

Inventory of fruit flies on red chilies (*Capsicum annum* L.) in Lubuk Cuik Village

Ade Fipriani Lubis¹, Sutriyono², Sri Susanti Ningsih³, Darliana Hasibuan⁴
Faris Harianto Panggabean⁵, Annisa Afriani Hutapea⁶

^{1,2,3,4,5,6}Departement Agroteknologi, Faculty of Agriculture, Universitas Asahan, Kisaran, Indonesia

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ABSTRACT

Many chili plants are cultivated because of their high demand. However, until now, the management of chili plants has had quite serious obstacles due to the impact of fruit fly infections. Efforts to control fruit flies have been made but are not optimal enough. Proper control begins with first knowing the correct identity of the pest to be controlled. So, it is necessary to carry out an inventory to find out what types of fruit flies are in the chili planting location. The research succeeded in collecting 150 individual fruit flies from chili farming land in Lubuk Cuik Village, Limapuluh Pesisir District, Batubara Regency. Based on the identification results, there are three types of two genera of fruit flies. These fruit flies are from the genus *Bactrocera* and *Zeugodacus*, namely the types *Bactrocera dorsalis*, *Z. cucurbitae* and *B. umbrosa*. The number of individual fruit flies for each type was 100 *B. dorsalis*, 20 *Z. cucurbitae* and 30 *B. umbrosa*.

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Corresponding Author:

Sutriyono

Faculty of Agriculture, Universitas Asahan

Jl. Jend. Ahmad Yani, Kota Kisaran, Sumatera Utara 20211

Email: osutri44@gmail.com

1. INTRODUCTION

Red chili (*Capsicum annum* L.) is a multi-purpose commodity (Rahmawati Arma, Dian Ekawati Sari, 2018). Chili fruit contains nutrients equivalent to fruits and vegetables which have health benefits such as capsaicin compounds, vitamins, minerals, protein, fat, carbohydrates, fiber, sugar and other nutrients (Solihin, Lihawa, dan Diki 2020).

Many chili plants are cultivated because of their high demand. However, until now, the management of chili plants has had quite serious obstacles due to the impact of fruit fly infections (Shingote et al., 2022). Efforts to control fruit flies have been made, but are not yet optimal. So it still causes quite large economic losses of up to 20 - 40% during the harvest period. Several studies on fruit flies that have been carried out previously in Indonesia show that fruit fly infections can cause losses of around 25-50% each year (Kardinan, 2003). Fruit flies can cause damage to more than 26 types of fruit and vegetable plants in tropical and subtropical areas (Siwi et al, 2006).

There are many obstacles faced by farmers in cultivating chilies, namely plant pest organisms such as pests and disease penyakit (Agustinawati et al., 2016);(Harmana & Rahardjo, 2021), an important pest that generally attacks chili plants is the fruit fly *Bactrocera dorsalis* Hendel (Budiyani & Sukasana, 2020). Fruit flies have an increasing intensity of attack on fruit and vegetables in cool climates, high humidity and not too strong winds (Susanto et al., 2022). Temperature, air humidity and wind speed as well as the influence of rainfall are also quite important in influencing the intensity level of fruit fly attacks (Susanto A, 2017). Some of them are fruit flies which are plant pest

organisms in Indonesia, such as *Z. cucurbitae*, *B. umbrosa*, *B. albistrigata*, *B. carambolae*, *B. papaya*, *B. dorsalis* (Drear *et al.* 2019; ; Helda & Mujiyanto 2016; Oliveira *et al.* 2016; Sastono & Wijaya 2017; Suwarno *et al.* 2018).

Based on this case, it is important to carry out further research to control fruit flies on chili plants. Proper control begins with first knowing the correct identity of the pest to be controlled. So, it is necessary to carry out an inventory to find out what types of fruit flies are in the chili planting location.

2. METHOD

The research location is chili farming land in Lubuk Cuik Village, Limapuluh Pesisir District, Batubara Regency, West Sumatra Province. The research was conducted in October – December 2023. Data identification and analysis was carried out at the Agrotechnology Laboratory at Asahan University. Research methods start from sample collection, preservation, identification, documentation, to data analysis, Collection.

The tools used in this research include insect nets, Steiner traps, collection bottles, tweezers, cameras. Meanwhile, the ingredients needed are flies and 70% alcohol. For fly identification purposes, an identification key using books (Borror *et al.*, 1992) and (Kalshoven, 1981) is used, as well as the identification process using the fruit fly determination book *The Australian Handbook For The Identification Of Fruit Flies* by Plant Health Australia (Plant Health Australia, 2018). Identification of flies is done macroscopically and microscopically (with a stereomicroscope) and is based on all the features of the external anatomical structure of the fly's body. Data is presented in the form of pictures and tables descriptively. The data presents the number of types and individuals and then the morphological characters of fruit flies.

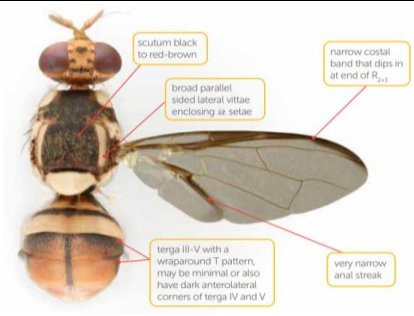
3. RESULTS AND DISCUSSION

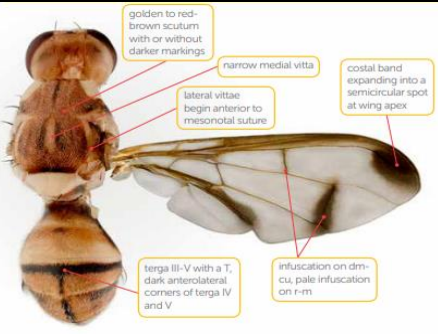
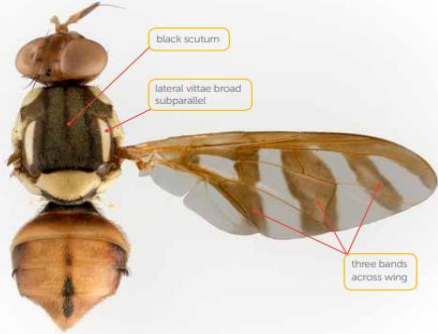
3.1. Number of individuals and types of fruit flies Research

This research succeeded in collecting 150 individual fruit flies from chili farming land in Lubuk Cuik Village, Limapuluh Pesisir District, Batubara Regency. Based on the identification results, there are three types of two genera of fruit flies. These fruit flies are from the genus *Bactrocera* and *Zeugodacus*, namely the types *Bactrocera dorsalis*, *Z. cucurbitae* and *B. umbrosa*. The number of individual fruit flies for each type was 100 *B. dorsalis*, 20 *Z. cucurbitae* and 30 *B. umbrosa*.

The difference in the number of the three types of fruit flies is because they both have different characteristics, namely *B. dorsalis* and *Z. cucurbitae* are polyphagous, while *B. umbrosa* is monophagous. The fruit flies *B. dorsalis* and *Z. cucurbitae* feed on various types of plants such as oranges, bananas, cocoa, noni, tomatoes, eggplant, chilies, guava and others (Rajab *et al.*, 2021). Chili plants from the Solanaceae family are one of the true food plants for *B. dorsalis* (Siwi., 2006). Apart from that, it is also supported by some vegetation around the chili plantations which is also liked by *B. dorsalis*. Meanwhile, *B. umbrosa* only likes chili plants and there are no other preferred alternative plants around the plantation. The greater number of *B. dorsalis* could also be due to the fact that this fly is a competitive and invasive (dominant) type, so it is often found in various regions, especially in tropical and subtropical areas (Saputra *et al.*, 2019).

Tabel 1. Results of Identification of Fruit Flies *Bactrocera* spp.

No	Spesies	Morfologi
1.	 <p>Figure 1. <i>Bactrocera dorsalis</i> Based on The Australian Handbook for The Identification of Fruit Flies (Plant Health Australia, 2018).</p>	<p>On the head there is a large black spot. The thorax on the scutum is reddish-brown black with a band on the side of the tip of the scutellum. On the abdomen there is a black line that runs across terga II-III, and longitudinally on terga III-V which is in the shape of the letter T. On the legs it is dark on the front and back tibia. On the wings with a narrow costal band that descends at R2+3, with a very narrow anal line (Plant Health Australia, 2018).</p>

2	 <p>Figure 2. <i>Zeugodacus cucurbitae</i> Based on The Australian Handbook for The Identification of Fruit Flies (Plant Health Australia, 2018).</p>	<p>On Thorax, golden to red-brown with or without darker markings, medial vittae narrow, lateral vittae begin anterior to mesonotal suture, On Wings costal band extends to a semicircular spot at wing apex, infusion on dm-cu, pale infusion on r-m, on the abdomen, terga III-V with the letter T, dark anterolateral corners of terga IV and V (Plant Health Australia, 2018).</p>
3	 <p>Figure 3. <i>Bactrocera umbrosa</i> Based on The Australian Handbook for The Identification of Fruit Flies (Plant Health Australia, 2018).</p>	<p>On the head, there is a small black dot on the face. The thorax has a black scutum with yellow bands on the lateral parts. The abdomen is yellow-orange and without a T pattern with various patterns. Legs with aligned tabia without dark markings. On the wing there are three transverse bands that run from the costal band to the rear edge of the wing (Plant Health Australia, 2018).</p>

3.2 Active Time of Fruit Flies

Observations of the active time of male fruit flies were carried out from 06.00 to 18.00 WIB. Observations and collection of catches are carried out every two hours to determine the best time for fruit flies to be active. The results of observing the active time of male fruit flies are presented in Table 1.

Fruit flies on chili plants move every day, most active from afternoon until late evening. Table 1 shows the results of field observations, which show that fruit flies are active from 14.00 to 16.00 WIB and from 16.00 to 18.00 WIB. This active time is based on the average number of fruit flies caught, respectively 20 and 17 individuals.

Hasil pengamatan ini sesuai dengan penelitian yang dilakukan oleh (Chen *et al*, 2006). yang menyatakan populasi lalat buah *Bactrocera dorsalis*, *B. umbrosa* dan *Zeugodacus cucurbitae* pada kebun cabai mencapai puncaknya pada sore hari. Lalat buah aktif pada sore hari menjelang senja dikarenakan *Bactrocera* spp, *B. umbrosa* dan *Zeugodacus cucurbitae*, biasanya berkopulasi pada senja hari (Kalie, 1999). Adapun terkait aktivitas lalat buah dalam menemukan tanaman inang ditentukan oleh warna dan aroma dari buah.

The results of these observations are in accordance with research conducted by (Chen *et al*, 2006). which states that the population of fruit flies *Bactrocera dorsalis*, *B. umbrosa* and *Zeugodacus cucurbitae* in chili gardens reaches its peak in the afternoon. Fruit flies are active in the afternoon before dusk because *Bactrocera* spp, *B. umbrosa* and *Zeugodacus cucurbitae*, usually copulate at dusk (Kalie, 1999). The activity of fruit flies in finding host plants is determined by the color and aroma of the fruit.

Tabel 2. Active time of fruit flies on chili plantations in Lubuk Cuik Village Limapuluh Pesisir District, Batubara Regency

Observation time	Number of Fruit Flies Caught (Tails)							Average
	1	2	3	4	5	6	7	
06.00 wib s/d 08.00 wib	9	8	7	9	7	8	9	8
08.00 wib s/d 10.00 wib	10	9	8	9	9	9	8	9
10.00 wib s/d 12.00 wib	8	7	8	7	7	7	8	7
12.00 wib s/d 14.00 wib	6	4	5	6	6	5	6	5
14.00 wib s/d 16.00 wib	20	19	21	22	20	19	23	20
16.00 wib s/d 18.00 wib	17	18	17	17	15	17	16	17

Manurung, 2012 explains that fruit flies do not move much in the field from 06.00 to 10.00 in the morning. This is caused by the behavior of fruit flies which are sensitive to environmental temperature, so that their body temperature threshold must be exceeded before they can carry out activities, such as moving their wings, antennae, legs, and finally flying to look for food or have sexual relations.



Figure 4. Fruit flies trapped in a steiner trap

3.3 Symptoms of Fruit Fly Attacks

Initial symptoms of chili fruit being attacked by fruit flies, characterized by the presence of black spots on the surface of the fruit skin which are puncture marks from the female fruit fly's ovipositor into the chili fruit to lay its eggs. The eggs hatch into larvae which live, eat and develop inside the fruit so that the fruit becomes rotten and contains larvae or known as maggots. After the eggs hatch, the larvae make holes in the fruit, making it easier for bacteria and fungi to enter. Fruit flies live in symbiotic mutualism with bacteria, so that when fruit flies lay eggs on fruit, the bacteria will be carried away, followed by fungi which ultimately causes rot (Godjo, 2018). After the eggs hatch, the larvae dig into the flesh of the fruit while releasing damaging or digestive enzymes which function to soften the flesh of the fruit so that it is easy to suck and digest. These enzymes are known to speed up rotting, apart from rotting bacteria which speed up fruit rotting activity. These bacteria live on the walls of the ovaries, crop and ileum of flies (Kardinan A., 2003).

Fruit that is attacked by fruit flies and rots, eventually falls to the ground. Fruit fly attacks on infected fruit have small puncture wounds, such as being pricked by a needle (Seethapathy et al., 2022; Yadav et al., 2014). This will result in black spots on the fruit. Infected fruit becomes soft rotten and black. Puncture wounds cause secondary infections in the form of fruit rot, both caused by fungi and bacteria. Fruit that is pricked by fruit flies will fall off. If you cut open the fruit, you will see black seeds and maggots which are fruit fly larvae.

According to Deptan (2007), it explains the symptoms of fruit fly attacks. When the fruit is cut open, there are small larvae. The flesh of the fruit changes color and the affected part becomes soft. Fruit will fall before it is ripe if attacked by this fly. These fallen fruits, if not immediately collected or destroyed, can become a source of infection or the development of the next generation of fruit flies. One species of fruit fly can be found attacking several types of fruit plants. (Pujiastuti, 2009). The damage caused by the larvae will cause the fruit to fall before it reaches maturity (Deptan, 2007). Fruit flies are one of the main pests that destroy plants and fruit. The damage experienced by plants as a result of fruit fly attacks is limited to the fruit only. The plant itself is not disturbed, remains normal, grows healthily and can still bear fruit (Susanti, 2012). The level of attack varies greatly depending on the presence of fruit fly populations in the field. With high populations, attack rates also tend to be high (Pujiastuti, 2007).

4. CONCLUSION

There are three types of fruit flies from chili plantations in Lubuk Cuiik Village, Fifty Coast District, Batubara Regency, namely *Bactrocera dorsalis*, *B. umbrosa* and *Zeugodacus cucurbitae*. The total number of individuals obtained was 150, with the number of *B. dorsalis* being greater than *B. umbrosa* and *Z. cucurbitae*. The differences in the characters of the three types of fruit flies can be seen from the morphological characters. The population of fruit flies *Bactrocera dorsalis*, *B. umbrosa* and *Zeugodacus cucurbitae* in chili gardens reaches its peak in the afternoon. Fruit flies are active in the afternoon before dusk because *Bactrocera spp*, *B. umbrosa* and *Zeugodacus cucurbitae*, usually copulate at dusk. To strengthen the results of morphological identification,

future studies can use molecular techniques (e.g. DNA barcoding analysis) to confirm the type of fruit flies more precisely, especially in species with very similar morphology.

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