82.79	79.99	68.73	59.99
					(79.03)	(81.84)	(75.73)	(65.52)	(63.46)	(56.00)	(50.79)
3.	Pyridaben 20% WP	100.0	500	6.06	98.13	99.99	100.00	100.00	98.93	97.69	95.37
					(82.31)	(89.43)	(90.00)	(90.00)	(82.68)	(82.24)	(78.04)
4.	Pyridaben 20% WP	125.0	625	4.66	99.60	100.00	100.00	100.00	99.29	98.17	97.79
					(86.61)	(90.00)	(90.00)	(90.00)	(85.17)	(82.56)	(82.92)
5.	Propargite 57% EC	570.0	1000	5.33	97.73	97.17	96.69	85.77	76.59	55.57	35.93
					(82.45)	(81.02)	(80.39)	(67.86)	(61.14)	(48.20)	(36.79)
6	Fenpyroximate 5% EC	20.0	400	6.33	97.69	98.97	97.53	92.13	82.89	72.71	59.31
					(82.15)	(85.00)	(80.98)	(74.27)	(65.62)	(58.60)	(50.38)
7.	Control (Untreated Check)	-	-	5.66	-	-	-	-	-	-	-
SEm(±)				**–**	**1.83**	**1.58**	**1.80**	**1.41**	**1.18**	**1.58**	**1.90**
LSD(0.05)					**5.64**	**4.88**	**5.54**	**4.33**	**3.63**	**4.86**	**5.83**

Note : Figures in the parenthesis are angular transformed values.

Table 3: Effect of pyridaben 20% WP on predatory mites during September- October, 2013

Sl. No.	Treatments	Dose ha^{-1}		Pretreatment count (No. of motile stage leaf^{-1})		Reductiono of population over control on 15th day after application	
		g. a.i.	Formulation (g ml^{-1})	*Amblyseius*	*Agistemus*	*Amblyseius*	*Agistemus*
1.	Pyridaben 20% WP	50.0	250	1.15	2.05	5.46 (2.419)	6.19 (2.553)
2.	Pyridaben 20% WP	75.0	375	2.00	1.10	6.28 (2.586)	7.12 (2.733)
3.	Pyridaben 20% WP	100.0	500	1.75	1.85	7.10 (2.721)	8.36 (2.956)
4.	Pyridaben 20% WP	125.0	625	2.15	2.55	12.57 (3.598)	14.55 (3.864)
5.	Propargite 57% EC	570.0	1000	1.55	1.65	28.96 (5.381)	28.79 (5.387)
6.	Fenpyroximate 5% EC	20.0	400	2.55	2.15	13.66 (3.736)	15.48 (3.989)
7.	Control (Untreated Check)	-	-	3.12	2.89	-	-
	SEm(±)					**0.30**	**0.26**
	LSD(0.05)			**NS**	**NS**	**0.915**	**0.815**

Note : Figures in the parenthesis are angular transformed values.

Table 4: Effect of ofpyridaben 20% WP on predatory mites during April- May, 2014

Sl. No.	Treatment	Dose ha^{-1}		Pretreatment count (No. of motile stage leaf^{-1})		Reductiono of population over control on 15th day after application	
		g. a.i.	Formulation (g)	*Amblyseius*	*Agistemus*	*Amblyseius*	*Agistemus*
1.	Pyridaben 20% WP	50.0	250	2.75	2.00	5.73(13.84)	6.97(15.31)
2.	Pyridaben 20% WP	75.0	375	2.00	1.75	6.17(14.37)	6.99(15.33)
3.	Pyridaben 20% WP	100.0	500	3.05	2.25	6.99(15.32)	8.97(17.42)
4.	Pyridaben 20% WP	125.0	625	3.00	2.50	13.23(21.32)	13.93(21.91)
5.	Propargite 57% EC	570.0	1000	2.50	1.75	29.23(32.73)	28.95(32.55)
6.	Fenpyroximate 5% EC	20.0	400	2.75	2.50	12.99(21.12)	14.79(22.61)
7.	Control (Untreated Check)	-	-	2.55	2.00	-	-
	SEm(±)					**0.379**	**0.295**
	LSD(0.05)			**NS**	**NS**	**1.17**	**0.91**

Note : Figures in the parenthesis are angular transformed values.

satisfactory control of *Acaphyllatheae* and *Brevipalpusobovatus* on tea.

The focus on insecticide research always aims at searching of new molecule that have different mode of action and have novel biochemical targets in the context of pest control and resistance management. Some test reports are available from outside India. Childers (1997) has proven the effectiveness of pyridaben in controlling tetranychid, tenuipalpid and eriophyid mite on citrus. Pyridaben was also tested against red spider mite on marigold plants and was found to give good mortality over nymphs than the adults (Raymond *et.al*, 2010). Laboratory experiment showed higher effectiveness of pyridaben 10%WP against broad mite (Monchai, 1998). However, published reports on the efficacy of pyridaben on tea mite under North Bengal condition is wanting. Radhakrishnan *et al*. (2015) have already established the effectiveness of pyridaben 20% WP in controlling tea RSM in South India. Based on the present studies it can be concluded that pyridaben 20% WP @ 125 g a.i ha^{-1}can be used for the effective management of RSM, *O. coffeae* in tea. Only one late spring or early summer application may be recommended. It is non phytotoxic to tea and relatively safer to natural enemies. However, registration of this product and its clearance of regulation for the usage in tea is awaited.

REFERENCES

B. Radhakrishnan, K KSrikumar, B Suresh Kumar, 2015: Evaluation of Pyridaben 20 WP against red spider mite, *Oligonychuscoffeae*Nietener infesting tea in Southern India. *Pest Management in Hort. Ecosystem.* **21(1)**: 65-68

Chen XueFen; Xiao QiAng; Yao HuiMing, 1993 : Efficacy of pyridaben on tea mite pests. *China Tea* **14(6)**: 6-7