

## The Attractant Compounds Enhance Ability of Colored Traps for Fruit Flies Monitoring in Chili Cultivation Areas on Tarakan Island

Abdul Rahim<sup>1\*</sup>, Surlanti Samuel<sup>2</sup>

<sup>1</sup>Departement of Agrotechnology, University of Borneo Tarakan, Indonesia

\*email : rahim@borneo.ac.id

### ABSTRACT

Fruit flies are pests that attack several seasonal fruit plants. They have population dynamics throughout the year. This study aims to compare the effectiveness of monitoring using coloured traps, and the traps added chemicals attract fruit flies on chili plants. The experiments have installed 15 replications in each different chili plant location. The comparison of the number of individual flies per trap was analysed using the F test and the DMRT test. The results showed that there were 2 (two) species of fruit flies, namely *Bractocera dorsalis* and *Bractocera umbrosa* in coloured traps. The yellow traps collected 18 fruit flies, and the green had only 2 individuals. Furthermore, the added chemical compound of attracting fruit flies (methyl eugenol) increased the number of fruit flies caught in the coloured traps. The yellow, green, and white traps found 213, 18, and 32 individuals, respectively. These results indicate that adding attractant compounds will increase the ability of coloured traps to catch fruit flies in chili cultivation areas.

### Keywords:

*Fruit Flies, Chili, Coloured Trap, Attractant*

### INTRODUCTION

Cayenne pepper (*Capsicum frutescens* L.) has been of high economic value and main commodity in horticulture plants. The plant has more utility of derivatives agriculture products. Based on data from North Kalimantan Province, cayenne pepper tends to decrease in production which it was 32.983 quintals in 2018, and it reached 38.211 in 2019 quintals [1].

Pest and disease are one of the factors that affect the productivity of chili plants. Fruit flies are attacking seasonal fruit plants and have population dynamics throughout the year [2]. There are

several research results showing the diversity of fruit fly species in Indonesia. The results of [3] reported that as many as 18 species of fruit flies were found in the Bogor area and its surroundings. Then, there are several species of fruit flies belonging to the OPTK A1 and OPTK A2 categories which are invasive pests. In addition, it was also reported that there were 23 species in the Seulawag Valley area of Aceh Besar [4], and only two species were found in Tarakan Island, that is *Bractocera dorsalis*, *Bractocera umbrosa* [5]

The loss of yield caused fruit flies (*Bactrocera* spp.) to reach 20-60%, and it is not uncommon to

even fail the harvest [7] [8] which is depended on agroecosystem conditions, fruit types, fruit maturity, and so on [9].

Fruit and vegetable farmers are generally still depending on synthetic pesticides to control fruit flies. However, there had been potential impacts on pollution and the environment and agricultural products. The availability of environmentally friendly fruit fly control technologies is non-negotiable which fruit products are protected from contamination by harmful chemicals, especially pesticides [9]. Apart from being environmentally friendly, the technology should also be effective and efficient in controlling pests and easily applied by farmers in the field.

Mechanical control of fruit flies using traps has been widely used. The colored traps are also an alternative to controlling fruit flies [9] [10]. The trap of red colored containers was reported attract around 65.5 fruit flies in the growth phase of vegetative plants. Meanwhile the green colored traps were reported attract 95 fruit flies in the generative plant growth [4]. In addition, the traps of plastic bottles have been used and combining them with fruit fly attractant [5] [11].

In practice, farmers sometimes only use colored traps because chemical attractants are not available in their area. This situation is caused by traps that are not effective in controlling fruit flies. In addition, the use of the addition of attract compounds to colored traps is still rarely used in cayenne pepper plantations on Tarakan Island. Therefore, the effectiveness of the combination of traps with colored paper still needs to be studied in order to provide information on their use at the

farmer level. In particular, the use of chemicals with a less dose on colored traps.

## **METHOD**

### ***Time and Research Sites***

This research was carried out from January 2022 to August 2022 at three sites. All of sites were arranged in Juata Laut village which first site at coordinates N: 3.3888, E: 117.54846, the second site at N: 38882, 117.5484, and the third site at N: 3.4365, E: 117.5752.

### ***Research procedures***

We were created traps from mineral water 1.5 l. and the inside of the trap will be attached with coloured paper. Then, we were open centre of the bottle which least 3 x 3 cm. Also, we put water into bottom of the bottle.

The research was examined in two times for test of effectivity of traps. The First test, we were installed traps on 15 points. Then, each point was consisted of three type of traps which were yellow, green, and white without chemical attractant. The distance between point were around 10 m.

The second research, we were continued examined traps on 15 points too which the coloured traps with chemical attractant. The chemical was methyl eugenol that were used less dosage or 0.5 ml.

The fruit flies were collected during 5 days. In each day, we were put fruit flies and into tube with alcohol 70%. For identification, we were used some key of determination for fruit flies in Indonesia.

### ***Data and Analyses***

We were described characteristic of all of site which type of plants around main crop (chili).

Then, we were calculated number of fruit flies in each species.

The data were compared by analysis of variance which used F-test. To continue analyse, we were compared by Duncan multiple range test (DMRT, 5%). In addition, we were described too fluctuation of fruit flies into trap at 5 days.

## RESULT AND DISCUSSION

### Characteristic of Sites

In Weather stations, temperatures showed around the area from 28.74°C – 29.25°C, average humidity of 78.89%. Then, rainfalls reached 50 ml – 1000 ml ( $\bar{x}$  = 494.4). In addition, the occurrence of rain had 10 days.

The results of observations at the research location showed that in the chili cultivation area, several cultivated plants were also found planting rice, citrus, vegetables, and residential areas (Table 1).

**Table 1.** Characteristic of research sites

Location (Site)	Cultivation Areas	Characteristic of Site
Site 1	Vegetables and Fruits	Areas around fruit and vegetable cultivation areas, such as pariah, papaya, chilies and other vegetables.
Site 2	Fruits	The area around the papaya fruit cultivation area, and there are settlements.
Site 3	Vegetables and Fruits	The area is around the area of fruit and vegetable cultivation. Such as papaya and mustard greens, kale, and spinach.

### Species and number of pests in each trap per sites

The types of insects trapped in the color trap without attractants are *Apis mellifera*, *Bactrocera dorsalis*, *Bactrocera umbrosa*, *Harmonia axyridis*, Heteroptera, and Harlequin ladybugs. The yellow trap type had the highest number of insects caught,

namely 6 species. Meanwhile, the largest number of insects trapped was in location/site 1. The highest number of individuals was in yellow traps with attractants (Table 2).

The most common fruit fly pests found in the study area were *B. dorsalis* with a total of 193 individuals. Meanwhile, the location where the most common pests were found was at the Site 1

**Table 1.** Species and number individual in all sites

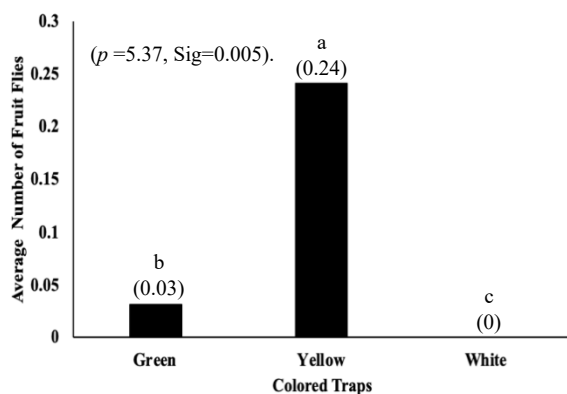
Colored Traps	Specieis/ Morphospecies	Site (S)		
		S1	S2	S3
Green	<i>Bactrocera dorcalis</i>	0	2	0
Yellow	<i>Apis mellifera</i>	1	0	1
	<i>Bactrocera dorsalis</i>	2	6	8
	<i>Bactrocera umbrosa</i>	0	0	2
	<i>Harmonia axyridis</i>	2	0	0
	<i>Heteroptera</i>	1	0	0
	<i>Kepik Harlequin</i>	1	0	0
White	-	0	0	0
Green +		2	7	6
Attractant	<i>Bactrocera dorcalis</i>			
	<i>Bactrocera umbrosa</i>	1	1	1
Yellow +				
	<i>Bactrocera dorsalis</i>	80	59	54
	<i>Bactrocera umbrosa</i>	7	5	8
	<i>Harmonia axyridis</i>	1		
White +				
	<i>Bactrocera dorsalis</i>	11	11	7
	<i>Bactrocera umbrosa</i>	2	1	0
	<i>Harmonia axyridis</i>	1	1	0
<b>Total Jenis</b>		<b>112</b>	<b>93</b>	<b>86</b>

In this research, the use of color traps was known to able control fruit fly pests, but other types of insects were also trapped. Fruit flies are pests found in chili cultivation. These results also indicate the presence of other plants around the chili plants, which can support the presence or presence of fruit fly pests. Based on the results of the study [8], fruit fly pests were found in the cultivation area of horticultural plants from the Solanaceae family group, including the *Capsicum frutescens* chili plant, also known as cayenne pepper.

The types of fly pests found at the study site were *B. dorcalis* and *B. umbrosa*. This result is thought to be due to the presence of this fruit fly pest which is the most commonly found on Tarakan Island and or it could be caused by the use of traps that are more suitable for this fruit fly pest. The another reported that fruit fly species *B. papayae*, *B. philippinensis*, *B. umbrosa* had higher practical value in the methyl eugenol attractant type than in the other attractant. These results indicate a match between the type of trap used and the type of species trapped [12].

**Traps without Chemical Attractants**

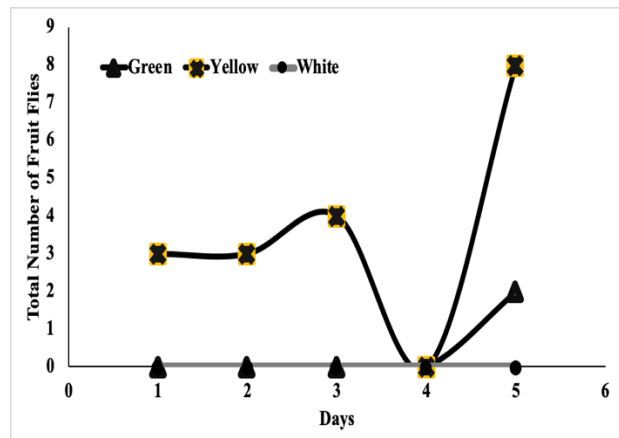
The yellow trap had an average number of individual flies for ( $\bar{x} = 0.24$ ) which were compared to green traps ( $\bar{x} = 0.03$ ), and white traps ( $\bar{x} = 0$ ). The results of the analysis of variance showed that there were differences in the average individual flies for several colour traps ( $p=5.37$ , Sig=0.005). Meanwhile, the analysis of the DMRT test showed that the average individual fly pests in the yellow traps were significantly different from those in the green and white traps (Fig. 1).



**Fig 1.** The mean number of individual fruit fly pests in several colour traps without attractants (Different letters on the same bar chart show no difference in the average number of individuals based on 5% DMRT)

In this study, the number of fruit flies on the yellow trap was higher than in other colours. According to [13] insects generally like yellow, insects visually recognize yellow as collections of green leaves. This opinion also proves the results of research why green research it is also able to catch fruit flies compared to white because green is a combination of blue and yellow. In similar reported, the colour traps were able to trap fruit flies, and yellow traps had a higher of number individuals than other colours (red, white, and green) which were number on yellow trap 12.16, white 11.75, green 9.68, and red 9.06 individual/trap/week [14].

We were observed the fluctuations number of fruit flies in each day. The research showed that the yellow traps were able to catch fruit flies at the start of installation (although individuals were very low) and tended to be stable. However, at one time there was a relatively high decrease and increase. Whereas, the green and white traps tended to be unable or less power attract at the beginning of the trap setting and the presence. Then. fruit fly pests were found in the green traps when the fruit fly pest populations tended to increase (Fig. 2).

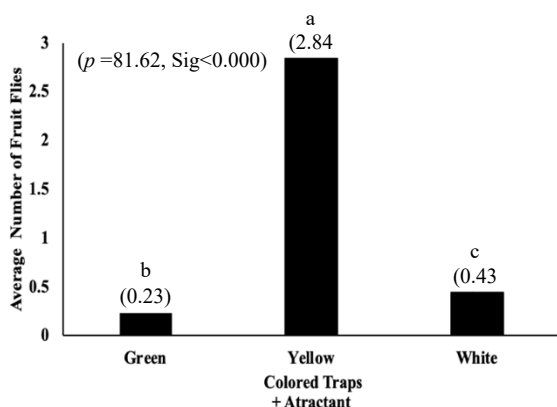


**Fig. 2.** Fluctuations of fruit fly pests trapped in several colour traps without attractants.

Fluctuations in the number of fruit flies indicated that decrease in the number of fruits flies a few days after installation. However, it is possible that it will increase in the next few days. This indicates that under these conditions the color spectrum can be captured properly by fruit flies or an increase in the fruit fly population thereby providing opportunities for trapping.

### Traps with Chemical Attractants

The colour traps with an attractant (methyl eugenol) showed the average number of individual fly pests highest in yellow traps ( $\bar{x} = 2.84$ ) than in white traps ( $\bar{x} = 0.43$ ), and green traps ( $\bar{x} = 0.23$ ). The results analysis of variance showed differences in average individual flies for several colour traps ( $p=81.62$ ,  $\text{Sig}<0.000$ ). Meanwhile, the DMRT test analysis showed that the average individual fly pests in the yellow traps with an attractant were significantly different from the green and white traps with an attractant (Fig. 2).



**Fig 3.** The mean number of individual fruit fly pests in several colour traps without attractants (Different letters on the same bar chart showed no difference in the average number of individuals based on 5% DMRT).

This research showed that attractants enhanced the presence of fruit flies in colour traps. This is due to field conditions or external factors. For

example, the presence of other plants or other objects can block the colour visualization that can be received by fruit flies. Meanwhile, attractant compounds are able to pass through these obstacles because they can be detected by the sense of smell of flies (insects) on the antennae and palps which are very sensitive and so they are able to smell even weak odours.

This study carried out a combination of traps with an attractant compound (methyl eugenol). The results showed an increase in the trapped fly population, and the yellow traps added with methyl eugenol were higher than the other coloured traps. These results indicate that the addition of methyl eugenol can increase the effectiveness of the traps used. According to [13] methyl eugenol traps were more attractive than yellow traps. Methyl Eugenol attractants cover a wider area than other attractants. These results indicate that there is a combination of compounds released by attractant substances with a yellow colour spectrum to attract the attention of fruit flies.

This research also showed that attractant compounds were more able to attract fruit flies. The first factor was external factors, the presence of other plants affected the shadow of the color visualization received by fruit flies. Meanwhile, attractant compounds were passed through these obstacles. They have detected the sense of smell of flies (insects) on the antennae and palps which are very sensitive in weak odours. According to [15] methyl eugenol was easy to apply in large areas of land. The chemical is volatile (evaporates), then its range or radius were quite far, reaching hundreds

of meters or even thousands of meters depending on the wind direction.

Observations of fluctuations in colour traps treated with attractants showed that yellow traps were able to trap fruit flies at the start of installation (higher than colour traps without attractants) and tended to increase. However, at one point there was a relatively stable decline and increase. Meanwhile, the green and white traps also tend to be able to attract fruit flies at the beginning of setting the traps, but the presence of fruit flies is lower when compared to the yellow traps (Fig 4).

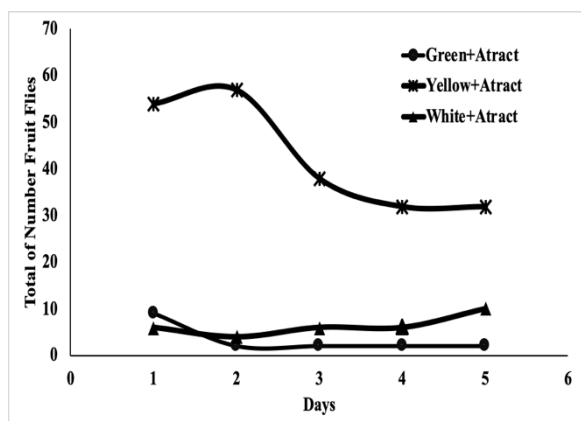


Fig. 4. Fluctuations of fruit fly pests trapped in several colour traps with attractants.

The beginning of the installation the number of fruit flies trapped was higher, but there was a tendency to decrease the number of fruit flies trapped. This indicated the decrease in the concentration of fly compounds released by the traps, which is thought to be caused by environmental factors such as rain and sunlight which accelerate the absorption of these compounds.

## CONCLUSION

There were 2 (two) species of fruit flies which the species were *B. dorsalis* and *Br. umbrosa* in the colored trap test. In addition, yellow traps trap fruit flies higher than green and white traps. The yellow traps that were added less dosage of attract compounds were higher than the without chemical on the traps.

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