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Evaluation of insecticides for the management of chilli gall formers

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Abstract

The investigation on gall formers and their management in chilli was conducted at the Main Agricultural Research Station (MARS), Raichur, University of Agricultural Sciences, Raichur, during the year 2014-15. Management of chilli gall formers in Raichur 2014 and 2015, pooled analysis for two years indicated that highest percent reduction over control was observed in Chlorantraniliprole + Dichlorvos @ 0.3 ml + 0.5 ml/l (73.41%) followed by Thiamethoxam + Dichlorvos @ 0.2 g + 0.5 ml/l (65.48%) and Fipronil + Dichlorvos @ 3 ml + 0.5 ml/l (58.68%). Lowest percent reduction over control was observed in the treatment Azadirachtin 0.03% @ 3.00 ml/l with 29.07 percent only.

Keywords: Management, gall, damage, *Asphondylia capparidis*, *Goethella asulcata* and *Ceratoneura indi*

Introduction

Chilli (*Capsicum annum*) is a most diverse vegetable species and is considered to be high value crop. Which belongs to genus *Capsicum*, family *Solanaceae* with chromosome number $2n=24$. It is believed that origin of chilli is around 700 BC and origin was Mexico. It is introduced to India through Indonesia and other part of Asia around 400-500 years ago by Portuguese traders (Berke and Sheih, 2000) [2].

The major chilli growing states include Andhra Pradesh (49%), Maharashtra (26%), Karnataka (15%), West Bengal (12%) and Tamil Nadu (3%) consisting nearly 75 percent of total area and production and Andhra Pradesh is the major growing state where area under chilli is 2.06 lakh ha with the production of 8.83 lakh ha under Byadagi variety and other chilli cultivars producing 1.03 lakh MT (Anon, 2017) [1].

No studies have taken up to understand the composition and complexity of these species across space and time. Under such situation, developing a suitable pest management strategy becomes uphill task.

Materials and Methods

The experiment was laid out in a randomized block design with three replications and 10 treatments (Table 1) at MARS, Raichur during *khari* season 2014 and 2015. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 10 treatments including untreated control, replicated thrice with a crop spacing of 75 cm × 45 cm. The plot size was 3.6 m × 5 m (18.00 m²) and a buffer area of 0.50 m width was left around each plot.

From in each plot 10 plants were selected randomly and tagged and observations were recorded a day before spray and 3, 5, 7 and 10 days after imposition of treatments on the percent damage to different fruiting bodies at different time interval after the intervention. Two sprays were taken at 12th and 14th week after planting. The total dry chilli yield/plot was recorded. However, before flowering need based spray of profenofos 50 EC @ 2 ml/l and imidacloprid 17.8 SL @ 0.25 ml/l was taken to manage thrips, mites and cut worms. The percentage of galled flowers was computed by following formula

$$\text{Percent damage} = \frac{\text{No. of deformed flowers/fruits/plant} \times 100}{\text{Total No. of fruits and fruits/plant}}$$

The mean percent reduction over control and percent increase in yield over control were calculated by using the following formula.

$$\text{Reduction over UTC} = \frac{\text{Control} - \text{Treatment} * 100}{\text{Control}}$$

Results and Discussion

Management of chilli gall midge in MARS, Raichur during cropping season, Kharif 2014-15 and 2015-16

First season, 2014-15

Efficacy of different insecticides and insecticide combinations was studied to know the best management insecticide or insecticide combination against the chilli gall formers.

First spray of first season

During the first spray, a day before percent infestation due to gall formers among different treatments ranged between 37.33 to 44.00 and there was no significant difference. Three days after spray, the lowest percent infestation of 25.10 percent was recorded in Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l with 29.33 percent and Fipronil + DDVP @ 3 ml + 0.5 ml/l

which recorded 31.57 percent and differed statistically with each other. Neem oil + DDVP @ 3 ml + 0.5 ml/l recorded 33.20 percent. At five days after spray, the lowest percent infestation with gall formers was observed in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l (17.33%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (21.33) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (24.00). Untreated control recorded percent infestation of 45.00.

Percent infestation at seven days after spray was lowest in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 10.00 percent followed by next best treatments in the order as Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (21.33) and Fipronil + DDVP @ 3 ml + 0.5 ml/l. Neem oil + DDVP @ 3 ml + 0.5 ml/l recorded 19.00 percent. Thiamethoxam 25WG @ 0.2 g/l and Fipronil 5SC @ 3.0 ml/l recorded percent infestation of 23.33 and 24.66 percent respectively and differed statistically. Similar trend was observed even at 10 days after spray. Untreated control recorded highest percent infestation of 45.66 (Table 1).

Table 1: Efficacy of different treatments against chilli gall formers after the first and second spray during *Kharif* 2014 in MARS, Raichur

Treatment No.	Treatment Details	Dosage	Pre-count (DBS)	First spray percent infestation				Pre-count (DBS)	Second spray percent infestation				Mean	ROC (%)
				3DAS	5DAS	7DAS	10DAS		3DAS	5DAS	7DAS	10DAS		
T ₁	Fipronil 5SC	3 ml/l	44.00 (41.55)	36.66 (37.26)d	33.33 (35.26)d	24.66 (29.77)d	19.00 (25.84)d	39.34 (38.85)	33.33 (35.26)d	27.67 (31.74)d	21.00 (27.27)d	15.67 (23.32)d	26.42	39.27
T ₂	Thiamethoxam 25WG	0.2 g/l	42.66 (40.78)	35.33 (36.47)e	31.66 (34.24)e	23.33 (28.88)e	15.67 (23.32)e	33.67 (35.47)	32.00 (34.45)e	26.00 (30.66)e	19.67 (26.33)e	12.34 (20.57)e	24.50	43.67
T ₃	Azadirachtin 0.03%	3.0 ml/l	40.00 (39.23)	39.66 (39.03)b	37.33 (37.66)b	30.00 (33.21)b	25.33 (30.22)b	30.67 (33.63)	36.33 (37.07)b	31.67 (34.25)b	26.34 (30.88)b	22.00 (27.97)b	31.08	28.54
T ₄	Dichlorvos 76EC	0.5 ml/l	39.33 (38.84)	38.33 (38.25)c	35.00 (36.27)c	28.66 (32.37)c	22.00 (27.97)c	34.00 (35.67)	35.00 (36.27)c	29.34 (32.80)c	25.00 (30.00)c	18.67 (25.60)c	29.00	33.33
T ₅	Fipronil 5 SC + Dichlorvos 76EC	3 ml + 0.5 ml	35.33 (36.47)	31.57 (34.19)h	24.00 (29.33)h	16.33 (23.83)h	8.66 (17.11)h	34.67 (36.07)	28.24 (32.10)g	18.34 (25.36)h	12.67 (20.85)h	5.66 (13.76)h	18.18	58.19
T ₆	Thiamethoxam + Dichlorvos 76EC	0.2 g + 0.5 ml	38.66 (38.45)	29.33 (32.79)i	21.33 (27.51)i	13.00 (21.13)i	5.33 (13.35)i	32.67 (34.86)	26.00 (30.66)h	15.66 (23.31)i	9.34 (17.80)i	3.66 (11.03)i	15.46	64.47
T ₇	Neem oil + Dichlorvos 76EC	3 ml + 0.5 ml	37.33 (37.66)	33.20 (35.18)g	27.00 (31.31)g	19.00 (25.84)g	11.00 (19.37)g	30.67 (33.63)	29.87 (33.13)f	21.33 (27.51)g	15.34 (23.06)g	7.67 (16.08)g	20.55	52.75
T ₈	Chlorantraniliprole 18.5% SC	0.3 ml/l	35.33 (36.47)	34.47 (35.95)f	28.33 (32.16)f	20.00 (26.57)f	14.33 (22.24)f	36.67 (37.27)	31.14 (33.92)e	22.67 (28.43)f	16.34 (23.84)f	11.00 (19.37)f	22.29	48.77
T ₉	Chlorantraniliprole + Dichlorvos 76EC	0.3 ml + 0.5 ml	41.33 (40.01)	25.10 (30.07)j	17.33 (24.60)j	10.00 (18.43)j	3.00 (9.97)j	38.00 (38.06)	21.77 (27.81)i	11.33 (19.67)j	6.00 (14.18)j	2.33 (8.78)j	12.11	72.16
T ₁₀	Untreated check		38.33 (38.25)	43.66 (41.36)a	45.00 (42.13)a	49.33 (44.62)a	45.66 (42.51)a	35.34 (36.48)	40.33 (39.42)a	43.00 (40.98)a	39.33 (38.84)a	41.66 (40.20)a	43.50	
SEm±			1.93	0.21	0.13	0.15	0.19	2.05	0.31	0.25	0.17	0.12		
CD at 5%			NS	0.63	0.38	0.47	0.58	NS	0.95	0.77	0.52	0.36		
CV (%)			16.54	11.37	10.66	13.21	15.15	17.88	13.62	16.30	14.33	11.68		

N=50 DBS: Day Before Spraying, DAS: Day After Spraying

NS: Non significant, UTC: Untreated Control ROC: Reduction over control

* Figures in the parentheses are arc sin transformed values

Second spray of first season

During the second spray a day before percent infestation due to gall formers, among different treatment infestation ranged between 30.67 to 39.34 percent and there was no significant difference. Three days after spray, lowest percent infestation was recorded in Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 21.77 percent followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l with 26.00 percent and Fipronil + DDVP @ 3 ml + 0.5 ml/l which recorded 28.24 and differed

statistically with each other. Neem oil + DDVP @ 3 ml + 0.5 ml/l recorded 29.87 percent. At five days after spray, the lowest percent infestation of 11.33 percent with gall formers was observed in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (15.66) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (18.34%). Untreated control recorded percent infestation of 43.00.

Percent infestation at seven days after spray was lowest in the

treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 6.00 percent followed by next best treatments in the order as Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (9.34) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (12.67). Neem oil + DDVP @ 3 ml + 0.5 ml/l recorded 15.34.00 percent. Thiamethoxam 25WG @ 0.2 g/l and Fipronil 5SC @ 3.0 ml/l recorded percent infestation of 19.67 and 21.00 respectively and differed statistically. Similar trend was observed even at ten days after spray (Table 1)

During the year 2014 among different treatments, highest percent reduction over control was observed in the combination of Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l (72.16%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (64.47%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (58.19%). Lowest percent reduction over control was observed in the treatment Azadirachtin 0.03% @ 3.00 ml/l with 28.54 percent.

Second season, 2015-16

First spray of second season

A day before first spray, the percent infestation due to gall formers among different treatment ranged between 37.33 to 44.66 percent without any significant difference. Three days after spray, lowest percent infestation was recorded in

Rynaxypyr + DDVP @ 0.3 ml + 0.5 ml/l with 27.76 followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l with 31.99 percent and Fipronil + DDVP @ 3 ml + 0.5 ml/l which recorded 34.23 and differed statistically with each other. Neem oil + DDVP @ 3 ml + 0.5 ml/l recorded 35.86 percent. At five days after spray, the lowest percent infestation with gall formers was observed in the treatment Rynaxypyr + DDVP @ 0.3 ml + 0.5 ml/l (18.66%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (22.66%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (26.33%). Untreated control recorded percent infestation of 48.00.

Percent infestation at seven days after spray was lowest in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 6.67 percent followed by the next best treatments in the order as Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (9.67%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l. Neem oil + DDVP @ 3 ml + 0.5 ml/l recorded 15.67 percent. Thiamethoxam 25WG @ 0.2 g/l and Fipronil 5SC @ 3.0 ml/l recorded percent infestation of 20.00 and 21.33 respectively which differed statistically. Similar trend was observed even at 10 days after the spray where Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l maintained its superiority in reducing population. Untreated control recorded highest percent infestation of 42.66 (Table 2).

Table 2: Efficacy of different treatments against chilli gall formers after the first and second spray during *Kharif* 2015 in MARS, Raichur

Treatment No.	Treatment Details	Dosage	Pre-count (DBS)	First spray percent infestation				Pre-count (DBS)	Second spray percent infestation				Mean	ROC (%)
				3DAS	5DAS	7DAS	10DAS		3DAS	5DAS	7DAS	10DAS		
T ₁	Fipronil 5SC	3 ml/l	44.66 (41.93)	39.32 (38.83)d	35.66 (36.67)d	21.33 (27.51)d	17.33 (24.60)d	34.33 (35.87)	27.67 (31.74)d	24.00 (29.33)d	16.33 (23.83)d	19.33 (26.08)d	25.12	40.30
T ₂	Thiamethoxam 25WG	0.2 g/l	40.33 (39.42)	38.00 (38.06)e	33.99 (35.66)e	20.00 (26.57)e	14.00 (21.97)e	30.01 (33.22)	26.34 (30.88)e	22.33 (28.20)e	15.00 (22.79)e	17.66 (24.85)e	23.42	44.36
T ₃	Azadirachtin 0.03%	3.0 ml/l	37.33 (37.66)	42.33 (40.59)b	39.66 (39.03)b	26.67 (31.09)b	23.67 (29.11)b	29.00 (32.58)	30.67 (33.63)b	28.01 (31.95)b	21.68 (27.75)b	24.33 (29.55)b	29.63	29.59
T ₄	Dichlorvos 76EC	0.5 ml/l	40.66 (39.62)	41.00 (39.82)c	37.33 (37.66)c	25.33 (30.22)c	20.34 (26.81)c	30.34 (33.42)	29.34 (32.80)c	25.68 (30.45)c	19.66 (26.32)c	22.32 (28.19)c	27.63	34.35
T ₅	Fipronil + DDVP	3 ml + 0.5 ml	46.00 (42.71)	34.23 (35.81)h	26.33 (30.87)h	13.00 (21.13)h	7.66 (16.07)h	28.33 (32.16)	22.58 (28.37)h	14.33 (22.24)h	8.00 (16.43)h	11.33 (19.67)h	17.18	59.17
T ₆	Thiamethoxam + Dichlorvos 76EC	0.2 g + 0.5 ml	42.00 (40.40)	31.99 (34.44)i	22.66 (28.43)i	9.67 (18.12)i	3.67 (11.04)i	29.01 (32.59)	20.34 (26.81)i	12.33 (20.56)i	4.68 (12.49)i	7.34 (15.72)i	14.09	66.53
T ₇	Neem oil + Dichlorvos 76EC	3 ml + 0.5 ml	37.33 (37.66)	35.86 (36.79)g	29.33 (32.79)g	15.67 (23.32)g	9.34 (17.80)g	31.66 (34.24)	24.21 (29.47)g	17.67 (24.86)g	10.66 (19.06)g	13.32 (21.41)g	19.51	53.64
T ₈	Chlorantraniliprole 18.5% SC	0.3 ml/l	41.33 (40.01)	37.13 (37.54)f	30.66 (33.62)f	16.67 (24.10)f	12.67 (20.85)f	33.01 (35.07)	27.48 (31.62)f	19.01 (25.85)f	11.68 (19.98)f	14.34 (22.25)f	21.21	49.61
T ₉	Chlorantraniliprole 18.5% SC + Dichlorvos 76EC	0.3 ml + 0.5 ml	39.33 (38.84)	27.76 (31.79)j	18.66 (25.59)j	6.67 (14.97)j	2.00 (8.13)j	33.00 (35.06)	16.11 (23.66)j	7.00 (15.34)j	2.33 (8.78)j	5.00 (12.92)j	10.69	74.59
T ₁₀	Untreated check	3ml/l	43.33 (41.17)	45.66 (42.51)a	48.00 (43.85)a	42.66 (40.78)a	38.00 (38.06)a	32.66 (34.85)	36.00 (36.87)a	39.66 (39.03)a	41.00 (39.82)a	45.66 (42.51)a	42.08	
	S.Em±		2.16	0.16	0.25	0.33	0.2	1.79	0.26	0.51	0.22	0.17		
	CD at 5%		NS	0.51	0.75	0.97	0.61	NS	0.8	1.53	0.66	0.53		
	CV (%)		18.65	13.33	14.32	16.54	12.78	16.52	11.55	15.74	12.92	10.83		

N=50, DBS: Day Before Spraying, DAS: Day after Spraying

NS: Non significant, UTC: Untreated Control, ROC: Reduction over control

* Figures in the parentheses are arc sin transformed values

Second spray of second season

During the second spray a day before percent infestation due

to gall formers among different treatment ranged between 28.33 to 34.33 and there was no significant difference. Three

days after spray, lowest percent infestation was recorded in Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 16.11 percent followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l with 20.34 percent and Fipronil + DDVP @ 3 ml + 0.5 ml/l which recorded 22.58 and differed statistically with each other. Neem oil + DDVP @ 3 ml + 0.5 ml/l recorded 24.21 percent. At five days after spray the lowest percent infestation with gall formers was observed in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l (07.00%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (12.33%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (14.33%). Untreated control recorded percent infestation of 39.66.

Percent infestation at seven days after spray was lowest (2.33%) in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l and the next best treatments in the order were Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (4.68%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (8.00%). Thiamethoxam 25WG @ 0.2 g/l and Fipronil 5SC @ 3.0 ml/l recorded percent infestation of 15.00 and 16.33 respectively and differed statistically. Similar trend was observed even at 10 days after spray.

During the year 2015 among different treatments, highest percent of (74.59) reduction over control was observed in Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l (74.59%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (66.53%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (59.17%). Lowest percent reduction (29.59 percent) over control was observed in the treatment Azadirachtin 0.03% @ 3.00 ml/l (Table 2)

In pooled analysis of two years, in three days after spray lowest percent infestation was recorded in Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 26.43 followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l with 30.66 percent and Fipronil + DDVP @ 3 ml + 0.5 ml/l which recorded 32.90 and differed statistically with each other. At five days after spray the lowest percent infestation with gall formers was observed in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l (18.00%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (22.00%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (25.17%).

Percent infestation at seven days after spray was lowest in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 8.34 percent followed by next best treatments in the order were Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (11.34%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l. Similar trend was observed even at 10 days after spray where Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l maintained its superiority in reducing population (2.50%).

Pooled mean data after three days of second spray, lowest percent infestation was recorded in Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 18.94 percent followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l with 23.17 percent and Fipronil + DDVP @ 3 ml + 0.5 ml/l which recorded 25.40 and differed statistically with each other. At five days after spray, the lowest percent infestation with gall formers was observed in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l followed by Thiamethoxam +

DDVP @ 0.2 g + 0.5 ml/l and Fipronil + DDVP @ 3 ml + 0.5 ml/l. Percent infestation at seven days after spray was lowest in the treatment Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l with 4.17 percent followed by next best treatments in the order were Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (7.01%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (10.34%). Pooled analysis for two years indicated that highest percent reduction over control was observed in Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l (73.41%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (65.48%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (58.68%). Lowest percent reduction over control was observed in the treatment Azadirachtin 0.03% @ 3.00 ml/l with 29.07 percent (Table 3) The present findings were contradictory with Devaraj (2012) [4] who reported neem formulation, Econeem (Azadirachtin 1% at 4 ml/l) as effective against *A. pongamiae* which was on par with the chemicals like imidacloprid (27.28%) and thiomethoxam (25.00%). However in findings Azadirachtin was least effective having 29.07% reduction over control and the present efficiency was higher in the case of thiomethoxam (43.99%) and thiamethoxam + DDVP (65.48%). The present findings were contradictory with Archana (2011) [11], who reported nimbecidine @ 3 ml per l as effective treatment in controlling rice gall midge and which was on par with thiamethoxam 25WG @ 0.2 g/l, but in the case of present findings, Azadirachtin is least effective having (29.07%) with efficiency high in the case of thiomethoxam (43.99%). Shukla *et al.* (2000) [8] recommended spraying neem based insecticides like econeem at the time of budding stage to contain gall infestation in *P. pinnata*.

The present findings were in agreement with Gahukar (2012) [5] who reported that, spraying neem oil (1%) or neem crude extract (5%) mixed with a sticker, Sandovit@ (0.05%) during flowering stage reduced gall midge infestation up to 57.00 percent in chilli by acting as antifeedant, growth regulator, repellent and direct mortality factor against gall midge. David (1990) [3] reported that neem oil @ 2% was more effective in controlling the jasmin blossom midge, *Contarinia* sp. Further, the neem cake also helped in controlling the gall midge incidence where it acted on the pests as antifeedant and repellent.

In the present findings, best treatment in reducing gall formers incidence was Chlorantraniliprole + DDVP @ 0.3 ml + 0.5 ml/l (73.41%) followed by Thiamethoxam + DDVP @ 0.2 g + 0.5 ml/l (65.48%) and Fipronil + DDVP @ 3 ml + 0.5 ml/l (58.68%) and Thiamethoxam @ 0.2g/l (43.99%). Present results are in conformity with the results of Pathipati *et al.* (2016) [7] and indicated that thiamethoxam (30.10%) recorded least percent damage which was found to be significantly superior to untreated check.

Whereas, lowest percent reduction over control was observed in treatment, Azadirachtin (29.07%) was in disagreement with the report of Krishankumar *et al.* (2010) [6] where management of gall midge, *A. caparis* on chilli and brinjal with application of neem cake followed by spray with NSKE 4% as most effective treatment.

Table 3: Management of chilli gall formers in *Kharif* 2014 & 15 (Pooled) in MARS, Raichur

Treat.no.	Treatment Details	Dosage	Pre-count (DBS)	First spray Percent infestation				Pre-count (DBS)	Second spray Percent infestation				Mean	ROC (%)
				3DAS	5DAS	7DAS	10DAS		3DAS	5DAS	7DAS	10DAS		
T ₁	Fipronil 5SC	3ml/l	44.00 (41.55)	37.99 (38.05)c	34.50 (35.97)d	23.07 (28.71)d	18.13 (25.20)d	36.65 (37.26)	30.40 (33.46)d	25.84 (30.55)d	18.67 (25.60)d	17.44 (24.68)d	25.75	39.81
T ₂	Thiamethoxam 25WG	0.2 g/l	41.50 (40.10)	36.67 (37.27)cd	32.83 (34.95)e	21.67 (27.74)e	14.84 (22.65)e	31.80 (34.33)	29.17 (32.69)e	24.17 (29.44)e	17.34 (24.60)e	15.07 (22.84)e	23.97	43.99
T ₃	Azadirachtin 0.03%	3.0 ml/l	38.33 (38.25)	41.00 (39.81)b	38.50 (38.35)b	28.33 (32.16)b	24.44 (29.63)b	29.84 (33.11)	33.48 (35.35)b	29.88 (33.14)b	24.01 (29.34)b	23.16 (28.77)b	30.35	29.07
T ₄	Dichlorvos 76EC	0.5 ml/l	40.00 (39.23)	39.67 (39.04)b	36.17 (36.97)c	27.00 (31.30)c	21.17 (27.39)c	32.17 (34.55)	32.17 (34.55)c	27.51 (31.63)c	22.33 (28.20)c	20.50 (26.92)c	28.31	33.83
T ₅	Fipronil + Dichlorvos 76EC	3 ml + 0.5 ml	40.66 (39.62)	32.90 (35.00)f	25.17 (30.11)h	14.67 (22.52)h	8.16 (16.60)g	31.50 (34.14)	25.40 (30.26)g	16.34 (23.84)h	10.34 (18.75)h	8.50 (16.95)h	17.68	58.68
T ₆	Thiamethoxam + Dichlorvos 76EC	0.2 g + 0.5 ml	40.33 (39.42)	30.66 (33.62)g	22.00 (27.97)i	11.34 (19.67)i	4.50 (12.25)h	30.84 (33.73)	23.17 (28.77)h	14.00 (21.97)i	7.01 (15.35)i	5.50 (13.56)i	14.77	65.48
T ₇	Neem oil + Dichlorvos 76EC	3 ml + 0.5 ml	37.00 (37.46)	34.51 (35.98)e	28.17 (32.05)g	17.34 (24.60)g	10.17 (18.60)f	31.17 (33.94)	27.04 (31.33)f	19.50 (26.21)g	13.00 (21.13)g	10.50 (18.90)g	20.03	53.20
T ₈	Chlorantraniliprole 18.5% SC	0.3 ml/l	37.66 (37.86)	35.80 (36.75)de	29.44 (32.86)f	18.20 (25.25)f	1.00 (5.74)j	34.84 (36.18)	29.31 (32.78)e	20.84 (27.16)f	14.01 (21.98)f	12.67 (20.85)f	20.16	52.89
T ₉	Chlorantraniliprole 18.5% SC + Dichlorvos 76EC	0.3 ml + 0.5 ml	40.00 (39.23)	26.43 (30.94)h	18.00 (25.10)j	8.34 (16.78)j	2.50 (9.10)i	35.50 (36.57)	18.94 (25.80)i	9.17 (17.62)j	4.17 (11.78)j	3.50 (10.78)j	11.38	73.41
T ₁₀	Untreated check		40.33 (39.42)	44.66 (41.93)a	46.50 (42.99)a	46.00 (42.70)a	41.83 (40.30)a	34.00 (35.67)	38.17 (38.15)a	41.33 (40.01)a	40.17 (39.33)a	43.66 (41.36)a	42.79	
	S.Em±		2.72	0.41	0.33	0.25	0.35	2.03	0.28	0.25	0.36	0.19		
	CD at 5%		NS	1.22	0.98	0.77	1.07	NS	0.76	0.77	1.10	0.58		
	CV (%)		20.25	13.65	12.64	15.21	16.83	18.55	14.14	16.30	17.42	13.62		

N=50 DBS: Day Before Spraying, DAS: Day After Spraying NS: Non significant, UTC: Untreated Control

Conclusion

Management of chilli gall formers in Raichur revealed that Chlorantraniliprole + Dichlorvos and Thiamethoxam+ Dichlorvos were effective in managing the gall formers and in alone, next best treatment was Chlorantraniliprole and Thiamethoxam.

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