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Insect Attraction Associated with Oryza sativa L. on Trap Color Variation in Tountimomor Village, West Kakas District, Minahasa Regency

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ABSTRACT

Padi adalah tanaman pangan penting sebagai sumber utama karbohidrat. Di Desa Tountimomor, Kecamatan Kakas Barat, Menado, Sulawesi Utara terdeteksi produksi padi terganggu oleh serangan hama. Penelitian ini bertujuan mengevaluasi efektivitas perangkap warna dalam menarik serangga pada tanaman padi sebagai alternatif pengendalian ramah lingkungan. Menggunakan Rancangan Acak Kelompok (RAK) dengan 4 perlakuan (perangkap kuning, biru, merah, dan transparan/kontrol), setiap perangkap dipasang pada 5 plot. Serangga yang terperangkap diidentifikasi di laboratorium. Hasil menunjukkan perangkap kuning paling efektif dengan rata-rata 59 indivudu serangga, diikuti biru (42,4) dan merah (28,6). Perangkap warna dapat menjadi solusi pengendalian serangga yang efektif dan aman di lokasi pertanaman padi sawah di Menado.

Keyword: , sawah, Serangan hama, Pengendalian serangga, Perangkap warna, Insektisida alternatif

ABSTRAK

Rice is an important food crop as the main source of carbohydrates. In Tountimomor Village, West Kakas Subdistrict, Menado, Northern Sulawesi which detection of rice production is disrupted by pest attacks. This study aims to evaluate the effectiveness of color traps in attracting insects on rice plants as an alternative environmentally friendly control. Using a Randomized Group Design (RAK) with 4 treatments (yellow, blue, red, and transparent/control traps), each trap was set on 5 plots. Trapped insects were identified in the laboratory. Results showed yellow traps were most effective with an average of 59 insects, followed by blue (42.4) and red (28.6). Color traps can be an effective and safe insect control solution in paddy plantations in Menado.

Keyword: Rice, Pest infestation, Insect control, Color traps, Alternative insecticides

1. Introduction

Rice (*Oryza sativa* L.) is one of the most important cultivated plants in human civilization, because it is the main source of carbohydrates for the majority of the world's population after cereals such as corn and wheat (Anonymous, 2018). Rice has long been a staple food crop in various countries with tropical climates, especially in Asia and Africa (Herawati, 2012).

In 2019, Indonesia produced 54.60 million tons of dry milled grain (GKG), but experienced a decrease of 7.76% compared to 2018 which reached 59.20 million tons of GKG (Anonymous, 2020). This decline can be caused by various factors, one of which is pest attacks. Pests are organisms that damage plants or agricultural products through their living activities, which can cause physical damage and economic losses (Hasyim, 2015).

Various types of rice pests have been identified in previous research, such as the Brown Planthopper (Nilaparvata lugens), Green Planthopper (Nephotettix virescens), White Rice Stem Borer (Scirpophaga innotata), and Rice Leaf Folder (Cnaphalocrocis medinalis) (Heviyanti & Syahril, 2018). This pest attack creates major obstacles for farmers in increasing production yields. Therefore, various control methods have been carried out, such as mechanical, physical, biological and chemical control (Sjakoer, 2010). Among these methods, chemical control using pesticides is the most practical choice, even though it has a wide impact on the environment.

One environmentally friendly alternative method is the use of color traps. This trap takes advantage of insects' attraction to certain colors to gather and be caught. This concept is based on the phototaxis response of insects, namely the movement or orientation of insects towards light or certain colors (Rante, 2018). Research by Hendarsih and Usyati (1999) shows that color traps combined with sex pheromones can be an effective way to catch pests such as the Yellow Rice Stem Borer (Scirpophaga incertulas).

Based on these problems, this research aims to examine the effectiveness of several types of color traps in attracting insects associated with lowland rice plants. It is hoped that the results of this research can contribute to more sustainable pest management, especially in rice farming systems.

1.1. Problem Formulation

Does the use of different types of color traps affect the attraction level of insects associated with rice plants?

1.2. Research Objective

The purpose of this study was to analyze the effect of several types of color traps on the attraction of insects associated with rice plants.

1.3. Research Benefit

The results of this study are expected to provide information on the most effective types of color traps to be used in controlling insect pests in rice plants, thus supporting the implementation of environmentally friendly and sustainable agricultural practices.

2. Methodology

2.1. Time and Place

This research was carried out from July to September 2022 in Tountimomor Village, West Kakas District. Field research continued at the Laboratory of the Department of Plant Pests and Diseases, Plant Protection Study Program, Faculty of Agriculture, Sam Ratulangi University, Manado.

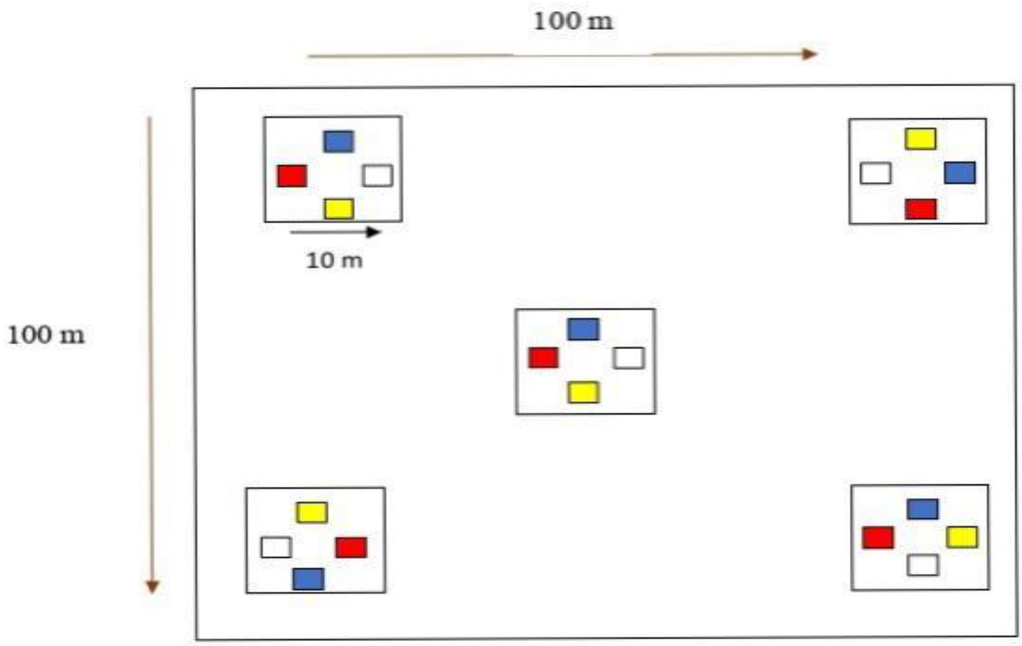
2.2. Tools and materials

Tools and materials used in this research include**:**Rice plant area, adhesive glue (mouse glue), bamboo, name labels, brushes, meters, transparent plastic, camera, hand counter, nails, hammer, plywood, yellow paper, blue paper, red paper, transparent paper, microscope , loupe, stationery, and identification reference book (Kalshoven, 1981; Borror et al., 1992; Boror et al., 1994; Shepard, 1992; Hendrichs, 1994; Siwi, 1991; Holand, 2012; Kim et al., 2011; Hawkeswood, 2003; Sembel, 2014; Lee et al., 2011; Nurhabibah, 2018; Kartohadjono et al., 2009).

2.3. Research Methods

This research used a Randomized Group Design (RAK) with four treatments, namel Yellow Sticky Trap (YST), Blue Trap (BT), Red Trap (RT), and Transparent Trap Control (TTC). Each treatment was repeated five times such as described into Figure 1.

Figure 1. Color Trap Laying Scheme



Explanation :

: Yellow Trap

:Red Trap

: Blue Trap

: Control/transparent

: The length and width of the land

: The size of the observation plot

2.4. Research Procedures
2.4.1. Survey and Location Determination
Location selection was carried out by survey in Tountimomor Village, West Kakas District.

2.4.2. Making Traps
1.Make 80 rectangular traps measuring 30 × 20 cm using plywood.
2.The plywood is covered with yellow, red and blue paper on both sides, then put in clear plastic and smeared with adhesive glue.
3.Transparent traps are made by installing plywood on bamboo poles as a support

2.4.3. Setting Traps

1.Color traps are installed in the rice planting area with an area of ±100 × 100 m. There are five plots measuring 10 × 10 m.

2.The trap is installed diagonally with a height of 60 cm or adjusted to the height of the plant.

3.Observations were carried out during the vegetative to generative phase (40–75 DAT) with a trap setting interval of two weeks.

4.Plastic traps that have been used are replaced with new plastic, while old plastic is documented for identification.

5.Insects that are difficult to remove from the trap are observed using an insect net..

2.4.4. Identification in the Laboratory

Traps containing insects are taken to the laboratory to be observed using a magnifying glass or microscope. Data collected includes the number of insects trapped and identification of the type of insect.

2.5. Observation Parameters

1.Population and types of insects caught in color traps.

2.Types of insects found on rice plants.

2.6. Data analysis

Data were analyzed using the Minitab version 16 program with analysis of variance (ANOVA) and Tukey's follow-up test at a significance level of 5%. If there is a real difference, a further test is carried out with BNJ (Honest Significant Difference) at the 5% level.

3. Results and Discussion

3.1. Population and Types of Insects Caught in Color Traps

Based on the research results, 7 orders and 23 families of insects were found (Table 1), consisting of: **Insect pests:** 12 families from 5 orders. **Natural enemy insects (predators):** 11 families from 7 orders. **Parasitoid insects:** 1 family from 1 order.

Table 1.Composition of insect based on variance traps

Treatment	No.	Order	Family	Genera	Day				Total individual	Status
					30	45	60	75		
Yellow Sticky Trap (YST)	1	Hemiptera	Pentatomidae	*Dolycorus* sp	-	-	1	3	4	Pest
				Scotinophara coarctata	-	2	2	-	4	Pest
			Miridae	*Cyrtohinus lividipennis*	6	-	-	-	6	Pest
				Stenodema sp	-	-	4	5	9	Predator
			Alydidae	*Leptocorisa* sp	-	3	6	9	18	Pest
			Lygaeideae	*Paraecosmetus*	-	-	3	4	7	Pest
			Cicadellidae	*Cofana spectra*	41	89	14	32	176	Pest
				Recilia dorsalis	22	21	32	35	78	Pest
				Nephotetix sp	7	13	23	34	77	Pest
	2	Orthoptera	Acrididae	*Oxya chinensis*	-	1	1	-	2	Pest
				Anacridium sp	2	1	2	1	6	Pest
			Tettigoniidae	*Conocephalus*	-	1	1	-	2	Predator
	3	Lepidoptera	Crambidae	*Chilo* sp.	3	-	-	-	3	Pest
			Hesperiidae	*Parnara* sp.	1	1	-	-	2	Pest
			Pyralidae	*Cnaphalocrocis medinalis*	-	-	-	-	-	Pest
	4	Diptera	Cecidomydae	*Orseolia* sp.	3	-	1	-	4	Pest
			Tachinidae	*Agryophylax nigrotibilis*	-	3	2	6	11	Predator
			Chlopidae	*Chlorops* sp.	-	-	19	8	27	Pest
			Sciomyzidae	*Sepedon* sp.	27	35	29	63	153	Predator
			Aphelinidae	*Encarsia* sp.	-	-	-	4	4	Parasitoid
	5	Coleoptera	Coccinellidae	*Menochilus sexmaculatus*	132	41	15	6	194	Predator
			Carabidae	*Ophionea nigrofasciata*	-	1	-	-	1	Predator
			Chrysomelidae	*Phyllotretra* sp	1	-	-	7	8	Predator
			Staphylinidae	*Paederus* sp	3	-	-	-	3	Predator
	6	Hymenoptera	Shpecidae	*Sceliphron* sp	-	-	4	3	7	Predator
	7	Odonata	Coenagrionidae	*Agriocnemis* sp	-	-	-	1	1	Predator
	8	Araneae	Tetragnathidae	*Tetragnatha maxillosa*	8	28	8	6	50	Predator
			Oxyopidae	*Oxyopes* sp	-	-	-	-	-	Predator
			Total		**256**	**240**	**167**	**230**		**857**

Treatment	No.	Order	Family	Genera	Day				Total individual	Status
					30	45	60	75		
	1.	Hemiptera	Pentatomidae	*Dolycorus* sp	-	-	2	-	2	Pest
				Scotinophara coarctata	-	1	-	-	1	Pest
			Miridae	*Cyrtohinus lividipennis*	-	-	-	-	-	Predator
				Stenodema sp	-	-	1	1	2	Pest
			Alydidae	*Leptocorisa* sp	-	1	4	13	18	Pest
			Lygaeideae	*Paraecosmetus*	-	-	2	5	7	Pest
			Cicadellidae	*Cofana spectra*	27	53	14	17	111	Pest
				Recilia dorsalis	7	36	26	11	80	Pest
				Nephotetix spp	29	20	14	4	67	Pest
	2.	Orthoptera	Acrididae	*Oxya chinensis*	-	1	-	-	1	Pest

				Anacridium sp	-	1	3	3	7	Pest
			Tettigoniidae	*Conocephalus*	-	-	-	-	-	Predator
	3.	Lepidoptera	Crambidae	*Chilo* sp	2	1	3	-	6	Pest
Blue Trap (BT)			Hesperiidae	*Parnara* sp	-	-	-	-	-	Pest
			Pyralidae	*Cnaphalocrocis medinalis*	-	-	-	-	-	Pest
	4.	Diptera	Cecidomydae	*Orseolia* sp.	7	-	-	-	7	Pest
			Tachinidae	*Agryophylax nigrotibilis*	6	5	-	-	11	Predator
			Chlopidae	*Chlorops* sp	-	-	14	-	14	Pest
			Sciomyzidae	*Sepedon* sp	18	19	21	26	84	Predator
			Aphelinidae	*Encarsia* sp	1	-	-	-	1	Parasitoid
	5.	Coleoptera	Coccinellidae	*Menochilus sexmaculatus*	68	10	3	9	90	Predator
			Carabidae	*Ophionea nigrofasciata*	-	3	2	3	8	Predator
			Chrysomelidae	*Phyllotretra* sp	-	13	2	-	15	Predator
			Staphylinidae	*Paederus* sp	1	8	1	2	12	Predator
	6.	Hymenoptera	Shpecidae	*Sceliphron* sp	-	-	-	4	4	Predator
	7.	Odonata	Coenagrionidae	*Agriocnemis*	-	-	-	-	-	Predator
	8.	Araneae	Tetragnathidae	*Tetragnatha maxillosa*	6	34	25	9	74	Predator
			Oxyopidae	*Oxyopes* sp	-	-	-	-	-	Predator
			Total		**173**	**211**	**137**	**107**		**622**

Treatment	**No.**	**Order**	**Family**	**Genera**	**Day 30**	**45**	**60**	**75**	**Total individu**	**Status**
	1.	Hemiptera	Pentatomidae	*Dolycorus* sp	-	-	-	2	2	Pest
				Scotinophara coarctata	3	1	-	-	4	Pest
			Miridae	*Cyrtohinus lividipennis*	-	1	-	-	1	Predator
			Alydidae	*Stenodema* sp			6	8	1	Pest
			Lygaeideae	*Leptocorisa* sp	-	-	1	3	7	Pest
			Cicadellidae	*Paraecosmetus*	1	2	-	7	13	Pest
				Cofana spectra	-	6	20	30	129	Pest
				Recilia dorsalis	39	40	15	18	79	Pest
				Nephotetix spp	14	32	8	8	44	Pest
					13	15				
	2.	Orthoptera	Acrididae	*Oxya chinensis*		1	-	-	1	Pest
				Anacridium sp	-	-	-	4	6	Pest
			Tettigoniidae	*Conocephalus*	2 -	-	2	-	2	Predator
	3.	Lepidoptera	Crambidae	*Chilo* sp.	-	-	-	-	-	Pest
			Hesperiidae	*Parnara* sp.	-	-	-	-	-	Pest
			Pyralidae	*Cnaphalocrocis medinalis*	-	-	1	-	1	Pest
Red Trap (RT)	4.	Diptera	Cecidomydae	*Orseolia* sp.	2	-	-	1	3	Pest
			Tachinidae	*Agryophylax nigrotibilis*	-	-	-	-	-	Predator
			Chlopidae	*Chlorops* sp	-	-	13	5	18	Pest
			Sciomyzidae	*Sepedon* sp	19	7	9	13	48	Predator
			Aphelinidae	*Encarsia* sp	1	-	-	-	1	Parasitoid

	5.	Coleoptera	Coccinellidae	*Menochilus sexmaculatus*	19	8	3	4	30	Predator
			Carabidae	*Ophionea nigrofasciata*	2	-	3	-	5	Predator
			Chrysomelia	*Phyllotretra* sp.			1	2	3	Predator
			Staphylinidae	*Paederus* sp.	- 2	- 3	-	-	5	Predator
	6.	Hymenoptera	Shpecidae	*Sceliphron* sp.	1	1	1	7	10	Predator
	7.	Odonata	Coenagrionidae	*Agriocnemis*	-	-	1	-	1	Predator
	8.	Araneae	Tetragnathidae	*Tetragnatha maxillosa*	14	23	14	9	60	Predator
			Oxyopidae	*Oxyopes* sp	-	-	-	1	1	Predator
			Total		**132**	**139**	**98**	**122**		**478**
Treatment	**No.**	**Order**	**Family**	**Genera**	**Day 30**	**45**	**60**	**75**	**Total individual**	**Status**
	1.	Hemiptera	Pentatomidae	*Dolycorus* sp	-	1	1	1	3	Pest
				Scotinophara coarctata	-	1	-	-	1	Pest
			Miridae	*Cyrtohinus lividipennis*	-	-	-	-	-	Predator
				Stenodema sp	-	-	2	-	2	Pest
			Alydidae	*Leptocorisa* sp	-	-	1	3	4	Pest
			Lygaeideae	*Paraecosmetus*	-	-	1	-	-	Pest
			Cicadellidae	*Cofana spectra*	16	23	6	7	52	Pest
				Recilia dorsalis	-	3	1	-	4	Pest
				Nephotetix spp	8	-	7	-	15	Pest
	2.	Orthoptera	Acrididae	*Oxya chinensis*	-	-	-	1	1	Pest
				Anacridium sp	3	-	-	2	5	Pest
		Tettigoniidae	*Conocephalus*	Conocephalus	1	-	-	-	1	
	3.	Lepidoptera	Crambidae	*Chilo* sp	-	-	1	2	3	Pest
			Hesperiidae	*Parnara* sp	-	-	-	-	-	Pest
			Pyralidae	*Cnaphalocrocis medinalis*	-	-	-	-	-	Pest
	4.	Diptera	Cecidomydae	*Orseolia* sp	-	-	1	-	1	Pest
			Tachinidae	*Agryophylax nigrotibilis*	-	-	-	-	-	Predator
			Chlopidae	*Chlorops* sp	-	-	5	4	9	Pest
			Sciomyzidae	*Sepedon* sp	5	17	2	9	33	Predator
			Aphelinidae	*Encarsia* sp	-	-	1	-	1	Parasitoid
	5.	Coleoptera	Coccinellidae	*Menochilus sexmaculatus*	33	2	7	3	45	Predator
			Carabidae	*Ophionea nigrofasciata*	-	-	1	-	1	Predator
			Chrysomelidae	*Phyllotretra* sp	-	-	-	-1	-	Predator
			Staphylinidae	*Paederus* sp	1	-	-		2	Predator
	6.	Hymenoptera	Shpecidae	*Sceliphron* sp	-	-	-	-	-	Predator
	7.	Odonata	Coenagrionidae	*Agriocnemis*	-	-	-	-	-	Predator
	8.	Araneae	Tetragnathidae	*Tetragnatha*	-	19	4	5	28	Predator

	maxillosa						
Oxyopidae	*Oxyopes* sp	-	-	-	-	-	Predator
Total		**67**	**66**	**41**	**38**	**212**	

The results showed that yellow traps attracted the most insects with a total of 857 individuals from 25 types, followed by blue traps (622 individuals, 22 genera), red traps (478 individuals, 24 genera), and control/transparent (212 individuals, 20 genera) was described into Figure 2 below.

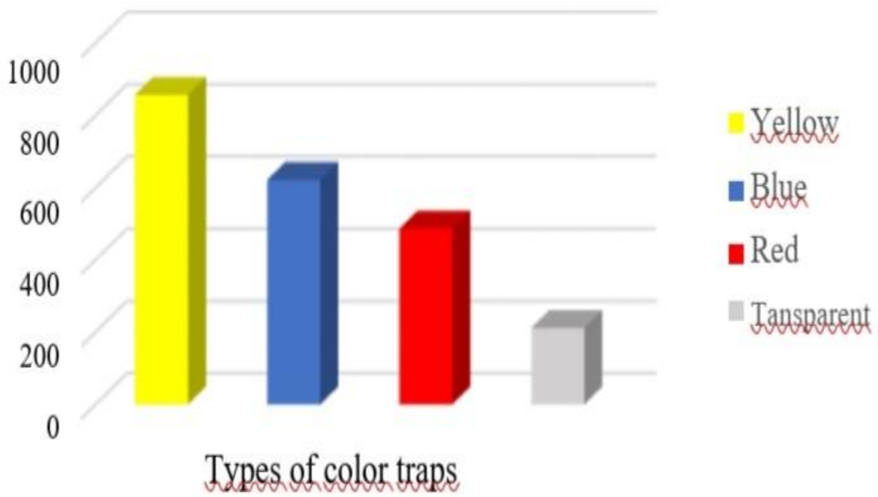


Figure 2. Diagram of Number of Insects Based on Trap Color

Insects tend to be more attracted to yellow traps, as explained by Mas'ud (2011). Insects are more attracted to contrasting colors such as yellow, blue, green and red. In addition, insects see colors in a different way than humans, because most only have two visual pigments that absorb yellow-green and blue-ultraviolet (Hasibuan, 2020).

The yellow color resembles fresh leaves or fruit, so it attracts insects looking for food, laying eggs or breeding. The yellow color is in the wavelength range that insects prefer, namely **560–590 nm**, while the blue color is at **450–500 nm** (Munandar et al., 2018).

From Table 2 at 30 DAP, 45 HST and 60 DAP observations, the yellow, blue and red traps did not show significant differences. However, at 75 DAP, the yellow trap showed significant differences compared to other traps. This is caused by the generative phase of rice plants at 75 DAP, where the number of tillers and grains increases, thereby attracting insects to take shelter and search for food.

The highest population in yellow traps occurred at 45 DAP (59 individuals), followed by 75 DAP (53 individuals) and 30 DAP (52.20 individuals). Blue traps had the highest population at 45 DAP (42.40 individuals), while red traps had the highest population at 30 DAP (28.60 individuals). Blue and red colors can also be used as alternative traps for environmentally friendly insect control.

Table 2. Average Insect Population Based on Trap Color

Treatment	***30 HST***	***45 HST***	***60 HST***	***75 HST***
Yellow	52,20	59,00	53,00	45,80

Blue	40,80	42,40	37,60	31,20
Red	28,60	27,80	25,40	20,60
Transparent	12,40	15,20	13,00	11,00

Note: Numbers followed by the same letter in the same column are not significantly different based on the 5% BNJ test

3.2. Types of Insects Found on Paddy Rice Plants

Observation results from 30 DAP, 45 DAP, 60 DAP, and 75 DAP show that the insects found consisted of: Pests consist of 5 orders, 12 families and 16 genera, including**:** *Dolycorus sp, Scotinophara coartata, Stenodema sp, Leptocorisa sp*, *Paraecosmetus sp*, *Cofana spectra*, *Recilia dorsalis*, *Nephotettix spp, Oxya chinensis*, *Anacridium sp, Chilo sp, Parnara sp, Cnaphalocrocis medinalis, Orseolia sp*, *Chlorops sp*, dan *Phyllotretra sp*.

Natural Enemies (Predators) consist of 7 orders, 11 families and 11 genera, including**:** *Cyrtohinus lividipennis*, *Conocephalus sp, Agryophylax nigrotibialis*, *Sepedon sp*, *Menochilus sexmaculatus*, *Ophionea nigrofasciata*, *Paederus sp*, *Sceliphron sp*, *Agriocnemis sp*, *Tetragnatha maxillosa*, dan *Oxyopes sp*. Parasitoids:l consit of 1 order, 1 family and 1 genus, namely *Encarsia* sp.

Natural enemies such as the beetle *Menochilus sexmaculatus* have the highest population (359 individuals). Predators from the Coccinellidae family are known as biological agents commonly found in agricultural ecosystems in Indonesia (Amir, 2002 in Nelly, 2015).

4. Conclusion

The research findings demonstrate that yellow traps are the most effective in capturing pest insects, with an average of 59.00 individuals, compared to blue traps (42.40 individuals) and red traps (28.60 individuals). These results highlight the potential of yellow traps as a practical and environmentally friendly pest control method.

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6.Conflict of Interest

The author declares that he has no conflict of interest related to the publication of this thesis. All research activities, data collection, and analysis were conducted independently without any financial, professional, or personal relationships that could influence the results or interpretation of this research.

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