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Evaluation Of Different Coloured Sticky Traps In *Aphis Gossypii* (Glover) Management In Cotton Field: An Environmentally Beneficial Method.

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ABSTRACT
Cotton is a significant crop in worldwide, but its cultivation faces many challenges in the pest infestation of cotton aphid (*Aphis gossypii*). Traditional pest control methods, such as chemical pesticides, have led to environmental and health concerns. Handmade sticky traps, coated with a sticky substance, have emerged as a promising method for sustainable cotton pest management. The colour of the traps plays a crucial role in attracting specific insect species, making colour selection an important aspect of their efficacy. This study aimed to evaluate the effectiveness of different coloured handmade sticky traps in managing *Aphis gossypii* populations in cotton fields. The results showed that yellow-coloured sticky traps demonstrated that highest efficacy in capturing *Aphis gossypii*, followed by blue traps, and red traps showed the least potential. The peak attraction for all colours occurred during the vegetative and flowering stages, where pest pressure was highest, particularly around the 20th to 21st standard meteorological week.

Key words: Cotton, management, different coloured sticky traps, field condition.

INTRODUCTION

Cotton (*Gossypium* spp.) is one of the most significant crops worldwide, serving as a vital raw material for the textile industry (**Boopathi *et al*., 2015; Kushanov *et al*., 2021**). However, its cultivation faces numerous challenges, including infestation by various pests, which can significantly reduce yield and quality (**Mollae *et al*., 2019)**. Among the most detrimental pest are the cotton aphid (*Aphis gossypii*). The pest not only cause direct damage by feeding on plant sap but also act as vectors for several plant viruses, further exacerbating the economic losses (**Singh and Singh, 2021**). Traditional pest control methods have heavily relied on chemical pesticides, which, despite their efficacy, pose serious environmental and health concerns. Overuse of these chemicals has led to the development of pesticide resistance in pest populations, disruption of natural predator-prey dynamics, and contamination of soil and water resources (**Shah *et al*., 2024**). Additionally, the indiscriminate use of pesticides can negatively impact non-target organisms, including beneficial insects such as pollinators and natural pest enemies (**Serrão *et al*., 2022).** In recent years, there has been a growing interest in developing sustainable and environmentally friendly pest management strategies. Among these, the use of sticky traps has emerged as a promising method. Sticky traps are simple devices coated with a sticky substance that captures insects upon contact (**Shashank *et al*., 2024**). The colour of the traps plays a crucial role in attracting specific insect species, making colour selection an important aspect of their efficacy (**Blackmer *et al*., 2008**). Handmade sticky traps offer several advantages, including low cost, ease of production, and customization in terms of colour and size. These traps can be tailored to target specific pests by using colours that are known to attract them. For instance, yellow and blue are particularly effective in attracting *Aphis gossypii* were respectively. By exploiting the visual preferences of these pests, handmade sticky traps can provide an efficient and eco-friendly alternative to chemical controls.

This study aims to evaluate the effectiveness of different coloured handmade sticky traps in managing *Aphis gossypii* populations in cotton fields. By comparing the efficacy of various trap colours, we seek to identify the most suitable options for pest management, thus contributing to the development of sustainable agricultural practices. Furthermore, this research underscores the potential of non-chemical methods in integrated pest management (IPM) programs, promoting environmental conservation and reducing reliance on synthetic pesticides.

MATERIALS AND METHODS

Field Location

The field experimental investigation took place during the summer irrigated season (January-July) of 2022 in Ulakkudi village, located within the Thoothukudi district of Tamil Nadu. It is positioned at 8.7789° N latitude and 77.8453° E longitude. (Figure 1)

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Figure 1. Map showing field study site in Ulakkudi village of Thoothukudi district

Experimental procedure

The agricultural fieldwork involved ploughing and seed sowing. Cotton seeds (SVPR-2) were purchased from Tirunelveli town local market, and the first sowing was performed on January 20, 2022, with gap filling on January 27, 2022. The experimental field was kept moist by providing necessary irrigation to ensure suitable conditions for the crop. The experimental plot, representing a typical cotton field in a subtropical environment, had sandy loam soil with normal acidity levels. Two cotton plots, each containing experimental beds, were selected for the study. To monitor the number of cotton aphids three coloured traps-yellow, blue and red, were used. The trial was planned in Randomized Block Design. No pesticides were applied to the cotton field crop (Hoddle *et al*., 2002).

Preparation of coloured sticky traps

Generally, sticky traps available from private companies cost Rs. 80 per trap and are effective for a maximum of five days, after which they become ineffective due to adhesion of insects, scales, and dust. Therefore, a cost-effective sticky trap using laminated coloured sheets coated with grease was developed. These traps can be reused by removing the grease and trapped insects. The laminated coloured sheet (40 cm x 20 cm) costs Rs 25, making it cost-effective and efficient. The sticky trap was fixed to the ground using wooden stakes placed at equal distances in the cotton field, and commercial-grade grease was used as an adhesive on the outer surface of the trap. The traps were placed at four different locations, and the traps locations were changed weekly. The attraction of aphids to the traps was recorded (Prema *et al*., 2018).

Data observation

Observations were taken continued at seven-day intervals from the date of seeding to harvest, commencing from 7 days after installation The numbers of Aphids trapped on each sticky trap were counted and recorded. Total Aphids were counted from different colour traps using a handheld magnifying lens. The collected data were analysed mean values are statistically (10th Standard Meteorological Week) until (31th Standard Meteorological Week). (Prema *et al*. ,2018).

RESULTS

The study evaluated the effectiveness of three different coloured laminated sticky traps (yellow, blue, and red) in attracting and capturing *Aphis gossypii* in the cotton fields during various stages of crop development, spanning from January 2022 to July 2022 in Ulakkudi village. The yellow-coloured sticky traps demonstrated the highest efficacy in capturing *Aphis gossypii* throughout the experimental period (Table 1) and (Figure 2) with a peak mean count of 39.85 aphids recorded during the 21st standard meteorological week (SMW).

Table 1. Attraction of *Aphis gossypi* to caught on different laminated sticky traps in cotton field (January 2022 to July 2022)

Sticky Traps	*Means number of cotton aphids catches/trap Standard Meteorological Weeks (SMW)																						Overall Mean Value
	10 th	11 th	12 th	13 th	14 th	15 th	16 th	17 th	18 th	19 th	20 th	21 th	22 th	23 th	24 th	25 th	26 th	27 th	28 th	29 th	30 th	31 th	
	Early stage			Vegetative stage									Flowers &bolls developmental stage					Cotton bolls maturation stage					
Yellow Colour	11.57	14.14	17.71	19.85	23.85	14.14	18.42	24.14	30.14	34.71	38.28	39.85	24.28	19.28	15.71	13.14	20.42	12.57	8.42	6.71	4.71	3.14	16.92
Blue Colour	10.71	13.42	16.42	18.85	22.42	12.71	16,42	21.14	28.28	29.28	35.57	37.71	21.85	18.14	15.14	12.28	17.14	8.42	6.85	4.42	4.14	2.42	15.59
Red Colour	8.57	11.14	14.14	16.85	18.85	9.85	14.14	17.28	23.57	25.85	32.14	35.42	19.57	15.71	10.71	11.28	12.14	6.71	5.14	3.14	0.00	0.00	12.70

*Means number of all Standard Meteorological weeks

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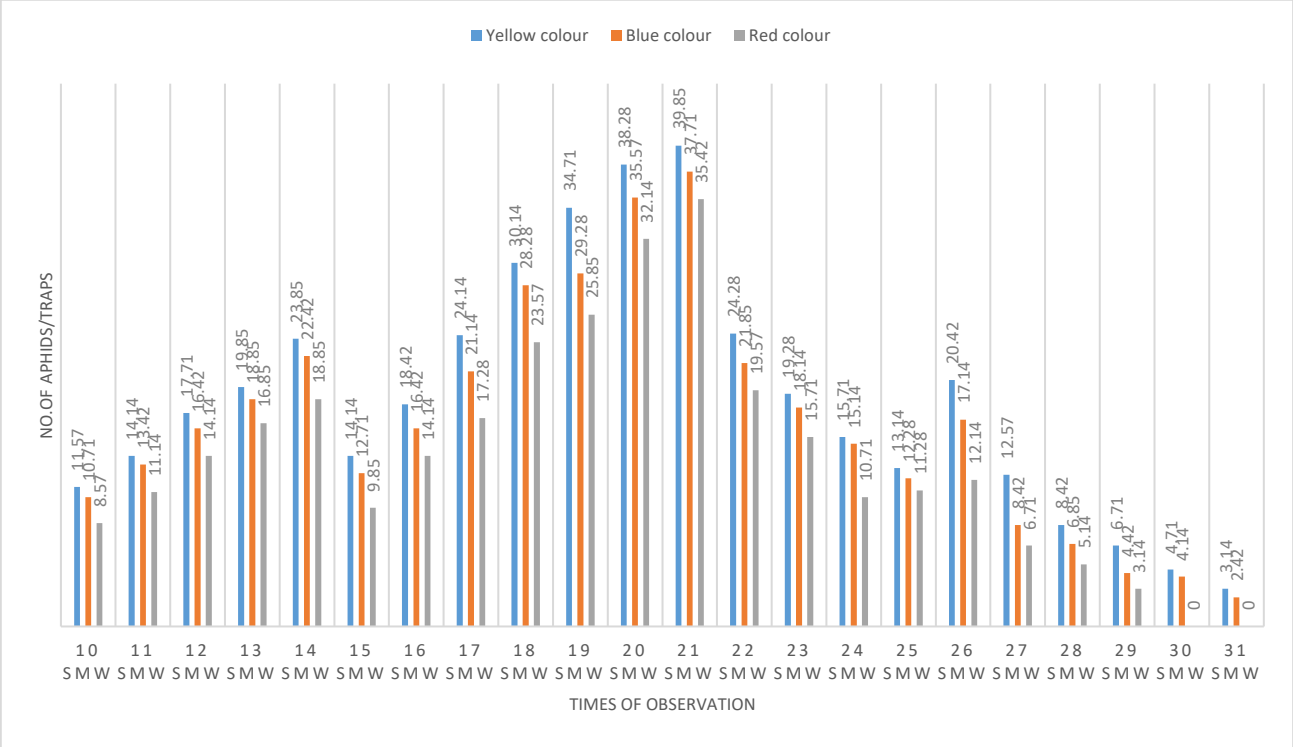

Figure 2. Number of cotton aphids catches on different coloured sticky traps during different stages of cotton.

The yellow traps maintained higher capture rates across all growth stages, particularly during the vegetative and flowering stages of cotton, with consistent aphid numbers, averaging 16.92 across the observation period. In contrast, blue sticky traps also showed significant effectiveness, though slightly lower than the yellow traps. The peak aphid capture for blue traps was 37.71 aphids during the 21st SMW, with an average of 15.59 aphids caught across the entire observation period. While blue traps followed a similar trend as the yellow traps, their overall performance in attracting aphids remained marginally inferior. Red-coloured sticky traps were the least effective in attracting *Aphis gossypii*, with a peak count of 35.42 aphids during the 21st SMW and an overall average of 12.70 aphids. Though red traps did capture aphids, the numbers remained consistently lower compared to the yellow and blue traps across all developmental stages of the cotton crop. Overall, the results indicate that the yellow traps are the most effective in attracting *Aphis gossypii*, followed by blue traps, while red traps show the least potential. The peak attraction for all colours occurred during the vegetative and flowering stages, where pest pressure was highest, particularly around the 20th to 21st SMW. These findings suggest that colour preference plays a significant role in aphid management, with yellow being the most suitable option for non-chemical control methods in integrated pest management (IPM) systems.

DISCUSSION

Sticky traps are a valuable tool in modern agricultural pest management, offering an environmentally friendly and cost-effective method for monitoring and controlling insect populations (**Rahman *et al.*, 2024**). These traps, typically consisting of adhesive-coated surfaces in various colors, are designed to attract and capture flying insects such as aphids, whiteflies, thrips, and leafhoppers (Patil and Fauquet 2021). By utilizing specific color wavelengths, sticky traps exploit the visual preferences of different pest species, making them highly efficient for both pest surveillance and population reduction. As a component of Integrated Pest Management (IPM) strategies, sticky traps allow for early detection of pest infestations, minimizing the need for chemical interventions and supporting sustainable agricultural practices (Kammar *et al*., 2020). Their simplicity, affordability, and non-toxic nature make sticky traps a preferred choice for farmers aiming to protect crops while reducing environmental impact. Several authors and researchers have reviewed the effectiveness of different colored sticky traps in managing various agricultural pests. These studies have largely focused on the color preferences of pests, the role of sticky traps in Integrated Pest Management (IPM), and how different hues can selectively attract specific insect species. Numerous studies confirm that Yellow is highly effective in attracting pests like whiteflies, aphids, thrips, and leafhoppers, making yellow sticky traps popular in fields for managing populations (Buragohain *et al.*, 2017;Nair *et al.*, 2021). Insect vision, particularly that of pests like aphids and whiteflies, is sensitive to certain wavelengths of light, especially yellow, making it an effective color for trapping these insects. Blue sticky traps have been found to significantly reduce thrips populations in both open fields and greenhouse environments (Otieno *et al.*, 2018; Sampson *et al.*, 2021).

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Blue traps are more efficient in capturing thrips than yellow traps in greenhouse-grown. green traps can be used for monitoring the populations of certain greenhouse pests and that trap color selection should be aligned with the target pest. pheromone-enhanced sticky traps in tomato fields are found them to be highly effective in capturing male moths, reducing the overall reproductive capacity of the pest population (Skinner *et al*., 2019). Sticky traps are an essential part of IPM because they not only monitor pests but can also contribute to population control when deployed in high numbers, making them effective in maintaining pest levels below economic thresholds. Effectiveness Across Different Crops Reviews across various crop systems, such as cotton, tomatoes, cucumbers, and fruit trees, indicate that colored sticky traps can help manage pests in both open fields and protected environments (Romeh 2019). Yellow traps are highly effective in managing *Aphis gossypii* and *Bemisia tabaci* in cotton fields, as noted in several studies (Mohan *et al*., 2014). yellow traps effectively attract thrips, aligning with research on various crops, making coloured targets a common tool for aphid monitoring (Thomas 2020).

Seasonal variation in trap efficiency is influenced by pest activity and environmental conditions, with timing and regular replacement potentially affecting pest capture rates. Showed that yellow sticky traps were effective in reducing aphid populations in organic cotton fields, highlighting their role in reducing pesticide use. The findings of the study are in line of many previous research, suggested that the yellow coloured traps were more attractive to aphids than those of yellow-green, orange, green and blue colour in cotton field condition. The possible attraction to yellow colour is associated with nymphs, reported that the yellow coloured sticky traps were more effective as compared to red and blue coloured traps and can be used in combination with reflective mulches for the management of aphids.

CONCLUSION

The use of coloured sticky traps, particularly yellow and blue, offers a promising, environmentally beneficial method for managing *Aphis gossypii* in cotton fields. Their role in reducing chemical inputs, protecting beneficial organisms, and contributing to sustainable pest management practices underlines their value in modern agricultural systems. As a scalable and adaptable tool, sticky traps can play a pivotal role in advancing sustainable IPM approaches that align with ecological and economic goals in cotton production.

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