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# EVALUATION OF COLOURED STICKY TRAPS FOR *THRIPS PARVISPINUS* (KARNY) MANAGEMENT AND ITS IMPACT ON CHILLI YIELD

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**ABSTRACT**

*Thrips parvispinus* (Karny) is a major pest of chilli (*Capsicum annuum* L.), causing significant yield losses through direct feeding and virus transmission. Effective monitoring strategies are essential for timely pest management. This study evaluated the efficacy of colored sticky traps (blue, yellow, green, white, pink, red, a combination of sticky traps, and transparent) in capturing *T. parvispinus* and their influence on chilli yield. A field experiment was conducted using a randomized block design with eight treatments and three replications at the Entomology Research Block, College of Agriculture, Raichur, during late Kharif 2023-24. Results showed that blue sticky traps were the most effective in attracting *T. parvispinus*, followed by white and yellow traps, while transparent traps had the lowest captures. Thrips populations peaked at 75 days after installation (DAI), with blue traps recording the highest infestations, followed by white and yellow, while red, pink, and transparent traps had minimal attraction. While blue traps efficiently captured thrips, yellow traps attracted more coccinellid predators, indicating possible disruptions to beneficial insect populations. Yield trends mirrored thrips capture patterns, with the highest yields recorded in plots using a combination of sticky traps, followed by blue and white traps. Untreated plots had the lowest yields, emphasizing the role of sticky traps in thrips management. These findings suggest that colored sticky traps, particularly blue, can serve as an effective monitoring tool for *T. parvispinus* in chilli cultivation, aiding in timely pest control decisions.

***Key words*: *Thrips parvispinus*, Sticky traps, Chilli, IPM, Pest monitoring, Yield improvement**

## Introduction

Chilli (*Capsicum annuum* L.) is a vital spice and vegetable crop cultivated globally, with India leading in production, covering 8.90 lakh hectares and yielding 29.13 lakh metric tons at 3.3 MT/ha in 2023-24 (Anon., 2024). Beyond its culinary significance, chilli finds applications in medicine, cosmetics, and beverages (Tiwari *et al.*, 2005).

Despite its economic value, chilli production suffers severe losses (50-90%) due to insect pests (Nelson & Natrajan, 1994; Kumar, 1995). Among these, thrips (*Scirtothrips dorsalis* (Hood)), whitefly (*Bemisia tabaci* (Genn)), aphids (*Aphis gossypii* (Glover)), and mites (*Polyphagotarsonemus latus* (Banks)), as well as defoliating pests like the tobacco caterpillar, *Spodoptera litura* (Fabricius) and fruit borer, *Helicoverpa armigera* (Hubner), can severely damage the plant from germination to harvest. Thrips, in particular, not only cause direct damage but also transmit plant viruses (Sridhar *et al.*, 2021).

A recent invasion of *T. parvispinus* (Karny), first recorded in India on papaya (Tyagi *et al.*, 2015), has escalated into a significant challenge, infesting over 0.4 million hectares of chilli in 2022. Originally from Southeast Asia, this pest now affects multiple crops, including *Capsicum annuum*, cotton, and mango (Nagaraju *et al.*, 2021; Rachana *et al.*, 2022). Globally, it has caused major yield reductions, such as a 23% loss in Indonesian pepper crops (Johari & Natalia, 2018; Sugano *et al.*, 2013).

With its high reproductive rate, cryptic behaviour, and resistance to chemical controls, *T. parvispinus* demands an innovative integrated pest management (IPM) strategy. Heavy infestations lead to leaf curling, chlorophyll depletion, necrotic patches, and flower abortion, significantly reducing yield (Sridhar *et al.*, 2021; Mound & Collins, 2000). Sustainable control methods are imperative to mitigate pesticide resistance and environmental risks.

Sticky traps serve as a simple yet powerful cultural control method, offering an eco-friendly solution for pest management. Leveraging thrips color preferences enhances trap efficiency, improving pest monitoring while minimizing pesticide reliance. Beyond surveillance, colored sticky traps play a crucial role in sustainable crop protection. Their integration into IPM programs enables precise thrips population tracking, ensuring timely and effective pest control interventions.

This research, "Evaluation of Coloured Sticky Traps for *Thrips parvispinus* (Karny) Management and Its Impact on Chilli Yield," introduces an eco-friendly approach to integrated pest management, offering a scalable and sustainable solution for chilli growers**.**

## Material and Methods

### Location and Experimental Site

The present investigation was carried out in the field to compare the efficacy and specificity of *T. parvispinus* towards different coloured sticky traps during late Kharif 2023-24 at the Entomology Research Block, College of Agriculture, Raichur.

### Experimental Procedure

The experiment was laid out in a randomized block design with a plot size of 189 m² and unit plot size of 4.5 × 5.25 m², consisting of eight treatments and three replications. The popular chilli hybrid HPH-5531 seedlings, thirty days old, were transplanted during the last week of August with a spacing of 90 cm × 30 cm. Six different coloured sticky traps—blue, yellow, green, white, pink, red—and a transparent sheet (control) were used, along with an additional treatment combining all sticky traps for a free-choice test. Each sticky trap, measuring 20 cm in width and 29 cm in height, was used to determine *T. parvispinus* preference. No pesticides were applied to the main field crop.

### Preparation of Different Coloured Sticky Traps

The commercially available blue-, white-, and yellow-coloured sticky traps were procured from Barrix Pvt. Ltd., Bengaluru, whereas green, pink, and red traps were customized by laminating green, pink, and red colour paper with an OHP sheet. The transparent sheet was considered as control. One each of these traps was installed per plot, consisting of 12 × 8 square grids measuring 1 square inch per grid (Devi and Roy, 2017). Each of these traps was tied to a bamboo stick and installed above the crop canopy level. The traps were adjusted according to the height of the crop canopy as it grew (Plate 1). Barrix glue was uniformly smeared on the surface of each colour trap at 15-day intervals on the manually customized sticky traps after documenting the thrips population, and the traps were replaced every 15 days. The treatments, i.e., different coloured sticky traps (Table 1), were installed in the experimental plot following randomization (Plate 1).

**Table 1:** Treatment details of the efficacy of different coloured sticky traps.

| Sl. No. | Treatment details | Sticky traps numbers |
|---|---|---|
| 1 | $T_1$: Blue sticky trap | One |
| 2 | $T_2$: Yellow sticky trap | One |
| 3 | $T_3$: Green sticky trap | One |
| 4 | $T_4$: White sticky trap | One |
| 5 | $T_5$: Pink sticky trap | One |
| 6 | $T_6$: Red sticky trap | One |
| 7 | $T_7$: Combination of sticky traps | Six |
| 8 | $T_8$: Control (Transparent sticky trap) | One |

### Observations Recorded

Thrips glued to coloured sticky traps were counted from 25 square grids using a hand-held magnifying lens of 10× magnification. Observations were taken every fifteen days, commencing from 15 days after installation (DAI) until harvesting. The yield data of individual treatments were obtained by harvesting the entire replicated plots. Coccinellids glued to coloured sticky traps were counted from 25 square grids. Observations were


**Plate 1:** General view of field experiment.

**Table 2:** Preference of T. parvispinus population to different coloured sticky traps in chilli.

| Treat-ments | Mean number of thrips per grid | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Vegetative stage | Flowering stage | | | | Fruiting stage | | |
| | 30DAI | 45DAI | 60DAI | 75DAI | 90DAI | 105DAI | 120DAI | 135DAI |
| $T_1$ | 0.41(0.95)[a] | 1.73(1.49)[a] | 3.72(2.05)[a] | 22.36(4.77)[a] | 14.97(3.92)[a] | 7.16(2.74)[a] | 4.76(2.28)[a] | 2.15(1.61)[a] |
| $T_2$ | 0.23(0.85)[ab] | 1.08(1.26)[a] | 1.69(1.46)[b] | 11.40(3.44)[b] | 8.95(3.05)[b] | 3.68(2.04)[b] | 3.16(1.91)[b] | 1.13(1.27)[b] |
| $T_3$ | 0.04(0.73)[b] | 0.31(0.90)[b] | 0.84(1.16)[c] | 2.41(1.70)[c] | 2.15(1.62)[c] | 1.79(1.51)[c] | 1.57(1.43)[c] | 0.41(0.95)[c] |
| $T_4$ | 0.37(0.92)[a] | 1.61(1.43)[a] | 2.60(1.76)[a] | 19.19(4.43)[a] | 13.44(3.73)[a] | 5.59(2.46)[ab] | 3.95(2.10)[ab] | 1.49(1.41)[ab] |
| $T_5$ | 0.01(0.72)[b] | 0.28(0.88)[b] | 0.71(1.09)[c] | 1.48(1.41)[c] | 1.77(1.50)[cd] | 1.80(1.47)[c] | 0.92(1.19)[cd] | 0.35(0.92)[c] |
| $T_6$ | 0.01(0.72)[b] | 0.17(0.82)[b] | 0.67(1.08)[c] | 1.09(1.21)[c] | 1.21(1.31)[cd] | 0.88(1.17)[cd] | 0.76(1.12)[cd] | 0.25(0.87)[c] |
| $T_7$ | 0.32(0.90)[a] | 1.45(1.40)[b] | 2.83(1.82)[a] | 19.13(4.39)[a] | 12.03(3.52)[ab] | 6.39(2.62)[a] | 4.69(2.28)[a] | 1.97(1.56)[a] |
| $T_8$ | 0.03(0.73)[b] | 0.05(0.74)[b] | 0.29(0.89)[c] | 0.64(1.06)[c] | 0.63(1.06)[c] | 0.44(0.97)[d] | 0.24(0.86)[d] | 0.12(0.79)[c] |
| **S.Em (±)** | **0.05** | **0.07** | **0.09** | **0.21** | **0.17** | **0.14** | **0.10** | **0.08** |
| **CD @ 5%** | **0.15** | **0.23** | **0.28** | **0.66** | **0.52** | **0.42** | **0.31** | **0.24** |
| **CV (%)** | **10.35** | **11.56** | **11.05** | **13.27** | **11.94** | **12.62** | **10.59** | **11.38** |

**$T_1$:** Blue sticky trap; **$T_2$:** Yellow sticky trap; **$T_3$:** Green sticky trap; **$T_4$:** White sticky trap; **$T_5$:** Pink sticky trap; **$T_6$:** Red sticky trap; **$T_7$:** Combination of all sticky traps; **$T_8$:** Transparent sticky trap (Control)
**NS- Non significant; DAI: Days after installation; Values in parenthesis are $\sqrt{x+0.5}$ transformed; Transformed values followed by same alphabet in columns did not differ significantly (p=0.05) by DMRT**

taken at fifteen-day intervals, commencing from 15 DAI until harvesting. The specimens were collected and stored in glass vials containing 70% ethyl alcohol.

### Statistical Analysis

The data were subjected to analysis of variance (ANOVA), and mean values of both thrips and natural enemies were adjusted and separated by Duncan's Multiple Range Test (DMRT) according to Gomez and Gomez (1984).

## Results and Discussion

### Mean Population of Thrips, Coccinellid, and Impact on Yield

At 30 days after installation (DAI), the blue sticky trap captured significantly more *T. parvispinus* (0.41 thrips per grid) compared to white (0.37 thrips per grid) and yellow (0.23 thrips per grid) traps (Table 2). The pink and red traps caught the least (0.01 thrips per grid). This pattern persisted at 45, 60, and 75 DAI, with the highest number of thrips recorded at 75 DAI on blue traps (22.36 thrips per grid), followed by white (19.19 thrips per grid) and yellow traps (11.40 thrips per grid). Transparent traps attracted the fewest thrips (0.64 thrips per grid). The seventh treatment, which involved installing all coloured sticky traps, was primarily conducted to confirm the thrips colour preference. The results revealed that when the choice was given, a greater number of thrips were attracted to the blue sticky traps compared to the other coloured sticky traps.

**Table 3:** Pooled data of the population of *T. parvispinus* on different coloured sticky traps and impact on dry chilli yield.

| Treatments | Mean number of *T. parvispinus*per grid of sticky trap across three different stages | | | | Yield q/ha |
|---|---|---|---|---|---|
| | Vegetative stage | Flowering stage | Fruiting stage | Pooled data | |
| $T_1$:Blue sticky trap | 0.24(0.76)[a] | 9.05(3.90)[a] | 5.58(2.43)[a] | 5.57(2.46)[a] | 14.48[a] |
| $T_2$:Yellow sticky trap | 0.08(0.84)[a] | 4.88(2.32)[c] | 3.03(1.88)[b] | 3.03(1.87)[b] | 13.76[a] |
| $T_3$:Green sticky trap | 0.00(0.71)[a] | 1.25(1.32)[d] | 1.32(1.35)[c] | 0.94(1.20)[c] | 9.53[b] |
| $T_4$:White sticky trap | 0.07(0.76)[a] | 7.63(2.85)[b] | 4.40(2.20)[ab] | 4.65(2.25)[a] | 14.37[a] |
| $T_5$:Pink sticky trap | 0.00(0.71)[a] | 0.92(1.19)[de] | 1.11(1.26)[cd] | 0.74(1.11)[cd] | 8.47[b] |
| $T_6$:Red sticky trap | 0.00(0.71)[a] | 0.67(1.08)[ef] | 0.68(1.09)[cd] | 0.50(0.10)[cd] | 8.90[b] |
| $T_7$:Combination of all sticky traps | 0.06(0.75)[a] | 7.39(2.80)[b] | 5.53(2.45)[a] | 4.85(2.31)[cd] | 14.88[a] |
| $T_8$: Transparent sticky trap (control) | 0.00(0.71)[a] | 0.36(0.93)[f] | 0.32(0.90)[d] | 0.25(0.87)[d] | 7.40[b] |
| **S.Em (±)** | **0.04** | **0.08** | **0.11** | **0.10** | **0.67** |
| **CD @ 5%** | **NS** | **0.25** | **0.34** | **0.30** | **2.07** |
| **CV (%)** | **9.48** | **7.25** | **11.26** | **10.25** | **10.16** |

**NS- Non significant; DAI: Days after installation; Values in parenthesis are $\sqrt{x+0.5}$ transformed; Transformed values followed by same alphabet in columns did not differ significantly (p=0.05) by DMRT**

**Table 4:** Preference of coccinellid predators to different coloured sticky traps during the cropping period in chilli.

| Treat-ments | Mean number of conccinellid predators per grid | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Vegetative stage | Flowering stage | | | | Fruiting stage | | | Mean |
| | 30DAI | 45DAI | 60DAI | 75DAI | 90DAI | 105DAI | 120DAI | 135DAI | |
| $T_1$ | 0.04(0.73)$^{a}$ | 0.19(0.82)$^{a}$ | 0.27(0.87)$^{a}$ | 0.39(0.93)$^{ab}$ | 0.19(0.82)$^{b}$ | 0.15(0.81)$^{ab}$ | 0.09(0.77)$^{a}$ | 0.05(0.74)$^{a}$ | 0.17 |
| $T_2$ | 0.19(0.81)$^{a}$ | 0.29(0.88)$^{a}$ | 0.45(0.96)$^{a}$ | 0.73(1.10)$^{a}$ | 0.63(1.05)$^{a}$ | 0.52(1.00)$^{a}$ | 0.35(0.90)$^{a}$ | 0.16(0.80)$^{a}$ | 0.42 |
| $T_3$ | 0.09(0.77)$^{a}$ | 0.19(0.82)$^{a}$ | 0.28(0.88)$^{a}$ | 0.31(0.90)$^{ab}$ | 0.21(0.84)$^{b}$ | 0.21$^{ab}$(0.84) | 0.24(0.84)$^{a}$ | 0.05(0.74)$^{a}$ | 0.20 |
| $T_4$ | 0.05(0.74)$^{a}$ | 0.21(0.84)$^{a}$ | 0.27(0.87)$^{a}$ | 0.45(0.97)$^{ab}$ | 0.20(0.83)$^{b}$ | 0.25(0.88)$^{ab}$ | 0.16(0.81)$^{a}$ | 0.11(0.77)$^{a}$ | 0.21 |
| $T_5$ | 0.12(0.78)$^{a}$ | 0.27(0.87)$^{a}$ | 0.31(0.90)$^{a}$ | 0.13(0.80)$^{b}$ | 0.36(0.93)$^{ab}$ | 0.08(0.76)$^{b}$ | 0.23(0.84)$^{a}$ | 0.04(0.73)$^{a}$ | 0.19 |
| $T_6$ | 0.07(0.75)$^{a}$ | 0.23(0.86)$^{a}$ | 0.21(0.84)$^{a}$ | 0.21(0.84)$^{ab}$ | 0.23(0.85)$^{b}$ | 0.16(0.81)$^{ab}$ | 0.12(0.79)$^{a}$ | 0.05(0.74)$^{a}$ | 0.16 |
| $T_7$ | 0.08(0.76)$^{a}$ | 0.19(0.83)$^{a}$ | 0.45(0.97)$^{a}$ | 0.28(0.88)$^{ab}$ | 0.43(0.97)$^{ab}$ | 0.32(0.90)$^{ab}$ | 0.32(0.90)$^{a}$ | 0.13(0.79)$^{a}$ | 0.28 |
| $T_8$ | 0.00(0.71)$^{a}$ | 0.09(0.77)$^{a}$ | 0.16(0.81)$^{a}$ | 0.10(0.78)$^{a}$ | 0.17(0.82)$^{b}$ | 0.13(0.73)$^{ab}$ | 0.07(0.75)$^{a}$ | 0.01(0.72)$^{a}$ | 0.09 |
| **S.Em(±)** | **0.05** | **0.06** | **0.07** | **0.06** | **0.06** | **0.06** | **0.07** | **0.05** | |
| **CD @ 5%** | **NS** | **NS** | **NS** | **0.20** | **0.18** | **0.19** | **NS** | **NS** | |
| **CV (%)** | **12.44** | **12.13** | **13.46** | **12.48** | **11.17** | **13.48** | **14.97** | **11.55** | |

**$T_1$:** Blue sticky trap; **$T_2$:** Yellow sticky trap; **$T_3$:** Green sticky trap; **$T_4$:** White sticky trap; **$T_5$:** Pink sticky trap; **$T_6$:** Red sticky trap; **$T_7$:** Combination of all sticky traps; **$T_8$:** Transparent sticky trap (Control)
**NS- Non significant; DAI: Days after installation; Values in parenthesis are $\sqrt{x+0.5}$ transformed; Transformed values followed by same alphabet in columns did not differ significantly (p=0.05) by DMRT**

During the pre-fruiting and fruiting stages (90 to 135 DAI), thrips populations decreased but remained highest on blue traps, followed by white and yellow (Table 3). Overall, the number of trapped adult thrips increased during the flowering stage, peaking in December (3$^{rd}$ and 4$^{th}$ week of observation). The highest mean number of adult thrips was observed on blue sticky traps (22.36 thrips per grid), followed by white (19.19 thrips per grid) and yellow traps (11.40 thrips per grid). In contrast, fewer thrips were found on green (2.41 thrips per grid), pink (1.48 thrips per grid), red (1.09 thrips per grid), and transparent (control: 0.64 thrips per grid) traps. This trend was consistent from flowering to harvesting periods (Table 4).

The attractiveness of coloured sticky traps for trapping *T. parvispinus* followed the order: Blue > White > Yellow > Green > Pink > Red > Control. Among the three growth stages of chilli, the thrips population peaked during the flowering stage, followed by the fruiting stage, with the highest mean population on blue sticky traps (9.05 thrips per grid) and the lowest on transparent traps (control: 0.36 thrips per grid) (Fig. 1). The overall mean population showed significant differences among treatments (Table 3), with the minimum and maximum thrips populations recorded on transparent (0.25 thrips per grid) and blue (5.57 thrips per grid) sticky traps, respectively. The present findings corroborate those of Hossain *et al.,* (2020), who opined that blue and white were more effective in trapping the thrips *Scirtothrips dorsalis* in chilli, followed by yellow sticky traps. Similarly, Ranamukhaarachchi and Wickramarachchi (2007) revealed that blue and white colours were more effective in trapping the thrips *Ceratothripoides claratris* in tomatoes, followed by purple. This is because colours

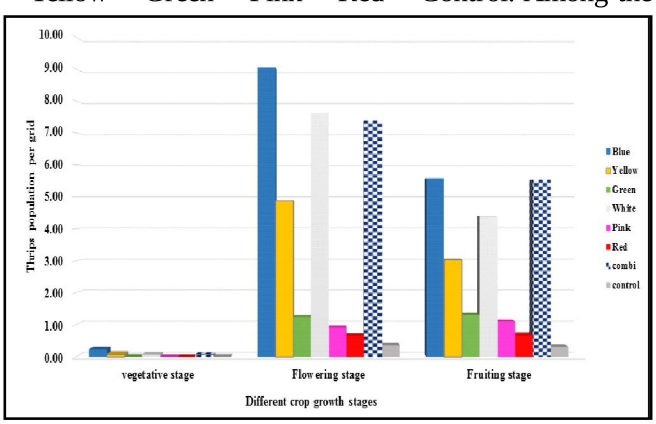



**Fig. 1:** Pooled data of the population of *T. parvispinus* on different coloured sticky traps at different crop growth stages

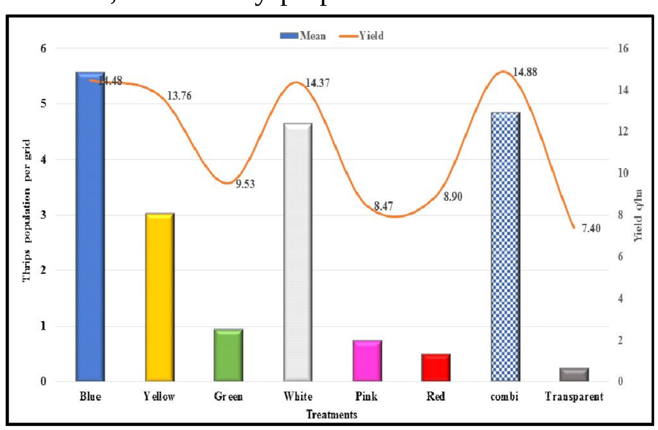



**Fig. 2:** Preference of different coloured sticky traps by *T. parvispinus* throughout the cropping period and impact on yield.

that strongly reflect UV and blue light caught more *C. claratris* compared to other colours. Hence, the intensity of blue and UV reflection appears to be an important component of trap efficiency.

Yield patterns mirrored thrips capture trends. The combined sticky trap setup achieved the highest yield (14.88 q/ha), followed by blue (14.48 q/ha) and white (14.37 q/ha) traps. Yellow traps resulted in slightly lower yields (13.76 q/ha) (Table 2), while the control plot had the lowest yield (7.40 q/ha) (Fig. 2). Cheema *et al.*, (2024) revealed that the blue coloured sticky traps (both commercial and handmade) were best in trapping bean flower thrips, and the plots with blue traps recorded significantly lesser thrips incidence in flowers and higher grain yields. The present result also suggests that sticky traps, especially blue followed by white, improved yields by reducing thrips populations.

## Coccinellid Population

The coccinellid population remained low during the vegetative to pre-flowering stage (30 to 45 days after installation), with no significant differences among treatments. However, as the crop progressed, yellow sticky traps consistently attracted the highest number of coccinellids, while the transparent trap recorded the least.

During the flowering stage (60 days after installation), coccinellid numbers ranged from 0.16 to 0.45 per grid, with the highest population recorded on yellow sticky traps (0.45 per grid). At 75 days after installation, predator numbers increased, with yellow traps (0.73 per grid) capturing the most, followed by white and blue traps. In the post-flowering and pre-fruiting stage (90 days after installation), coccinellid populations ranged from 0.17 to 0.63 per grid, with yellow traps maintaining the highest capture rate (0.63 per grid). As the crop reached the fruiting stage (105 to 135 days after installation), coccinellid captures declined across all traps, but yellow traps consistently recorded the highest numbers, while transparent and pink traps attracted the least (Fig. 3).

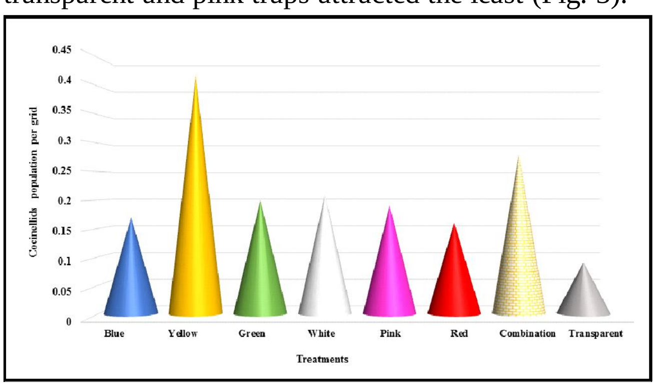
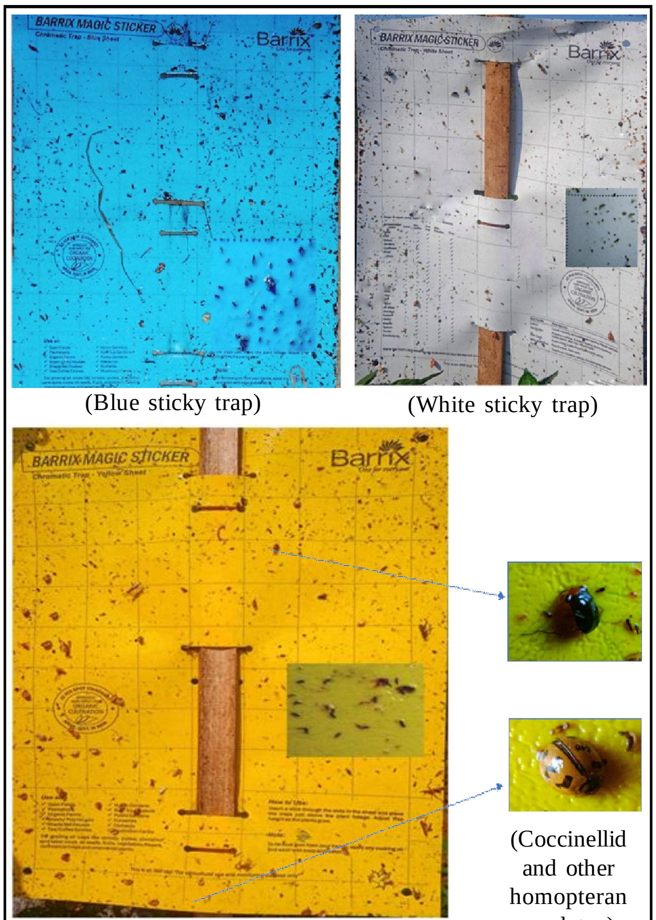



**Fig. 3:** Prevalence of coccinellids across different coloured sticky traps during cropping period.

The results indicated that yellow sticky traps are highly attractive to coccinellid predators, aligning with the findings of Riley and Schuster (1994), who reported that yellow traps effectively capture coleopterans, hemipterans, hymenopterans, and thysanopterans. However, while yellow traps were effective in trapping thrips, they also captured a high number of beneficial coccinellids. This suggests that the use of yellow traps in integrated pest management (IPM) strategies is not advisable, as they can disrupt the natural predator population and affect ecological balance in chili ecosystems.

Surprisingly, during the peak incidence of thrips population, the homopteran bug *Geocoris uliginosus* was found to be attracted to yellow-coloured sticky traps (Plate 2). The outcome of the present study aligns with Hossain *et al.*, (2020), who reported that yellow sticky traps attracted coccinellid predators. Devi and Roy (2014) also found that yellow sticky traps attracted more beneficial insects compared to blue sticky traps in the onion ecosystem. They opined that blue sticky traps can be used for monitoring and mass trapping as a component of an IPM programme.




(Blue sticky trap) (White sticky trap)

(Yellow sticky trap) (Coccinellid and other homopteran predator)

**Plate 2:** Thrips and beneficial insects preference on sticky traps.

The cryptic nature of thrips makes early detection crucial for effective pest control. Coloured sticky traps, particularly blue, have proven effective in monitoring thrips populations, aiding farmers in early intervention. This study identifies blue sticky traps as the most effective for capturing *T. parvispinus,* surpassing yellow, white, green, red, pink, and transparent sticky traps.

## Conclusion

Blue sticky traps are the most effective for capturing *T. parvispinus*, but while these alone may not completely control thrips throughout the crop cycle, they are valuable within an integrated pest management (IPM) program. Their use allows for timely pesticide application, improving crop protection and yield. Incorporating blue sticky traps in an IPM framework offers an eco-friendly, efficient strategy for managing thrips infestations in chilli cultivation.

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