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EVALUATION OF COLOURED STICKY TRAPS AND REFLECTIVE MULCHES FOR SUSTAINABLE MANAGEMENT OF CHILLI THRIPS (*Scirtothrips dorsalis* hood) IN CHILLI (*Capsicum annuum* L.)

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ABSTRACT

Chilli (*Capsicum annuum* L.) is an important vegetable crop affected by chilli thrips (*Scirtothrips dorsalis* Hood), which causes severe damage through sap feeding, resulting in leaf curling, stunted growth and yield reduction. An experiment was conducted to evaluate the effectiveness of coloured sticky traps and reflective mulches in managing chilli thrips and improving crop yield. The study comprised nine treatment combinations involving blue sticky traps, white sticky traps, no trap, combined with silver-on-silver mulch, silver-on-black mulch and no mulch, arranged in a Factorial Randomized Block Design (FRBD) with three replications. The results revealed that the combination of blue sticky trap and silver-on-silver mulch (T1) was the most effective treatment, recording the lowest pooled mean thrips population (2.33/5 plants) and the highest green chilli yield (11.37 t ha^{-1}). Blue sticky traps captured higher numbers of thrips than white sticky traps, indicating their greater attractiveness to the pest. The highest mean trap catch (14.08 thrips/trap) was recorded in the blue sticky trap without mulch treatment, while the untreated control recorded the highest thrips population (10.39/5 plants) and the lowest yield (0.27 t ha^{-1}). Interaction studies showed that blue sticky traps combined with reflective mulches consistently reduced thrips populations and enhanced yield. The findings suggest that integrating blue sticky traps with silver reflective mulch can serve as an effective, eco-friendly and sustainable strategy for monitoring and management of chilli thrips, leading to improved crop productivity.
***Keywords* :** Chilli, S*cirtothrips dorsalis*, Blue sticky trap, White sticky trap, Reflective mulches, Integrated pest management (IPM), Thrips monitoring, Yield enhancement.

Introduction

Chilli (*C. annuum*) is one of the most economically important spice and vegetable crops cultivated across India. It is valued for its pungency, flavour and nutritional composition, playing a crucial role in the Indian diet and export economy. Chilli is also recognized for its medicinal properties, as it contains capsaicin, antioxidants and vitamins A and C.

India ranks as the largest producer, consumer and exporter of chilli in the world. According to the advanced estimates for 2025-26, chilli is cultivated in an area of about 7.86 lakh hectares with an estimated production of 24.64 lakh metric tonnes (Spices Board, 2025-26).

Despite its significance, chilli cultivation is increasingly threatened by several biotic stresses, among which thrips have emerged as major pests in recent years. Currently, two species of thrips are recognized as the most damaging to chilli production in India.

S. dorsalis, commonly referred to as chilli thrips, is a widely distributed species that infests tender leaves, flower buds and flowers. Feeding by these species leads to characteristic symptoms such as leaf curling, silvering, stunted growth and flower drop, resulting in considerable yield losses (Sharma and Venkatesan, 2019). *Thrips parvispinus* Karny, also known as black thrips, is a relatively recent invasive species that has rapidly become a significant pest in several chilli growing regions, including Telangana. It causes more severe tissue damage than *S. dorsalis*, leading to necrotic lesions, bud and flower deformation, defoliation and substantial fruit loss (Rao *et al.*, 2022). The co-occurrence of these two species, combined with their rapid multiplication and potential to transmit viral pathogens, poses a serious challenge to chilli cultivation and highlights the need for effective, eco-friendly management strategies. Both species not only cause direct feeding damage but also act as vectors for *Tospoviruses* such as *Groundnut bud necrosis virus* (GBNV), leading to viral epidemics in chilli crops and aggravating yield losses (Reddy *et al.*, 2021).

Chemical control remains the predominant strategy for managing thrips in chilli cultivation. However, the indiscriminate and repeated use of insecticides has resulted in several adverse consequences, including the development of pesticide resistance, secondary pest outbreaks, disruption of natural enemy populations and environmental degradation (Kumar *et al.*, 2020). These challenges underscore the urgent need for sustainable, eco-friendly pest management approaches that reduce chemical reliance while maintaining crop protection.

In this context, physical control methods such as coloured sticky traps and reflective mulches have emerged as promising components within the Integrated Pest Management (IPM). Coloured sticky traps-particularly blue and yellow exploit the visual preferences of thrips, facilitating effective monitoring and mass trapping of the adult population (Sundararaj and David, 2018). Reflective mulches, such as silver or aluminized polyethylene, function by altering the light environment around the plant canopy, especially by reflecting Photosynthetically Active Radiation (PAR) in the 400-700 nm range, which is known to interfere with the host-finding and settling behaviour of small insect pests like thrips (Krishnaiah *et al.*, 2017).

Despite the individual promise of coloured sticky traps and reflective mulches, their combined impact on thrips management under Telangana agro-climatic conditions remains underexplored. Therefore, the current investigation aims to evaluate the integrated use of these physical control methods on thrips incidence, along with associated changes in light reflectance. This approach is expected to contribute to a sustainable IPM strategy that reduces insecticide dependence while maintaining crop yield and promotes sustainable agricultural practices.

Materials and Methods

Location and Experimental site

The present investigation was carried out in the field to evaluate the individual and combined effect of coloured sticky traps and reflective mulches on the management of thrips species in chilli, during *Rabi* season (September 2025 to April 2026) at the College Farm, Babu Jagjivan Ram Agricultural College, Sircilla, located in Rajanna Sircilla district, Telangana.

Experimental procedure

The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications and nine treatment combinations, resulting in a total of 27 experimental plots and each plot measured 5 m × 4 m (20 m²), involving two reflective mulch types (silver-on-silver and silver-on-black polyethylene), two sticky trap colours (blue and white) and a no-mulch and no-trap control. Chilli variety Sonal Hybrid, a popular commercial hybrid variety widely grown in Telangana and Andhra Pradesh was selected for the experiment. Seedlings were transplanted during last week of November with a spacing of 60 cm × 45 cm in all plots. No pesticides were applied to the main field crop.

Blue and white sticky traps

Bright-blue and white coloured polypropylene cards (25 cm × 30 cm) coated on both sides with a non-drying, weather-resistant pressure-sensitive adhesive, were used for trapping and monitoring thrips species in chilli. Sticky traps were mounted on wooden stakes at a height of 15-20 cm above the crop canopy level and installed at the rate of 1 trap per plot within each applicable treatment plot. Traps were replaced at 15-day intervals throughout the crop season to maintain their effectiveness. Used traps were carefully removed, placed in labelled polythene covers and brought to the laboratory for counting of trapped thrips.

Reflective Mulches

Two types of reflective polyethylene mulch films were used in the experiment, sourced from a commercial agricultural supplier. The mulch films were 25 microns thick and 1.2 m wide, conforming to standard agricultural mulch specifications.

Silver on Silver Mulch: Double-sided aluminized polyethylene mulch with high PAR reflectance (50-58%) and strong repellence of thrips, aphids and whiteflies.

Silver on Black Mulch: Silver-black polyethylene mulch with moderate PAR reflectance (35-45%), weed suppression and insect repellence; widely used in commercial vegetable production.

The mulch films were laid on pre-prepared raised beds (bed width 80 cm, height 10-12 cm) prior to transplanting. Holes of 5 cm diameter were made in the mulch at the prescribed spacing (60 cm × 45 cm) using a heated iron rod and seedlings were transplanted through these holes. The edges of the mulch were secured firmly in the soil to prevent dislodgement by wind. In treatments designated 'No Mulch', the soil surface was kept bare and manually weeded at regular intervals to maintain uniform weed-free conditions.

Table 1 : Treatment details of the experiment

Treatment No.	Sticky trap	Mulch type	Treatment combination
T1	Blue sticky trap	Silver on silver mulch	Blue trap + Silver on silver mulch
T2	Blue sticky trap	Silver on black mulch	Blue trap + Silver on black mulch
T3	Blue sticky trap	No mulch	Blue trap + No mulch
T4	White sticky trap	Silver on silver mulch	White trap + Silver on silver mulch
T5	White sticky trap	Silver on black mulch	White trap + Silver on black mulch
T6	White sticky trap	No mulch	White trap + No mulch
T7	No trap	Silver on silver mulch	No trap + Silver on silver mulch
T8	No trap	Silver on black mulch	No trap + Silver on black mulch
T9	No trap	No mulch	No trap + No mulch (Absolute Control)

Observations Recorded

Observations on the number of thrips per plant, the number of thrips trapped on sticky traps and total yield (t ha^{-1}) were recorded. Thrips populations were monitored at 30, 60, 90 and 120 DAT on five randomly selected plants per plot using a 10× hand lens to count chilli thrips (*S. dorsalis*). Sticky trap catches were recorded by counting the number of thrips trapped on each trap at 30, 60, 90 and 120 DAI (Days After Installation). Yield data were collected at harvest by picking all mature green chilli fruits from each plot over 3-5 pickings which was expressed as t ha^{-1}.

Table 2 : Mean population of chilli thrips (No. of thrips /5 plants) at different crop growth stages in chilli

Treatments	30 DAT	60 DAT	90 DAT	120 DAT
T_1	0.60 (1.05)	2.35 (1.69)^h	3.75 (2.06)^g	2.60 (1.76)^i
T_2	0.47 (0.98)	3.42 (1.98)^g	4.95 (2.33)^f	3.60 (2.02)^h
T_3	5.33 (2.42)	6.10 (2.57)^e	6.92 (2.72)^e	4.87 (2.32)^g
T_4	0.13 (0.80)	4.88 (2.32)^f	7.12 (2.76)^e	6.00 (2.55)^f
T_5	1.13 (1.28)	6.60 (2.66)^e	8.68 (3.03)^d	7.20 (2.77)^e
T_6	4.40 (2.21)	8.80 (3.05)^d	9.80 (3.21)^c	8.20 (2.95)^d
T_7	0.27 (0.88)	9.87 (3.22)^c	10.37 (3.30)^c	9.47 (3.16)^c
T_8	0.33 (0.91)	10.92 (3.38)^b	11.48 (3.46)^b	10.40 (3.30)^b
T_9	4.07 (2.14)	13.10 (3.69)^a	12.72 (3.64)^a	11.67 (3.49)^a
S. Em (±)	0.189	0.039	0.047	0.024
CD @ 5%	NS	0.118	0.143	0.073
CV (%)	20.76	2.50	2.76	1.60

T_1: Blue sticky trap + Silver on silver mulch; **T_2:** Blue sticky trap + Silver on black mulch; **T_3:** Blue sticky trap + No mulch; **T_4:** White sticky trap + Silver on silver mulch; **T_5:** White sticky trap + Silver on black mulch; **T_6:** White sticky trap + No mulch; **T_7:** No trap+ Silver on silver mulch; **T_8:** No trap + Silver on black mulch; **T_9:** No trap + No mulch (Absolute control)

NS- Non- significant; DAT- Days after transplantation; Values in parenthesis are √X+0.5 transformed; Transformed values followed by same alphabet in columns did not differ significantly (p=0.05) by DMRT

Table 3 : Mean population of chilli thrips (No. of thrips /5 plants) trapped on different coloured sticky traps at different days after installation in chilli

Treatments	30 DAI	60 DAI	90 DAI	120 DAI
T_1	7.08	8.67	10.83	13.00
T_2	8.58	10.08	12.17	15.67
T_3	11.58	12.33	13.75	18.67
T_4	2.83	4.67	5.67	6.00
T_5	4.08	5.58	7.33	8.00
T_6	6.00	7.42	9.00	11.67
T_7	0	0	0	0
T_8	0	0	0	0
T_9	0	0	0	0

T_1: Blue sticky trap + Silver on silver mulch; **T_2:** Blue sticky trap + Silver on black mulch; **T_3:** Blue sticky trap + No mulch; **T_4:** White sticky trap + Silver on silver mulch; **T_5:** White sticky trap + Silver on black mulch; **T_6:** White sticky trap + No mulch; **T_7:** No trap+ Silver on silver mulch; **T_8:** No trap + Silver on black mulch; **T_9:** No trap + No mulch (Absolute control); **DAI: Days After Installation**

Table 4 : Mean green chilli yield (t/ha) at 90 and 120 DAT in chilli

Treatments	90 DAT (t/ha)	120 DAT (t/ha)
T_1	5.27^a	6.10^a
T_2	4.40^b	4.50^b
T_3	2.73^d	2.73^c
T_4	3.57^c	3.00^c
T_5	2.17^{de}	1.73^d
T_6	1.50^e	1.22^{de}
T_7	0.78^f	0.67^{ef}
T_8	0.27^{fg}	0.40^{ef}
T_9	0.03^g	0.23^f
S. Em (±)	0.237	0.301
CD @ 5%	0.717	0.912
CV (%)	17.9	22.8

T_1: Blue sticky trap + Silver on silver mulch; **T_2:** Blue sticky trap + Silver on black mulch
T_3: Blue sticky trap + No mulch; **T_4:** White sticky trap + Silver on silver mulch; **T_5:** White sticky trap + Silver on black mulch; **T_6:** White sticky trap + No mulch; **T_7:** No trap+ Silver on silver mulch; **T_8:** No trap + Silver on black mulch; **T_9:** No trap + No mulch (Absolute control)
NS- Non- significant; DAT- Days after transplantation; Mean values followed by same alphabet in columns did not differ significantly (p=0.05) by DMRT

Statistical Analysis

The data were subjected to analysis of variance (ANOVA), appropriate for FRBD. Treatment means were compared using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

Results and Discussion

The population of chilli thrips differed significantly among treatments from 60 DAT onwards, as shown in Table 2. The lowest thrips population was consistently recorded in T1 (Blue sticky trap + Silver on silver mulch) with 2.35, 3.75 and 2.60 thrips at 60, 90 and 120 DAT, respectively, whereas the highest population was observed in T9 (No trap + No mulch) with 13.10, 12.72 and 11.67 thrips, respectively. Overall, T1 was the most effective treatment in reducing chilli thrips population throughout the crop growth period. The reduced thrips population in T1 may be due to the attraction of thrips to blue sticky traps and the repellence caused by reflective silver mulch. Similar reductions in thrips incidence with reflective mulches and blue sticky traps were reported by Csizinszky *et al*., (1999) and Kumar *et al*., (2018).

The mean chilli thrips (60, 90 and 120 DAT) population increased from silver-on-silver mulch to no mulch, as shown in Fig. 1. The single line exhibits a positive upward slope from Mulch 1 to Mulch 3, indicating a progressive increase in thrips population with decreasing mulch reflectivity. The reduced chilli thrips population under reflective mulches may be due to reflected light disrupting thrips host-finding behaviour. Similar results were reported by Csizinszky *et al*., (1999) and Greer and Dole (2003), who found that reflective mulches significantly reduced sucking pest incidence in vegetable crops.

The mean chilli thrips population increased consistently from Trap 1 to Trap 3 across all mulch treatments at 60, 90 and 120 DAT, as illustrated in Figures 2-4. At each stage the lines are nearly parallel, indicating a weak interaction between coloured sticky traps and reflective mulches, with the lowest population recorded under Trap 1 × Mulch 1 and the highest under Trap 3 × Mulch 3. The lower thrips population under blue sticky traps and reflective mulches may be attributed to improved trapping combined with disruption of host-finding behaviour. Similar findings were reported by Csizinszky *et al*., (1999), Kumar *et al*., (2018), Pathan *et al*., (2023), Rashid *et al*., (2022), Shah *et al*., (2021) and Nehara *et al*., (2020), who variously observed reduced chilli thrips infestation with coloured sticky traps and reflective mulches interfering with host location.

The blue sticky traps captured more chilli thrips than white sticky traps throughout the observation period as depicted in Table 3. Among the treatments, T3 (Blue sticky trap + No mulch) recorded the highest trap catches, reaching 18.67 thrips at 120 DAI, whereas no thrips were recorded in treatments without sticky traps (T7, T8 and T9). The greater number of thrips captured in blue sticky traps suggests a stronger attraction of chilli thrips to the blue colour. This finding is in accordance with the reports of Mouden *et al*. (2017) and Kumar *et al*. (2018), who also found blue sticky traps to be more effective than white traps for monitoring and trapping thrips.

The green chilli yield varied significantly among the treatments at both 90 and 120 DAT, as shown in Table 4. Among all treatments, T1 (Blue sticky trap + Silver on silver mulch) produced the maximum yield of 5.27 and 6.10 t/ha at 90 and 120 DAT, respectively, while the minimum yield was recorded in T9 (No trap + No mulch) with 0.03 and 0.23 t/ha, respectively. The increased yield recorded in T1 could be attributed to the reduced thrips infestation achieved through the combined use of blue sticky traps and reflective silver mulch. Csizinszky *et al*., (1999) and Greer and Dole (2003) also reported higher crop yields under reflective mulch treatments due to effective management of insect pests and improved crop performance.

The chilli yield declined consistently from Trap 1 to Trap 3 under all mulch treatments at both 90 and 120 DAT, as illustrated in Figures 5 and 6. The lines are nearly parallel, indicating a weak interaction between coloured sticky traps and reflective mulches, with the highest yield recorded under Trap 1 × Mulch 1 and the lowest under Trap 3 × Mulch 3. Similar results were reported by Das and Chatterjee (2021) and Singh *et al*., (2023), who observed enhanced chilli yield under integrated pest management practices, and by Reddy *et al*., (2022) and Patil *et al*., (2021), who reported higher yields in chilli when reflective mulches were used to manage sucking pests.

The pooled mean chilli thrips population ranged from 2.33 to 10.39/5 plants, as presented in Table 5. The lowest thrips population and highest yield were recorded in T1 (Blue sticky trap + Silver on silver mulch) with 2.33 thrips/5 plants and 11.37 t/ha, respectively, whereas the highest thrips population and lowest yield were observed in T9 (No trap + No mulch) with 10.39 thrips/5 plants and 0.27 t/ha, respectively. The highest mean trap catch was recorded in T3 (14.08 thrips/trap). Similar observations were reported by Kumar *et al*., (2018) and Csizinszky *et al*., (1999), who found that effective suppression of thrips through sticky traps and reflective mulches resulted in improved crop yield.

Table 5 : Effect of coloured sticky traps and reflective mulches on population of chilli thrips, trap catch and yield

Treatments	Chilli thrips (No. of thrips/5 Plants)	Trap catch	Yield (t/ha)
T_1	2.33	9.90	11.37
T_2	3.11	11.63	8.90
T_3	5.80	14.08	5.47
T_4	4.53	4.79	6.57
T_5	5.90	6.25	3.90
T_6	7.80	8.52	2.72
T_7	7.49	NA	1.45
T_8	8.28	NA	0.67
T_9	10.39	NA	0.27
S. Em (±)	0.045	-	0.223
CD @ 5%	0.136	-	0.674
CV (%)	2.94	-	16.82

T_1: Blue sticky trap + Silver on silver mulch; **T_2:** Blue sticky trap + Silver on black mulch; **T_3:** Blue sticky trap + No mulch; **T_4:** White sticky trap + Silver on silver mulch; **T_5:** White sticky trap + Silver on black mulch; **T_6:** White sticky trap + No mulch; **T_7:** No trap+ Silver on silver mulch; **T_8:** No trap + Silver on black mulch; **T_9:** No trap + No mulch (Absolute control)

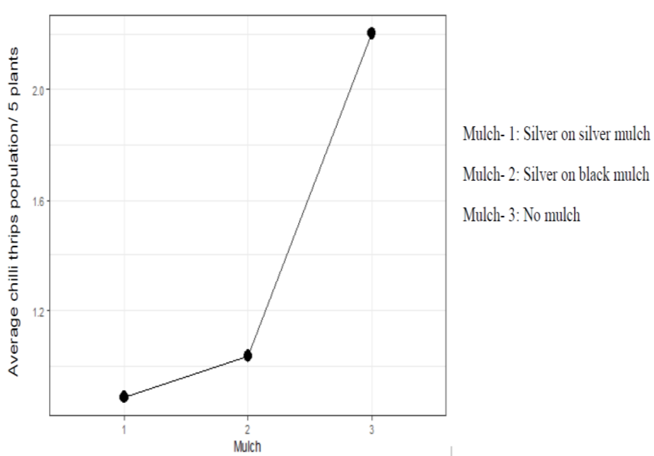

Fig. 1 : Effect of reflective mulches on the mean chilli thrips (No. of thrips/5 plants) population at 30 DAT in chilli

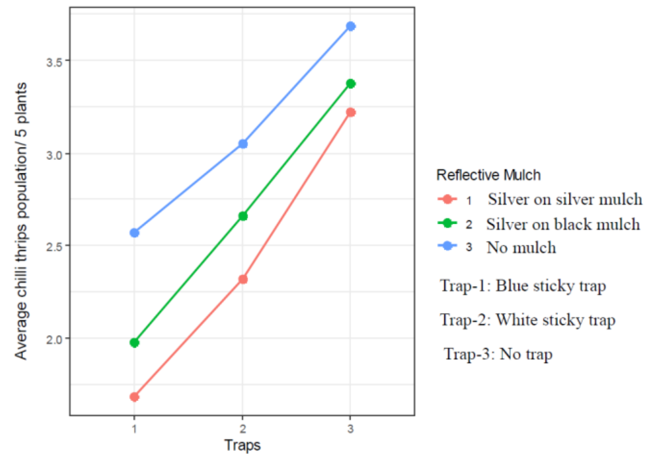

Fig. 2 : Interaction effect of coloured sticky traps and reflective mulches on the mean chilli thrips (No. of thrips/5 plants) population at 60 DAT in chilli

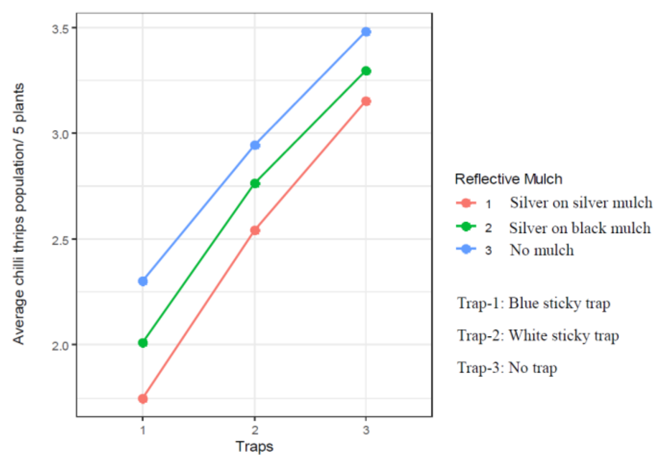

Fig. 3 : Interaction effect of coloured sticky traps and reflective mulches on the mean chilli thrips (No. of thrips/5 plants) population at 90 DAT in chilli

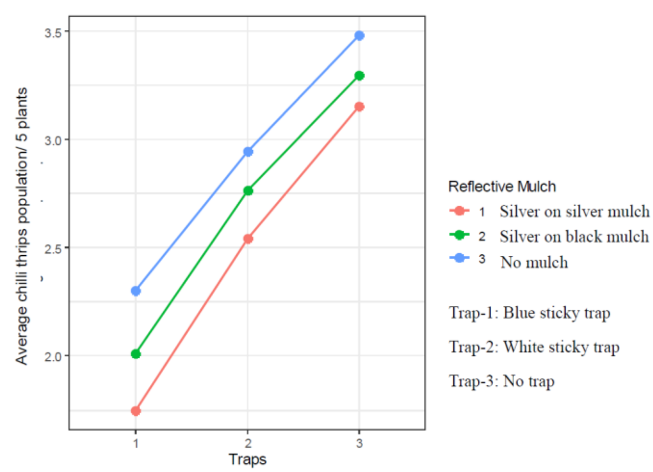

Fig. 4 : Interaction effect of coloured sticky traps and reflective mulches on the mean chilli thrips (No. of thrips/5 plants) population at 120 DAT in chilli

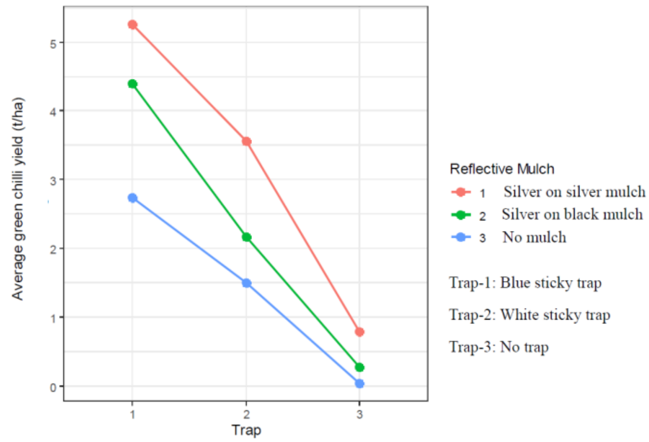

Fig. 5 : Interaction effect of coloured sticky traps and reflective mulches on chilli yield (t/ha) at 90 DAT

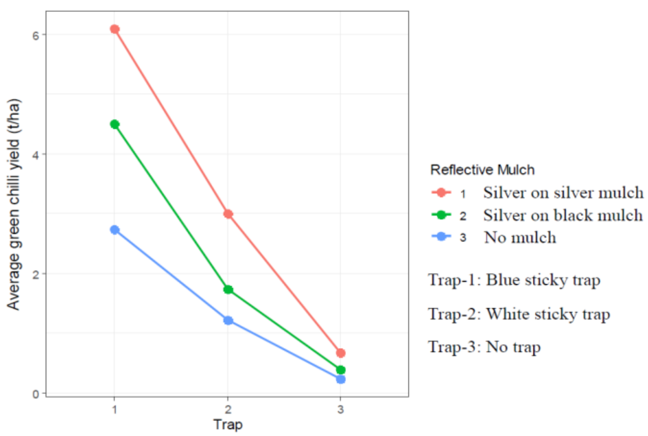

Fig. 6: Interaction effect of coloured sticky traps and reflective mulches on chilli yield (t/ha) at 120 DAT

Conclusion

The combined use of blue sticky traps and silver-on-silver reflective mulch was highly effective in reducing chilli thrips infestation and increasing chilli yield. Among all treatments, T1 (Blue sticky trap + Silver on silver mulch) recorded the lowest thrips population and the highest yield. Blue sticky traps were found to be more attractive to thrips than white sticky traps, while reflective mulches contributed to reduced pest incidence by disrupting host-finding behaviour. Therefore, the integration of blue sticky traps with reflective silver mulch can be recommended as an effective, economical and environmentally friendly strategy for the management of chilli thrips and improvement of chilli productivity.

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