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Inventory of Pests and Intensity of Fruit Fly Attacks (Bactrocera dorsalis) on Curly Red Chili Plants (Capsicum annum L.) in Sido Luhur Farmer Group of Cabeyan Village

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ABSTRACT

Curly red chili (*Capsicum annum L.*) is a horticultural plant with high economic value. So many people are cultivating it. Chili plants are susceptible to Plant Disrupting Organisms (OPT) attack, which can decrease the production yield and quality of chili harvests. One potentially damaging Plant Disrupting organism is pests, whose presence in chili plants is very diverse. The life cycle and eating activities are very detrimental to farmers because they will reduce the yield of chili plants. This study aims to determine the diversity of pest types and the rate of attack from fruit fly pests (*Bactrocera dorsalis*) on the curly red chili plant (*Capsicum annum L.*). Research has been carried out in Cabeyan Village, Bendosari district, and Sukoharjo from October 1, 2020–February 28, 2021. The study used observational, descriptive, and interview methods. Data collection is done directly and sampling using random sampling methods. This study found several types of pests consisting of 12 species divided into 11 species into phylum Arthropoda and 1 Species of Phylum Mollusca. As well as, the rate of attack of fruit flies (Bactrocera dorsalis) with the highest average intensity of attack at 76% of the attack scale is hefty.

KEYWORD

curly red chili, fruit fly attack, intensity, inventory, pest

INFORMATION

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1. INTRODUCTION

Red Curly Chili (*Capsicum annuum* L.) is a horticultural plant that belongs to the Solanaceae family. Curly red chili has high economic and nutritional value. The nutritional content of curly red chili includes protein, fat, carbohydrates, calcium, vitamin A and vitamin C, so curly red chili is a commodity that is needed by the community for cooking ingredients (Rindani, 2015). Curly red chili is very popular in Indonesia and has a spicy taste because it contains capsaicin and good nutritional content. The production of curly red chili in Indonesia

increased over the last five years. In 2016 the production of curly red chili became 1.04 million tons, then it increased to 1.20 million tons in 2017 and 2018. In 2019 it increased to 1. 21 million tons, then in 2020, red chili production increased to 1.26 million tons. Red chili production in Central Java Province in 2020 is only 166.26 thousand tons (BPS, 2020).

The need for chili is increasing every year due to the increasing population, as well as in connection with the increasingly diverse and varied types of dishes that use red chili as essential ingredients, ranging from household needs, fruit and vegetable asanas to foreign markets (Agustina *et al.*, 2014). Cultivation of chili plants is never separated from attacks by Plant Pest Organisms (OPT). Pests or diseases that can cause the quality and quantity of chili yields to decrease, so it is necessary to control to reduce the number of pests, one of which is Integrated Pest Management (IPM) (Moekasan *et al.*, 2015).

One pest that has great potential in reducing chili production in fruit flies. In Indonesia at this time, there were 66 fruit flies; among these very destructive species were Bactrocera spp (Fruit Flies) (Directorate of Horticultural Protection, 2002 in Herlinda *et al.*, 2009). This pest attack causes considerable losses, both in quantity and quality. The area of fruit fly attacks in Indonesia reaches 4,790 ha, with losses reaching IDR 21.99 billion (Balittro, 2008 in Susilo, 2008). This research was conducted to determine the diversity of pests and the level of attack of fruit flies (*Bactrocera dorsalis*) on curly red chili (*Capsicum annum L.*).

2. METHODOLOGY

This research was conducted from October 2020–February 2021 in Cabeyan Village, Bendosari, Sukoharjo. This research uses observation, descriptive, and interview methods. Data collection was carried out directly, and sampling was carried out by random sample with the provision that each bed was taken as much as 10% of the population. Research tools: hoe, seeder, black silver mulch, mulch hole punch, moose fastener, spray tank, bucket, stake, raffia rope, stationery, knife, ruler, plastic bag, insect identification book, and camera. Research materials: Curly red chili plants of TM999 variety, cow manure, pesticides, pearl NPK fertilizers, and fungicides. The research begins with planting curly red chili seeds. Observations are carried out once a week until harvest. Pest data from the field was then identified based on taxonomy and morphology using the insect identification book Borror *et al.* (1992). Pest attack intensity data was calculated using the formula proposed by Purbaningrum and Moekasan (2014):

$$IS = \frac{a}{(a + b)} \times 100\%$$

Note :
IS: Attack intensity (%)
a: Number of affected fruit or number of affected plants per plot
b: Number of Healthy fruit

3. RESULTS AND DISCUSSION

3.1. Pest Observation Results

From the research on pest inventory on curly red chili (*Capsicum Annum L.*) in Cabeyan village, Sukoharjo found twelve pests consisting of eleven pests of the phylum Arthropoda and one type of pest from the phylum Mollusca.

Table 1. Types of pests found in curly red chili (*Capsicum annum L.*)

Filum	Kelas	Ordo	Family	Spesies
		Diptera	Tephritidae	*Bactrocera dorsalis*
		Thysanoptera	Thripidae	*Thrips parvispinus Karny*
		Lepidoptera	Noctuidae	*Spodoptera litura* F.
		Acarina	Tarsonematidae	*Tetranychus telarius* L
		Coleoptera	Chrysomelidae	*Aulocophora similis* Oliver
Artropoda	Insecta	Orthoptera	Acrididae	*Valanga nigricornis*
				Oxya chinensis
			Gryllidae	*Gryllus bimaculatus*
		Hemiptera	Aphididae	*Myzus persicae* Sulz
			Aleyrodidae	*Bemisia tabaci* Genn.
			Pentatomidae	*Nezara viridula*
Molusca	Gastropoda	Mesogastropoda	Ampularidae	*Pomacea speciosa*

Source: Primary data, 2021

3.1.1. *Bactrocera dorsalis*

The fruit fly life cycle includes complete metamorphosis, which undergoes 4 phases: egg, larva, pupa, and imago/adult (Vijaysegaran and Drew, 2006). *Bactrocera* eggs are about 2 mm long and almost flat elliptical at the ventral end, concave dorsally. The white eggs are long and pointed at the ends. Eggs are laid in colonies in the fruit and will hatch into larvae two days after being placed in the fruit (Siwi and Hidayat, 2006). The body length of an adult fly is about 3.5–5 mm and has a yellowish-black color with a brown head and legs. The thorax is black, the male's abdomen is round, and the female fly has a stabbing tool. The fruit fly life cycle from egg to imago lasts approximately 27 days (Siwi, 2005).

Fruit flies are polyphagous pests that can attack various types of fruit. Fruit flies attack the curly red chili in the larval stage, which causes total damage to the plant. Infected fruit is easily recognized by the discoloration of the skin around the sting mark. The yellowish-white larvae will dig holes in the fruit and are often followed by the entry of bacteria or fungi so that there will be rapid fruit decay. Then, the fruit will fall, causing a decrease in the quality and quantity of the Red Curly Chili fruit. The damage caused by fruit flies is local, so that crop rotation can reduce the damage.

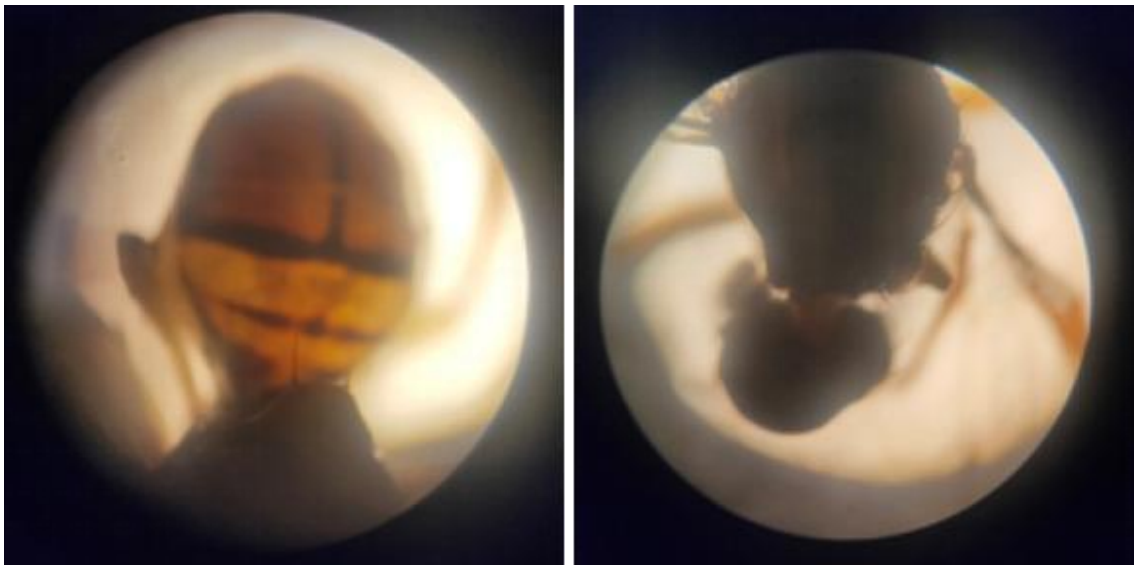

Figure 1. (A) Abdomen and (B) Thorax

3.1.2. Trips (*Thrips parvispinus Karny*)

Trips are found in the flowers and leaves of plants. The role of trips as a plant pest is due to their eating activities. Symptoms of the damage caused are silvery brown spots on the leaves, which can interfere with photosynthesis, curling and curling of the leaves, and little terminal shoots (Kirk, 2002).

Figure 2. Trips (*Thrips parvispinus* Karny)

3.1.3. *Spodoptera litura* F.

This pest attacks curly red chili plants from the vegetative phase to the generative phase. The armyworm eats plant parts, namely the leaves. The symptoms of the attack are in the form of hollow leaves, but the epidermis layer remains. As a result of this armyworm pest attack, the photosynthesis process in plants will be disrupted so that the yield will be reduced in quality and quantity.

Figure 3. *Spodoptera litura* F.

S. litura larvae have a lateral black dot on each abdomen. The young larvae are greenish, and the first instar larvae body is yellow-green, 2.0 to 2.74 mm long, and finely hairy. The head is

black with a width of 0.2-0.3 mm. The newly hatched armyworms are light green, with dark brown or brownish-black sides. The caterpillar cocoons in the soil, forming a reddish-brown pupa without a cocoon. Imago in the form of a moth with a brownish black color. The hind wings are usually white (Hera, 2007).

3.1.4. *Tetranychus telarius* L.

Based on observation, Imago mites (*Tetranychus telarius* Linn) attack curly red chili plants from the vegetative phase to the generative phase. Symptoms of mite attack are gray-brown dots on the leaves or shoots of plants that are sucked in by plant cell fluids. Mites are small-sized pests (0.3 mm), red, green, or yellow. Mites like humid air conditions and hot air circulation (Hikma, 2018).

Figure 4. *Tetranychus telarius* L.

3.1.5. *Myzus persicae* Sulz

Figure 5. *Myzus persicae* Sulz

Aphids are classified as polyphagous pests, with their main hosts being vegetable crops, namely chili, potatoes, and tomatoes. Aphids can act as vectors for more than 90 disease viruses in about 30 plant families, including beans, sugar beets, sugar cane, cabbage, tomatoes, potatoes, oranges, and tobacco (Meilin, 2014). Aphids are found on plants from the vegetative

phase to the generative degree. Symptoms of the attack are that the affected leaves will appear blotchy, causing the leaves to curl. The part of the attacked plant will be found in clusters of lice. If there is a heavy attack, the leaves will wrinkle (become wrinkled), stunt growth, and have a yellowish color. The leaves twisted, curled, and then withered and died. Aphids on the underside of leaves suck the juice of young leaves and young plant parts.

3.1.6. *Aulocophora similis* Oliver (Oteng-oteng)

Adult insects have a relatively small body, short, and fat. The back is brownish yellow and has a blackish mesothorax and metathorax. Overall, the adult insects appear to have a bright color and a plain glossy finish. The head does not extend into a snout. The tip of the abdomen is covered with elites and has short antennae, less than half the body length (Jana *et al.*, 2021). Oteng-oteng attacks plants from the larval stage, attacking plant roots until the plants wither and die. Adult oteng-oteng eats the leaves and leaves only the bones of the leaves.

Figure 6. *Aulocophora similis* Oliver

3.1.7. *Valanga nigricornis*

Valanga nigricornis is also called the wood grasshopper, which has the characteristics of short antennae, straight and slightly complicated front wings, membrane-shaped hind wings, body length of 6.2 cm. and longer hind legs than the front legs (Sofyan, 2010). Grasshoppers have a brownish-gray body color, brown thighs, and reddish or purple calves. The female body length is 58-71 mm, while the male is 49-63 mm. The nymphs and imago of this grasshopper are light green and yellow with a length of approximately 44-72 mm (Rukmana, 1997 in Prakoso, 2017).

According to Sudarmo (2000), adult female V. nigricornis has an egg-laying device called an ovipositor. The eggs are then put into the soil as deep as 5-8 cm, wrapped in a foam mass that dries and solidifies. The eggs are brown with a length of 2-3 cm. After 5-7.5 months, the eggs hatch. Usually occurs at the beginning of the rainy season (October-November). In this study, Valanga nigricornis was found when curly red chilies entered the vegetative age with symptoms of *V. nigricornis* attack, namely, there were bite marks on the edges of the leaves to the center of the leaves so that the leaves on chili plants had holes (Leatemia and Rumthe, 2011).

Figure 7. *Valanga nigricornis*

3.1.8. *Oxya chinensis*

The green grasshopper's body consists of 3 main parts: the head, thorax (thorax), and abdomen (abdomen), which has six jointed legs, two wings, and two antennae. The long hind legs are used for jumping, while the shorter forelegs are used for walking. *Oxya chinensis*, commonly called green grasshopper, has a dominant green color on its body and legs, brownish outer wings, and a yellowish belly. According to Borror (1992), grasshoppers have two pairs of wings: front and hind. The forewings are narrower than the rear wings, and the forewings have thickened or hardened veins. The hind wings are dilated with regular veins, and the hind wings fold under the forewings when resting. The green grasshopper has a slightly oval head with a pair of antennae on the head, and a couple of protruding eyes have a biting and chewing mouth type. It has six legs. The front four legs are smaller and shorter than the two hind legs. The front four legs are used for walking, and the two back legs, which are lengthier and more prominent, are used for high jumps. The green grasshopper is a herbivore that eats leaves.

Figure 8. *Oxya chinensis*

3.1.9. *Bemisia tabaci* Genn.

The development of *B. tabaci* consists of three stages, namely starting from egg, nymph, and imago. The eggs of *B. tabaci* are oval, clear white when just laid, then turn brown before hatching, placed on the underside of the leaves. The number of eggs produced by a female reaches 28 to 300, depending on the host plant and environmental temperature (Hirano *et al.*, 2002). This pest is found when the plant enters the vegetative and generative phases. Whitefly attacks can inhibit plant growth. Damage can be in the form of stunted plants and fallen leaves. This situation is due to leaf cell fluid that is sucked in by pests.

Figure 9. *Bemisia tabaci* Genn.

3.1.10. *Nezara viridula*

Green Ladybug (*Nezara Viridula L.*) is a polyphagous pest that thrives in tropical and subtropical regions of Europe, Asia, Africa, and America. Green ladybugs among farmers in North Sumatra are known as green bedbugs and, in some places, are known as green javelins. Green ladybug (*Nezara viridula*) is an essential pest for legumes because this pest is a pod-sucking pest. However, in chili plants, this pest still cannot be said to be the primary pest (Trizelia *et al.*, 2018).

Green ladybugs attack plants for the first time approximately 35 days after planting (DAT). At that time, the imago will attack the host plant, which aims to lay eggs on the leaf surface (Fortes *et al.*, 2006). In contrast, the life cycle of the green ladybug from egg to imago is 31-76 days (Werdin González and Ferrero, 2008). The nymph and imago stages have the same chance of causing damage.

3.1.11. *Pomacea speciosa*

In the research area in Cabeyan village, golden snail pests were found, one of the rice plants' main pests. Because the research area is close to the rice field, Pomacea speciosa also attacks curly red chili (*Capsicum annum L*). with the symptoms seen on the stems, stalks, and leaves damaged by bite marks, while the young stems will look cut. The golden snail starts its life from an egg. After hatching, it becomes a young (tiny) snail and grows into an adult snail. Briefly, the golden snail's life cycle is divided into three stages. Eggs are laid by the female parent in plants, small dikes, twigs, stakes, stones, etc., above the water surface at night. Group of pink eggs that will hatch in 7 to 14 days (Slamet, 1992).

Figure 10. (A) Egg phase and (B) Growth

3.1.12. *Gryllus bimaculatus* (Crickets)

Crickets are insects of the order Orthoptera, with two pairs of straight wings. The forewings are closed, and the hind wings are thin and transparent. Type of mouth crickets bite and undergo incomplete metamorphosis. In the research area, cicadas were found in the adult phase. This pest will attack curly red chili plants during the vegetative phase. Crickets attack plants by biting young plant parts (seeds) so that the plant will die and need to be replanted. Crickets attack plants at night and in calm conditions and will hide around chili plants or under mulch.

Figure 11. *Gryllus bimaculatus*

3.2. Pest Attack Intensity

The classification of pest attack intensity levels according to the Directorate of Food Crop Protection (2008) is as follows:

Table 2. Range of Damage Intensity and Category

Attack Intensity	Attack Intensity Classification
<25%	Light
25 - < 50%	Currently
50 - 75%	Heavy
>75%	Very Heavy

Source: Directorate of Food Crop Protection, 2008

From the results of observations of the intensity of the attack of fruit flies (*Bactrocera dorsalis*) on chili plants, the following data were obtained:

Table 3. Observations of Fruit Fly (*Bactrocera dorsalis*) Attack Intensity

Sample	Attack Intensity (%)	Scale
B1	39	Currently
B2	45	Currently
B3	43	Currently
B4	41	Currently
B5	51	Heavy
B6	49	Currently
B7	73	Heavy
B8	48	Currently
B9	67	Heavy
B10	49	Currently
B11	76	Very heavy
B12	59	Heavy
B13	62	Heavy
B14	40	Currently
B15	67	Heavy
B16	52	Heavy
B17	48	Currently
B18	56	Heavy

Source: Primary data, 2021

Fruit flies can harm fruit by puncturing it, leaving black dots on it, or letting it fall before it reaches the desired maturity, which reduces the quantity and quality of the fruit produced. Yield losses caused by fruit fly pests vary between 30% and 100%, depending on environmental conditions and the type of fruit attacked (Gupta and Verma, 1978; Dhillon *et al.*, 2005). The damage to chili plants caused by fruit flies can reach 30% (Duriat and Sastrosiswojo, 1995).

Due to location B11's proximity to community plantations/land that was also planted with chilies first, as well as cleanliness, likely, fruit flies from these crops are primarily responsible for the high attack intensity at location B11, which was 76 percent. This result is in line with Abadi (2014) assertion that adequate sanitation tries to destroy or disrupt the fruit fly's life cycle to prevent the spread of fruit flies. The research area is close to plantation areas and community settlements that cultivate fruit crops such as Mango, Guava, Starfruit, and Papaya. Allegedly these fruits become host plants for fruit flies. This condition follows what Syahfari

(2013) states: fruit flies have properties that can only lay eggs in fruit, and fruit flies only attack fruit with soft fruit skin texture, bright fruit flesh color, and quite pungent fruit smell.

3.3. Rainfall

BMKG divides monthly rainfall into four categories, namely low (0-100 mm), medium (100-300 mm), high (300-500 mm), and very high (> 500 mm) (Supriyati *et al.*, 2018). The amount of rainfall impacts the development and attack of pests on plants. Insect class pests attack plants during the vegetative phase, namely in November-December, and the growth of plant pests of the Gastropod class begins to breed at the beginning of the rainy season and will attack plants when they are still young.

Table 4. Amount of Rainfall in October 2020-February 2021 (in mm)

Month	Rainfall (mm)	Category
October	22	Low
November	64	Low
December	283	Currently
January	428	Tall
February	368	Tall

Source: BPS, 2022

According to Agus (1999), concerning the influence of rainfall, it is crucial that a high population will follow, namely the fruit fly pests in areas with high rainfall. In this study, chili plants entered the generative phase in December, coinciding with high rainfall. According to the rainfall data in Sukoharjo (Table 4 about Rainfall Data), December – February shows the high category, resulting in the attack of fruit fly pests (*Bactrocera dorsalis*) on curly red chili plants with an attacking intensity of more than 39%.

4. CONCLUSION

Twelve pests were found on chili plants in the study area, with 11 of those species being members of the phylum Arthropoda. These included *Bactrocera dorsalis* (fruit flies), *Thrips parvispinus Karny* (trips), *Spodoptera litura F.* (gray worms), *Tetranychus telarius L.* (mites), *Aulocophora similis Oliver* (Oteng-Oteng), Valanga and one species from *Phylum Mollusca* namely *Pomacea speciosa* (Golden Conch). Of the 12 pest species found, the intensity of pest attack observed was fruit fly (*Bactrocera dorsalis*), with the highest attack intensity per plant reaching 100% and the highest average attack intensity per plant at location B11 at 76% with a scale "Very Heavy" attack.

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