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Field Efficacy of Insecticides against Thrips- A Potential GBNV Vector in Blackgram

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ABSTRACT

Background: Field efficacy of insecticides to control thrips in significant blackgram cultivation regions with bud necrosis disease as a key concern.

Methods: Field experiment was conducted to test insecticides as seed treatment and foliar sprays for the management of thrips in blackgram during *rabi* 2019-20 and *kharif*, *rabi* of 2020-21.

Result: T5 (Seed treatment with Imidacloprid 70% WG followed by Fipronil 5 % SC @ 2 mL L^{-1}) was proved best in reducing the thrips population with highest grain yield *i.e.* 1414 kg ha^{-1} and highest ICBR 1:4.80 during *rabi* 2019-2020 with least bud necrosis disease incidence. During *Kharif* 2020-2021, highest population reduction was found in treatment Imidacloprid 70 WG seed treatment + spinosad 45 SC spray (86.67 per cent). During *rabi* 2020-2021, Imidacloprid 70 WG seed treatment + Fipronil 5 SC spray recorded highest grain yield *i.e.* 1439 kg ha^{-1} with ICBR 1:4.45 followed by thiamethoxam 70 WS seed treatment + Fipronil 5 SC spray.

Key words: Grain yield, ICBR, *Kharif, Rabi*, Thrips.

INTRODUCTION

Globally India is the largest producer of black gram, accounting for more than 70% of production followed by Myanmar and Pakistan (Bharathi *et al*., 2025). Blackgram is referred as the “king of the pulses” due to its delicious taste and numerous other nutritional qualities (Vadivel *et al*., 2023). It is rich in nutritional quality with 24-27% protein, 1% fat, 57% carbohydrate, 3.8% fibre and 4.8% ash. It is grown in both summer and winter seasons (Mohanlal *et al*., 2023). Furthermore, it is fed to milch cows in particular as nutrient-rich fodder. Among the states, A.P. is leading in production with 3.62 lakh tonnes. Average price of blackgram in A.P. during august 2025 is Rs. 6704/- per quintal. Increasing price pattern of blackgram in the open markets during recent years couldn’t give happiness to our farmers as they were struggling to secure the yields. The prime reason for this is sucking pest complex which acts as vector of deadly viral diseases like YMD (yellow mosaic disease) and bud necrosis. The symptoms of GBNV in the field have been thoroughly documented. Necrosis and chlorotic rings emerge after young quadrifoliate leaves first show minor chlorotic patches. The primary defining feature of wet and post-rainy seasons is terminal bud necrosis. Common secondary signs include distortion of leaflets, axillary branch growth and stunting. Early infection causes bushy, stunted and early-death plants. Only a few branches exhibit symptoms if the plants are more than a month old. The only way of managing this problematic viral menace in blackgram is through the management of its vector *i.e.* Thrips significant yield loss may occur If not properly managed at an early stage of the crop. In order to mitigate this menace, several insecticides as seed treatment, foliar sprays in combination were studied to know their efficacy in the management of thrips and also benefit cost ratios. Choosing an appropriate, cost effective insecticide is always challenging for the farming community.

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MATERIALS AND METHODS

This experiment was conducted during 2019-2022 at Agricultural College Farm -Bapatla, Guntur, A.P., laid out in RBD (randomized block design) with fifteen (15) treatments including untreated check, replicated thrice with a plot size of 12 m^2 to study the efficacy of insecticides as seed treatment and foliar sprays for the control of thrips in blackgram (LBG 752). The insecticide treatments were mentioned in the Table 1. The experimental field was kept unsprayed up to 15 DAS and later protected through blanket sprays using suitable pesticides to control other pest and diseases. Foliar application of selected insecticides was

given at 30 DAS, 45 DAS and 60 DAS during morning hours. Data on pest population was recorded one day before spraying as pre treatment count and at 1, 3, 7, 10 days after spraying as post treatment count. The observations were recorded from 10 randomly selected plants in each plot leaving the border rows. Second and third sprays were given at 15 days interval to allow subsequent population buildup in the experimental plots. Per cent population reduction was calculated by using modified Abbot's formula (Flemming and Ratnakaran, 1985):

% Population reduction =

$$\left\{1 - \left[\frac{\text{Post treatment population in the treatment}}{\text{Pre treatment population in the treatment}} \times \frac{\text{Pre treatment population in the untreated check}}{\text{Post treatment population in the untreated check}}\right]\right\} \times 100$$

The total number of diseased plants in each plot was counted at 15 days interval *i.e.* 15, 30, 45 (after 1st spray), 60 (after 2nd spray), 75 (after 3rd spray) days after sowing. PDI was calculated by using the following formula:

Per cent disease incidence =

$$\frac{\text{No. of diseased plants}}{\text{Total no. of plants}} \times 100$$

Upon harvest, the mean seed yield of treatments recorded per plot (kg/plot) was converted to kg/ha and subjected to ANOVA to test the significance of treatments. The incremental cost-benefit ratio was calculated to find out the most economical management method:

$$\text{ICB ratio} = \frac{\text{Extra benefit of enhanced yield}}{\text{Extra cost incurred for each treatment}}$$

Data *viz*., mean number of thrips per plant, percent reduction in the population of thrips over untreated check, mean per cent bud necrosis disease incidence and yield data was subjected to ANOVA after using suitable transformations. The mean comparisons were made by least significant difference (LSD) (Duncan, 1951).

RESULTS AND DISCUSSION

Cumulative efficacy of insecticides during *rabi* 2019-2020

Table 1 indicates that T_5 was found superior with lowest mean number of thrips per plant (0.22) and it was on par with T_{11}, T_8, T_{14}, T_9, T_3 and T_7 with 0.31, 0.51, 0.63, 0.80, 1.08 and 1.38 respectively. Highest mean per cent population reduction over untreated control was recorded 89.37 in case of T5 followed by T_{11} (80.91). Present findings pertaining to efficacy of Imidacloprid and thiamethoxam were in accordance with Radhika *et al.* (2018a) who reported that Imidacloprid 70 WS at 5 g kg^{-1} was found most effective with 2.67 thrips per six leaves among the tested insecticides followed by thiamethoxam 25 WG at 3 g kg^{-1} with 2.80 thrips per six leaves as seed treatment in blackgram during *rabi* 2017-18 in Hyderabad. The results regarding the efficacy of spinosad were in line with findings of Surbhi *et al.* (2018) who reported that insecticidal spray of spinosad 45 SC @ 0.0135% was found effective with lowest number of thrips*i.e.* 0.28 thrips/leaf on greengram with highest seed yield in thiamethoxam 25 WG @ 0.10% + spinosad 45 SC @ 0.0135 % treatments with 1066 kg ha^{-1} followed by Imidacloprid 30.5 SC @ 0.12% + spinosad 45 SC @ 0.0135% with 1025 kg ha^{-1}.

Mean PDI of bud necrosis during *rabi* 2019-2020

Overall mean per cent bud necrosis disease incidence (Table 2) was lowest (3.24) in T_5 and it was on par with T_8 (3.45), T_{11}(3.78), T_{14}(3.95), T_3(4.66), T_9 (4.70). Table 3 pertaining to ICBR, T_5has recorded the highest grain yield *i.e.* 1414 kg ha^{-1} with ICBR 1:4.80 followed by T_{11} (1:4.47), T_9 (1:3.25) and T_3 (1:2.99). The results regarding the efficacy of Fipronil 5SC spray @ 50 g a.i ha^{-1} can supported by the findings of Radhika *et al.* (2018a) who reported that Fipronil 5% SC @ 1 mL L^{-1} at weekly intervals against sucking pests in blackgram saved 269 kg ha^{-1} pod yield with an avoidable yield loss of 26.16 per cent.

Cumulative efficacy of insecticides during *Kharif* 2020-2021

Data in Table 4 reveals that T_5 has recorded 0.38 mean number of thrips plant^{-1} and it was statistically at par with T_8 (0.42), T_{14} (0.47), T_{11} (0.54), T_3 (1.04) and T_9 (1.21). Highest population reduction over control was found in T_8 (86.67 per cent) followed by T_5 (86.62), T_{11} (85.21), T_{14} (82.69). These results are in accordance with Reddy *et al.* (2020) who reported that Imidacloprid 17.8 SL (20.54%) was the most effective treatment in controlling the sucking insect pests in blackgram during *kharif* 2017. Results pertaining to efficacy of Fipronil can be supported by the findings of Singh *et al.* (2019) who reported that Imidacloprid (0.005%) and Fipronil (0.01%) proved to be the most effective next to acetamiprid (0.004%) against sucking insect pests in greengram during *kharif* season.

Mean PDI of bud necrosis during *kharif* 2020-2021

Among the treatments (Table 5), T_5 recorded least mean bud necrosis per cent disease incidence *i.e.* 5.19 and it was at par with T_{11} (5.64), T_3 (5.94) T_{14} (6.13), T9 (6.39), T_8 (6.64). Ruth *et al.* (2016) reported that seed treatment with Imidacloprid @ 5 g kg^{-1} seed + neem seed kernal extract @ 5% + spinosad 0.3 mL L^{-1} were found superior in controlling the viral diseases in tomato during *kharif* 2009. Whitefly and thrips population were low and were 1.18/plant and 0.51/plant, respectively after post treatment. Least incidence of bud necrosis disease was recorded *i.e.* 6.60, 9.93 and 14.88 at 30, 45 and 60 days after planting in the same treatment plots. Table 6 pertaining to ICBR indicates, T_5 has recorded highest grain yield *i.e.* 1372 kg ha^{-1} with ICBR 1:3.73 followed by T_{11} (1:2.93), T_3 (1:2.64) and T_9 (1:2.28). Similarly, Sujatha and Bharpoda (2017) who reported that higher incremental cost benefit ratio (ICBR) 1:7.81 was obtained in the treatment thiamethoxam 25 WG (0.01%) in greengram during *kharif* 2015.

Table 1: Cumulative efficacy of insecticides during *rabi* 2019-2020.

T. no.	Treatments	Dose g.a.i./ha	Mean no. of thrips per plant				Population reduction over untreated control (%)			
			First spray	Second spray	Third spray	Mean	First spray	Second spray	Third spray	Mean
1	Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	70	1.25 (1.73)^{f}	4.95 (2.58)^{f}	8.24 (3.02)g	4.81 (2.33)^{f}	16.67	0.53	0.37	5.85
2	Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	70	1.21 (1.71)^{f}	5.17 (2.66)^{f}	9.66 (3.26)h	5.35 (2.41)^{f}	6.73	4.15	0.07	3.65
3	T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	75	0.30 (1.17)^{abcd}	1.48 (1.47)^{cd}	1.46 (1.16)ab	1.08 (1.43)^{abcde}	58.46	56.94	54.30	56.56
4	T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	300	0.53 (1.22)^{bcde}	2.57 (1.77)^{e}	2.88 (1.72)de	1.99 (1.70)^{c}	47.50	30.70	26.91	35.04
5	T_1 + Fipronil 5% SC @ 2 mL L^{-1}	50	0.07 (1.06)^{a}	0.44 (1.14)^{a}	0.16 (1.00)a	0.22 (1.10)^{a}	90.00	84.91	93.21	89.37
6	T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	250	0.75 (1.32)^{e}	3.02 (1.99)^{e}	4.02 (2.19)f	2.60 (1.86)^{e}	50.00	10.49	7.21	22.57
7	T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	50	0.34 (1.17)^{abcd}	1.93 (1.51)^{cd}	1.88 (1.35)bc	1.38 (1.52)^{abcde}	52.69	48.03	54.90	51.87
8	T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	72	0.12 (1.08)^{ab}	0.93 (1.34)^{abc}	0.48 (1.00)a	0.51 (1.22)^{ab}	65.00	68.78	85.20	73.00
9	T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	75	0.23 (1.10)^{ab}	1.26 (1.41)^{bc}	0.91 (1.02)a	0.80 (1.33)^{abcd}	54.17	65.33	70.38	63.29
10	T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	300	0.63 (1.26)^{cde}	2.67 (1.83)^{e}	3.42 (1.83)e	2.24 (1.76)^{d}	51.09	21.62	14.58	29.10
11	T_2 + Fipronil 5% SC @ 2 mL L^{-1}	50	0.09 (1.08)^{ab}	0.62 (1.20)^{ab}	0.23 (1.00)a	0.31 (1.14)^{a}	72.50	78.65	91.56	80.91
12	T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	250	0.67 (1.28)^{de}	2.97 (1.97)^{e}	3.73 (2.08)f	2.45 (1.82)^{e}	45.45	27.18	7.64	26.76
13	T_2 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	50	0.41 (1.18)^{abcde}	2.25 (1.65)^{de}	2.23 (1.53)cd	1.63 (1.60)^{b}	47.50	32.50	36.79	38.93
14	T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	72	0.15 (1.10)^{ab}	0.97 (1.38)^{bc}	0.77 (1.00)a	0.63 (1.27)^{abc}	67.38	73.90	78.10	73.12
15	Untreated Control		6.38 (3.15)^{g}	13.06 (3.99)^{g}	14.92 (3.97)i	11.45 (3.49)^{g}				
	SEm±		0.05	0.08	0.07	0.15				
	CD≤0.05		0.14	0.23	0.21	0.45				
	CV (%)		7.64	8.58	7.56	15.43				

Values in parenthesis are * square root (√x+1) transformations; In a column, means followed by same letters do not differ significantly by LSD (P≤0.05).

Table 2: Effect of treatments on bud necrosis disease incidence during *rabi* 2019-2020.

Treatments	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	Overall mean
Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	0.00	3.93 (2.21)^{b}	10.20 (3.34)^{f}	16.80 (4.21)^{h}	18.10 (4.36)^{i}	12.26 (4.37)^{h}
Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	0.00	3.68 (2.16)^{ab}	9.43 (3.23)^{ef}	17.27 (4.24)^{h}	20.27 (4.59)^{i}	12.66 (4.61)^{hi}
T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	0.00	2.82 (1.95)^{ab}	4.61 (2.37)^{abc}	5.60 (2.57)^{cd}	5.60 (2.57)^{cd}	4.66 (2.57)^{abcde}
T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	0.00	2.03 (1.74)^{a}	5.97 (2.62)^{bcd}	8.48 (3.08)^{ef}	8.48 (3.08)^{fg}	6.24 (3.08)^{efg}
T_1 + Fipronil 5% SC @ 2 mL L^{-1}	0.00	3.10 (2.01)^{ab}	3.28 (2.06)^{a}	3.28 (2.06)^{a}	3.28 (2.06)^{a}	3.24 (2.07)^{a}
T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	0.00	3.73 (2.12)^{ab}	7.40 (2.89)^{de}	11.53 (3.54)^{g}	11.53 (3.54)^{h}	8.55 (3.54)^{g}
T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	0.00	4.16 (2.27)^{b}	5.93 (2.63)^{bcd}	6.26 (2.69)^{de}	6.26 (2.69)^{de}	5.65 (2.69)^{bcde}
T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	0.00	3.35 (2.08)^{ab}	3.48 (2.12)^{a}	3.48 (2.12)^{ab}	3.48 (2.12)^{ab}	3.45 (2.12)^{a}
T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	0.00	4.03 (2.24)^{b}	4.52 (2.35)^{ab}	5.13 (2.48)^{bcd}	5.13 (2.48)^{bcd}	4.70 (2.48)^{abcd}
T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	0.00	3.33 (2.08)^{ab}	6.73 (2.78)^{d}	8.05 (3.01)^{ef}	8.05 (3.01)^{efg}	6.54 (3.01)^{defg}
T_2 + Fipronil 5% SC @ 2 mL L^{-1}	0.00	3.78 (2.18)^{ab}	3.78 (2.18)^{a}	3.78 (2.18)^{abc}	3.78 (2.18)^{ab}	3.78 (2.19)^{ab}
T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	0.00	3.77 (2.18)^{ab}	6.50 (2.72)^{cd}	9.90 (3.30)^{fg}	9.90 (3.30)^{gh}	7.52 (3.30)^{fg}
T_2 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	0.00	3.07 (1.93)^{ab}	6.27 (2.69)^{bcd}	6.67 (2.77)^{de}	6.67 (2.77)^{def}	5.67 (2.77)^{cdef}
T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	0.00	3.95 (2.22)^{b}	3.95 (2.22)^{a}	3.95 (2.22)^{abc}	3.95 (2.22)^{abc}	3.95 (2.22)^{abc}
Untreated control	0.00	8.29 (3.04)^{c}	16.33 (4.16)^{g}	25.10 (5.10)^{i}	25.10 (5.10)^{j}	18.71 (5.11)^{i}
SEm±	0.00	0.16	0.12	0.14	0.13	0.19
SED	0.00	0.23	0.17	0.20	0.18	0.27
CD≤0.05	0.00	0.46	0.35	0.40	0.37	0.55
CV (%)	0.00	12.84	7.81	7.93	7.27	14.13

Values in parenthesis are * square root (√x+1) transformations; DAS = Day after sowing; in a column means followed by same letters do not differ significantly by LSD (P≤0.05).

Table 3: Details of plant protection costs incurred during *rabi* 2019-2020.

T. no.	Treatments	Quantity of insecticide (mL or g/ha)	Cost of insecticide (Rs/ha)	Labor charges (Rs/ha)	No. of sprays	Total cost per ha	Yield of blackgram grains kg/ha	Increase in yield over control (kg/ha)	Value of yield (Rs/ha @ Rs 5000/q)	Net profit (Rs/ha)	ICBR	Rank
1	Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	100	734	500	3	3702	594^{fg}	97	4861	1159	0.31	12
2	Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	100	800	500	3	3900	581^{fg}	83	4167	267	0.07	14
3	T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	250	2484	500	3	8952	1211^{abc}	714	35694	26742	2.99	4
4	T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	700	3134	500	3	10902	825^{def}	328	16389	5487	0.50	11
5	T_1 + Fipronil 5% SC @ 2 mL L^{-1}	1100	2134	500	3	7902	1414^{a}	917	45833	37931	4.80	1
6	T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	1100	1334	500	3	5502	711^{efg}	214	10694	5192	0.94	8
7	T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	550	5189	500	3	17067	1050^{bcd}	553	27639	10572	0.62	9
8	T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	270	4619	500	3	15357	1347^{ab}	850	42500	27143	1.77	5
9	T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	250	2550	500	3	9150	1275^{ab}	778	38889	29739	3.25	3
10	T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	700	3200	500	3	11100	844^{def}	347	17361	6261	0.56	10
11	T_2 + Fipronil 5% SC @ 2 mL L^{-1}	1100	2200	500	3	8100	1383^{a}	886	44305	36205	4.47	2
12	T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	1100	1400	500	3	5700	739^{defg}	242	12083	6383	1.12	7
13	T_2 + Spinetoram 11.7 % SC @ 0.9 mL L^{-1}	550	5255	500	3	17265	939^{cde}	442	22083	4818	0.28	13
14	T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	270	4685	500	3	15555	1336^{ab}	839	41944	26389	1.70	6
15	Untreated control						497^{g}					
	SEM±						110.20					
	CD						319.24					
	CV						19.36					

Labour charges/one spray/ha @ Rs.250/labour/day,
Price of blackgram grains @ Rs. 5000/qtl

Imidacloprid 70 WG @ Rs. 550/75 g
Thiamethoxam 70 WS @ Rs. 200/25 g
Flonicamid 50 WG @ Rs. 700/60 g
Diafenthiuron 50WP @ Rs.100/25 g
Fipronil 5 SC @ Rs. 140/100 mL
Buprofezin 25 SC @ Rs. 300/500 mL
Spinetoram 11.7 SC @ Rs.990/100 mL
Spinosad 45SC @ Rs. 170/7 mL
Untreated control

Table 4: Cumulative efficacy of insecticides during *kharif* 2020-2021.

T. no.	Treatments	Dose g.a.i./ha	Mean No of thrips per plant				Population reduction over untreated control (%)			
			First spray	Second spray	Third spray	Mean	First spray	Second spray	Third spray	Mean
1	Imidacloprid 70% WG @ 5 g per Kg seed (Seed treatment)	70	3.47 (2.18)^{e} 1.10	6.35 (2.93)^{e}	6.93 (2.85)^{d}	5.58(2.55)^{e}	1.30	1.58	0.42	
2	Thiamethoxom 70% WS @ 5 g per Kg seed (Seed treatment)	70	4.03 (2.27)^{e}	7.31 (3.11)^{e}	8.20 (3.07)^{e}	6.51(2.72)^{e}	6.92	0.24	1.29	2.82
3	T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	75	1.30 (1.14)^{a}	0.79 (1.16)^{a}	1.04 (1.05)^{a}	1.04 (1.43)^{ab}	65.92	75.89	68.50	70.10
4	T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	300	1.89 (1.25)^{a}	2.50 (1.78)^{d}	2.53 (1.77)^{c}	2.31 (1.82)^{cd}	59.46	20.59	16.50	32.19
5	T_1 + Fipronil 5% SC @ 2 mL L^{-1}	50	0.58 (1.00)^{a}	0.29 (1.06)^{a}	0.26 (1.00)^{a}	0.38 (1.17)^{a}	84.41	87.30	88.16	86.62
6	T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	250	1.73 (1.26)^{ab}	2.56 (1.75)^{cd}	2.42 (1.56)^{b}	2.24 (1.80)^{cd}	58.95	42.44	36.71	46.03
7	T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	50	1.54 (1.21)^{a}	1.80 (1.46)^{b}	1.81 (1.39)^{b}	1.72 (1.65)^{bcd}	50.45	51.40	49.00	50.28
8	T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	72	0.65 (1.00)^{a}	0.33 (1.10)^{a}	0.28 (1.00)^{a}	0.42 (1.19)^{a}	85.13	85.94	88.95	86.67
9	T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	75	1.32 (1.13)^{a}	0.91 (1.17)^{a}	1.41 (1.14)^{a}	1.21 (1.49)^{abc}	60.50	70.09	53.06	61.22
10	T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	300	1.71 (1.28)^{ab}	2.14 (1.51)^{bc}	2.32 (1.47)^{b}	2.06 (1.75)^{bcd}	53.41	42.75	33.38	43.18
11	T_2 + Fipronil 5% SC @ 2 mL L^{-1}	50	0.74 (1.00)^{a}	0.48 (1.15)^{a}	0.39 (1.00)^{a}	0.54 (1.24)^{a}	86.91	82.90	85.82	85.21
12	T_2 + Buprofezin 25 % SC @ 2 mL L^{-1}	250	2.16 (1.58)^{b}	2.84 (1.80)^{d}	2.84 (1.80)^{c}	2.61 (1.90)^{f}	30.63	42.74	13.17	28.85
13	T_2 + Spinetoram 11.7 % SC @ 0.9 mL L^{-1}	50	1.61 (1.21)^{a}	1.97 (1.49)^{bc}	1.88 (1.41)^{b}	1.82 (1.68)^{bcd}	57.84	45.82	48.11	50.59
14	T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	72	0.69 (1.00)^{a}	0.43 (1.11)^{a}	0.29 (1.00)^{a}	0.47 (1.21)^{a}	76.06	82.83	89.17	82.69
15	Untreated control		7.39 (3.02)^{d}	11.72 (3.85)^{f}	14.63 (3.99)^{f}	11.24 (3.47)^{f}				
	SEm±		0.11	0.09	0.07	0.12				
	CD≤0.05		0.32	0.26	0.20	0.33				
	CV (%)		13.41	10.08	7.58	11.07				

Values in parenthesis are * square root (√x+1) transformations; in a column means followed by same letters do not differ significantly by LSD (P≤0.05).

Table 5: Effect of treatments on bud necrosis disease incidence during *kharif* 2020-2021.

Treatments	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	Overall mean
Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	0.00 (1.00)^{a}	4.43 (2.33)^{abc}	11.41 (3.52)^{ef}	18.73 (4.44)^{g}	20.90 (4.68)^{e}	13.87 (4.68)^{g}
Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	0.00 (1.00)^{a}	5.52 (2.55)^{bcd}	13.30 (3.77)^{f}	20.37 (4.62)^{g}	20.37 (4.62)^{e}	14.89 (4.62)^{g}
T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	0.00 (1.00)^{a}	4.60 (2.36)^{abc}	5.67 (2.58)^{a}	6.54 (2.75)^{abc}	6.93 (2.82)^{ab}	5.94 (2.82)^{abcde}
T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	0.00 (1.00)^{a}	4.24 (2.28)^{ab}	8.65 (3.10)^{d}	9.55 (3.25)^{ef}	9.82 (3.29)^{cd}	8.06 (3.29)^{ef}
T_1 + Fipronil 5% SC @ 2 mL L^{-1}	0.00 (1.00)^{a}	5.03 (2.46)^{abcd}	5.24 (2.50)^{a}	5.24 (2.50)^{a}	5.24 (2.50)^{a}	5.19 (2.50)^{a}
T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	0.00 (1.00)^{a}	4.85 (2.41)^{abc}	8.06 (3.01)^{cd}	9.38 (3.22)^{ef}	9.55 (3.25)^{cd}	7.96 (3.25)^{def}
T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	0.00 (1.00)^{a}	3.91 (2.21)^{a}	5.31 (2.49)^{a}	8.25 (3.04)^{cde}	8.25 (3.04)^{bc}	6.43 (3.04)^{bcd}
T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	0.00 (1.00)^{a}	6.50 (2.74)^{d}	6.68 (2.77)^{abc}	6.68 (2.77)^{abcd}	6.68 (2.77)^{ab}	6.64 (2.77)^{abcd}
T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	0.00 (1.00)^{a}	5.04 (2.45)^{abcd}	6.62 (2.76)^{abc}	6.95 (2.82)^{bcd}	6.95 (2.82)^{ab}	6.39 (2.82)^{abcde}
T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	0.00 (1.00)^{a}	4.99 (2.45)^{abcd}	8.07 (3.01)^{cd}	9.10 (3.17)^{ef}	9.10 (3.17)^{c}	7.81 (3.18)^{cdef}
T_2 + Fipronil 5% SC @ 2 mL L^{-1}	0.00 (1.00)^{a}	4.67 (2.37)^{abc}	5.97 (2.64)^{ab}	5.97 (2.64)^{ab}	5.97 (2.64)^{a}	5.64 (2.64)^{ab}
T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	0.00 (1.00)^{a}	5.56 (2.56)^{bcd}	9.58 (3.25)^{de}	10.83 (3.41)^{f}	11.77 (3.54)^{d}	9.44 (3.57)^{f}
T_2 + Spinetoram 11.7 % SC @ 0.9 mL L^{-1}	0.00 (1.00)^{a}	5.83 (2.61)^{c}	7.25 (2.87)^{bcd}	8.33 (3.05)^{de}	8.33 (3.05)^{bc}	7.44 (3.05)^{bcd}
T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	0.00 (1.00)^{a}	5.75 (2.59)^{c}	6.25 (2.69)^{ab}	6.25 (2.69)^{ab}	6.25 (2.69)^{a}	6.13 (2.69)^{abc}
Untreated control	5.38 (2.53)^{b}	10.63 (3.41)^{e}	18.35 (4.40)^{g}	26.03 (5.20)^{h}	26.03 (5.20)^{f}	20.26 (5.20)^{h}
SEm±	0.01	0.10	0.10	0.10	0.12	0.17
SED	0.02	0.15	0.14	0.14	0.17	0.24
CD≤0.05	0.04	0.30	0.29	0.29	0.34	0.49
CV (%)	2.11	7.19	5.70	5.27	6.16	11.28

Values in parenthesis are * square root (√x+1) transformations; DAS = Day after sowing; in a column means followed by same letters do not differ significantly by LSD (P≤0.05).

Table 6: Details of plant protection costs incurred during *kharif* 2020-2021.

T. no.	Treatments	Quantity of insecticide (mL or g/ha)	Cost of insecticide (Rs/ha)	Labour charges (Rs per ha)	No. of sprays	Total cost per ha	Yield of blackgram grains kg/ha	Increase in yield over control (kg/ha)	Value of yield (Rs/ha@ Rs 5000/q)	Net profit (Rs/ha)	ICBR	Rank
1	Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	100	734	500	3	3702	742^{fg}	117	5833	2131	0.58	10
2	Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	100	800	500	3	3900	731^{fg}	106	5278	1378	0.35	12
3	T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	250	2484	500	3	8952	1276^{ab}	651	32555	23603	2.64	3
4	T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	700	3134	500	3	10902	906^{def}	281	14028	3126	0.29	14
5	T_1 + Fipronil 5% SC @ 2 mL L^{-1}	1100	2134	500	3	7902	1372^{a}	747	37361	29459	3.73	1
6	T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	1100	1334	500	3	5502	922^{def}	297	14861	9359	1.70	5
7	T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	550	5189	500	3	17067	1136^{abcd}	511	25555	8488	0.50	11
8	T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	270	4619	500	3	15357	1325^{a}	700	35000	19643	1.28	6
9	T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	250	2550	500	3	9150	1225^{abc}	600	30000	20850	2.28	4
10	T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	700	3200	500	3	11100	1015^{cde}	390	19500	8400	0.76	9
11	T_2 + Fipronil 5% SC @ 2 mL L^{-1}	1100	2200	500	3	8100	1261^{abc}	636	31805	23705	2.93	2
12	T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	1100	1400	500	3	5700	862^{efg}	237	11875	6175	1.08	8
13	T_2 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	550	5255	500	3	17265	1075^{bcde}	450	22500	5235	0.30	13
14	T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	270	4685	500	3	15555	1317^{ab}	692	34583	19028	1.22	7
15	Untreated control						625^{g}					
	SEM±						89.33					
	CD						258.78					
	CV						14.70					

Labour charges/one spray/ha @ Rs.250/labour/day,
Price of blackgram grains @ Rs. 5000/qtl

Imidacloprid 70 WG @ Rs. 550/75 g
Thiamethoxam 70 WS @ Rs. 200/25 g
Flonicamid 50 WG @ Rs. 700/60 g
Diafenthiuron 50WP @ Rs.100/25 g
Fipronil 5 SC @ Rs. 140/100 mL

Buprofezin 25 SC @ Rs. 300/500 mL
Spinetoram 11.7 SC @ Rs.990/100 mL
Spinosad 45 SC @ Rs. 170/7 mL
Untreated control

Table 7: Cumulative efficacy of insecticides during *rabi* 2020-2021.

T. no.	Treatments	Dose g.a.i./ha	Mean no. of thrips per plant				Population reduction over untreated control (%)			
			First spray	Second spray	Third spray	Mean	First spray	Second spray	Third spray	Mean
1	Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	70	3.51 (2.24)^{fg}	6.54 (2.92)^{d}	9.53 (3.26)^{d}	6.53 (2.70)^{f}	4.41	6.13	0.07	3.53
2	Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	70	4.34 (2.49)^{g}	7.43 (2.99)^{d}	9.65 (3.28)^{d}	7.14 (2.83)^{f}	3.69	12.43	0.04	5.39
3	T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	75	1.81 (1.53)^{bc}	1.08 (1.18)^{a}	1.14 (1.00)^{a}	1.34 (1.53)^{abcd}	56.26	81.37	64.65	67.42
4	T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	300	2.83 (1.85)^{de}	2.38 (1.59)^{bc}	2.15 (1.53)^{b}	2.45 (1.86)^{cde}	50.73	59.29	39.88	49.97
5	T_1 + Fipronil 5% SC @ 2 mL L^{-1}	50	0.48 (1.10)^{a}	0.25 (1.00)^{a}	0.37 (1.00)^{a}	0.37 (1.17)^{a}	90.32	93.85	83.50	89.22
6	T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	250	3.07 (2.00)^{ef}	3.15 (1.78)^{bc}	2.73 (1.64)^{bc}	2.98 (2.00)^{e}	31.23	55.81	29.71	38.92
7	T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	50	2.00 (1.58)^{c}	1.81 (1.53)^{b}	1.81 (1.40)^{b}	1.87 (1.69)^{bcde}	48.70	69.52	49.92	56.05
8	T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	72	0.93 (1.29)^{ab}	0.42 (1.00)^{a}	0.63 (1.00)^{a}	0.66 (1.29)^{ab}	80.29	91.95	75.01	82.42
9	T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	75	1.68 (1.47)^{bc}	0.95 (1.15)^{a}	0.96 (1.00)^{a}	1.19 (1.48)^{abc}	55.65	82.33	68.64	68.87
10	T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	300	2.83 (1.92)^{e}	2.75 (1.63)^{bc}	2.38 (1.63)^{b}	2.65 (1.91)^{de}	35.10	50.67	32.94	39.57
11	T_2 + Fipronil 5% SC @ 2 mL L^{-1}	50	0.51 (1.13)^{a}	0.29 (1.00)^{a}	0.47 (1.00)^{a}	0.42 (1.19)^{a}	91.62	93.40	83.41	89.48
12	T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	250	2.83 (1.97)^{e}	3.14 (1.82)^{c}	2.98 (1.88)^{c}	2.98 (2.00)$_{e}$	17.19	53.59	10.50	27.09
13	T_2 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	50	2.15 (1.62)^{cd}	2.06 (1.61)^{bc}	1.92 (1.41)^{b}	2.04 (1.74)^{cde}	49.77	65.54	47.92	54.41
14	T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	72	1.20 (1.44)^{bc}	0.51 (1.06)^{a}	0.71 (1.00)^{a}	0.81 (1.34)^{abc}	66.50	90.54	70.43	75.83
15	Untreated Control		7.87 (3.18)^{h}	12.09 (3.77)^{e}	15.00 (4.02)^{e}	11.65 (3.53)^{g}				
	SEm±		0.09	0.10	0.09	0.14				
	CD≤0.05		0.26	0.28	0.25	0.41				
	CV (%)		9.84	10.47	9.22	13.03				

Values in parenthesis are * Square root (√x+1) transformations; in a column means followed by same letters do not differ significantly by LSD (P≤0.05).

Table 8: Effect of treatments on bud necrosis disease incidence during *rabi* 2020-2021.

Treatments	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	Overall mean
Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	0.00	2.30 (1.81)^{cde}	11.77 (3.56)^{e}	16.13 (4.14)^{f}	17.15 (4.26)^{f}	11.84 (4.26)^{e}
Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	0.00	3.07 (2.02)^{efg}	14.30 (3.90)^{e}	17.67 (4.32)^{f}	17.67 (4.32)^{f}	13.18 (4.32)^{ef}
T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	0.00	2.13 (1.77)^{cd}	3.15 (2.03)^{b}	3.78 (2.18)^{c}	3.78 (2.18)^{c}	3.21 (2.19)^{bc}
T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	0.00	1.93 (1.71)^{bc}	7.37 (2.89)^{d}	7.66 (2.94)^{e}	7.66 (2.94)^{e}	6.16 (2.94)^{d}
T_1 + Fipronil 5% SC @ 2 mL L^{-1}	0.00	2.90 (1.97)^{defg}	3.10 (2.01)^{b}	3.10 (2.01)^{bc}	3.10 (2.01)^{bc}	3.05 (2.02)^{ab}
T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	0.00	4.82 (2.41)^{h}	4.82 (2.41)^{c}	7.05 (2.84)^{de}	7.05 (2.84)^{de}	5.93 (2.84)^{d}
T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	0.00	3.33 (2.08)^{fg}	5.85 (2.61)^{cd}	6.20 (2.68)^{d}	6.20 (2.68)^{d}	5.40 (2.68)^{cd}
T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	0.00	1.68 (1.62)^{abc}	2.22 (1.78)^{ab}	2.35 (1.82)^{b}	2.35 (1.82)^{b}	2.15 (1.83)^{ab}
T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	0.00	1.27 (1.51)^{ab}	2.33 (1.83)^{ab}	2.52 (1.88)^{b}	2.52 (1.88)^{b}	2.16 (1.88)^{ab}
T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	0.00	2.06 (1.75)^{bcd}	6.80 (2.79)^{d}	7.27 (2.87)^{de}	7.27 (2.87)^{de}	5.85 (2.88)^{d}
T_2 + Fipronil 5% SC @ 2 mL L^{-1}	0.00	1.15 (1.45)^{a}	1.32 (1.52)^{a}	1.32 (1.52)^{a}	1.32 (1.52)^{a}	1.28 (1.52)^{a}
T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	0.00	1.72 (1.64)^{abc}	7.75 (2.95)^{d}	8.34 (3.06)^{e}	8.34 (3.06)^{e}	6.54 (3.06)^{d}
T_2 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	0.00	1.07 (1.44)^{a}	5.82 (2.61)^{cd}	6.12 (2.67)^{d}	6.12 (2.67)^{d}	4.78 (2.67)^{cd}
T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	0.00	2.43 (1.85)^{cdef}	2.71 (1.92)^{b}	2.71 (1.92)^{b}	2.71 (1.92)^{b}	2.64 (1.93)^{ab}
Untreated control	0.00	3.47 (2.11)^{g}	18.07 (4.36)^{f}	23.34 (4.93)^{g}	23.34 (4.93)^{g}	17.05 (4.93)^{f}
SEm±	0.00	0.08	0.12	0.09	0.08	0.22
SED	0.00	0.12	0.16	0.12	0.12	0.31
CD≤0.05	0.00	0.24	0.34	0.25	0.25	0.63
CV (%)	0.00	7.84	7.71	5.44	5.25	17.69

Values in parenthesis are * square root (√x+1) transformations; in a column means followed by same letters do not differ significantly by LSD (P≤0.05). DAS= Days after sowing.

Table 9: Details of plant protection costs incurred during *rabi* 2020-2021.

T. no.	Treatments	Quantity of insecticide (mL or g/ha)	Cost of insecticide (Rs/ha)	Labor charges (Rs/ha)	No. of sprays	Total cost per ha	Yield of blackgram grains kg/ha	Increase in yield over control (kg/ha)	Value of yield (Rs/ha@ Rs 5000/q)	Net profit (Rs/ha)	ICBR	Rank
1	Imidacloprid 70% WG @ 5 g per kg seed (Seed treatment)	100	734	500	3	3702	717^{fgh}	139	6944	3242	0.88	9
2	Thiamethoxom 70% WS @ 5 g per kg seed (Seed treatment)	100	800	500	3	3900	664^{gh}	86	4306	406	0.10	13
3	T_1 + Flonicamid 50% WG @ 0.3 g L^{-1}	250	2484	500	3	8952	1133^{cd}	556	27778	18826	2.10	4
4	T_1 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	700	3134	500	3	10902	842^{efg}	264	13194	2292	0.21	10
5	T_1 + Fipronil 5% SC @ 2 mL L^{-1}	1100	2134	500	3	7902	1439^{a}	861	43055	35153	4.45	1
6	T_1 + Buprofezin 25% SC @ 2 mL L^{-1}	1100	1334	500	3	5502	831^{efg}	253	12639	7137	1.30	7
7	T_1 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	550	5189	500	3	17067	981^{de}	403	20139	3072	0.18	11
8	T_1 + Spinosad 45% SC @ 0.32 mL L^{-1}	270	4619	500	3	15357	1369^{abc}	792	39583	24226	1.58	5
9	T_2 + Flonicamid 50% WG @ 0.3 g L^{-1}	250	2550	500	3	9150	1161^{bcd}	583	29167	20017	2.19	3
10	T_2 + Diafenthiuron 50% WP @ 1.25 g L^{-1}	700	3200	500	3	11100	836^{efg}	258	12917	1817	0.16	12
11	T_2 + Fipronil 5% SC @ 2 mL L^{-1}	1100	2200	500	3	8100	1383^{ab}	806	40278	32178	3.97	2
12	T_2 + Buprofezin 25% SC @ 2 mL L^{-1}	1100	1400	500	3	5700	825^{efgh}	247	12361	6661	1.17	8
13	T_2 + Spinetoram 11.7% SC @ 0.9 mL L^{-1}	550	5255	500	3	17265	953^{def}	375	18750	1485	0.09	14
14	T_2 + Spinosad 45% SC @ 0.32 mL L^{-1}	270	4685	500	3	15555	1272^{abc}	694	34722	19167	1.23	6
15	Untreated control	NA	NA	NA	NA	NA	578^{h}	NA				
	SEM±						86.72					
	CD						251.23					
	CV						15.04					

Labour charges/one spray/ha @ Rs.250/labour/day,
Price of blackgram grains @ Rs. 5000/qtl

Imidacloprid 70 WG @ Rs. 550/75 g
Thiamethoxam 70 WS @ Rs. 200/25 g
Flonicamid 50 WG @ Rs. 700/60 g
Diafenthiuron 50WP @ Rs.100/25 g
Fipronil 5 SC @ Rs. 140/100 mL
Buprofezin 25 SC @ Rs. 300/500 mL
Spinetoram 11.7 SC @ Rs. 990/100 mL
Spinosad 45 SC @ Rs. 170/7 mL
Untreated control

Cumulative efficacy of insecticides during *rabi* 2020-2021

Results tabulated in Table 7 indicates that T_5 has recorded least mean number of thrips (0.37 plant^{-1}) and it was statistically on par with T_{11} (0.42), T_8 (0.66), T_{14} (0.81), T_9 (1.19), T_3 (1.34). Population reduction over untreated control was 89.48, 89.22 and 82.42 per cent in T_{11}, T_5 and T_8 respectively found effective among the treatments. Present findings pertaining to Spinosad are in accordance with Sharanappa *et al*. (2020) who reported that the overall mean per cent reduction of thrips population after imposing first, second and third spray was highest in Spinosad 45 SC (88.15%) followed by Fipronil 5 SC (87.24%) and found significantly superior than rest of the treatments in capsicum during *rabi* season. Present findings about Fipronil are in line with Swathi *et al*. (2018) who reported that acetamiprid 4% + Fipronil 4% @ 2 mL L^{-1} found effective against thrips by reducing 70.81% thrips population next to thiacloprid 21.7 SC @ 0.0325% with 74.80% reduction of thrips population over untreated control in rice fallow blackgram during *rabi* 2017-18.

Mean PDI of bud necrosisduring *rabi* 2020-2021

Table 8 indicates that T_{11} has recorded least mean disease incidence (1.28) and it was statistically on par with T_8 (2.15%), T_9 (2.16%), T_{11} (2.64 %) and T_5 (3.05%). Present findings are in line with Swathi *et al*. (2018) who reported that flonicamid 50 WG @ 0.0325% found effective against the population of whitefly by reducing 72.19 % and lowest per cent YMV disease incidence (17.66%) followed by acetamiprid 4% + Fipronil 4% @ 2 mL L^{-1} (64.94%) and thiamethoxam 25 WG @ 0.005% (62.21%) which were on par with each other in rice fallow blackgram during *rabi* 2017-18. Table 9 about ICBR reveals that T_5 has recorded highest grain yield *i.e*. 1439 kg ha^{-1} with ICBR 1:4.45 followed by T_{11} (1:3.97), T_3 (1:2.19) T_9 (1 2.10). Even though the treatments *viz*. T_8, T_{14} found effective, their ICBR found low (1:1.58 and 1:1.23, respectively) due to high input cost. The present findings are in line with Darshan *et al*. (2018) who reported that Imidacloprid 17.8 SL @ 0.005 per cent found most effective with lowest population of thrips (1.30) and found on par with thiamethoxam 25 WG @ 0.008 per cent (1.33) and acetamiprid 20 SP @ 0.004 per cent (1.36). The maximum yield was obtained in plots treated with thiamethoxam 25 WG @ 0.005% (701 kg ha^{-1}) against control plot (400 kg ha^{-1}) in mothbean during *rabi* season. Swathi *et al*. (2018) also reported that the highest seed yield was gained from the plots treated with thiamethoxam 25 WG @ 0.10% + spinosad 45 SC @ 0.0135% with 1066 kg ha^{-1} in rice fallow blackgram during *rabi* 2017-18.

CONCLUSION

Always it is challenging to manage or mitigate the viral diseases in field crops as they cant be controlled directly using therapeutic pesticides. One must understand the exact vector(s) responsible for their spread. In case of GBNV in blackgram obviously its Thrips, a cryptic, minute, complex Thysanopterans. This study aimed at suitable and cost-effective seed dresser and an insecticide for the management of Thrips directly and bud necrosis indirectly. Even some treatments found suitable for this task can be placed at second due to their input cost especially treatments contain Spinosad and flonicamid. This study also observed that similar treatments performed in a different way across the seasons and which has no significance.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

Not applicable.

Conflict of interest

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