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Identification and abundance of fruit fly species (*Bactrocera mcgregori*) in melinjo plant (*Gnetum gnemon*) in Damit Village, Batu Ampar Sub-district, Tanah Laut Regency

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Abstract

Research on fruit flies in melinjo plants in Indonesia has been carried out but will only be limited to locations on the island of Java, so it is necessary to prove whether fruit fly species that attack melinjo in South Kalimantan are the same or different from the results of previous studies. The locations chosen for this study were Damit Village, Batu Ampar Sub-district, Tanah Laut Regency has many melinjo plantations which are attacked by fruit flies; therefore, it is necessary to identify the species of fruit flies and to find out the abundance and sex ratio of the species population. The study was conducted by collecting the attacked fruit from five different points and putting the fruit in jars filled with wood sawdust. The results of the identification showed that the fruit flies that attacked melinjo fruit was *Bactrocera mcgregori*. The highest abundance of *B. mcgregori* was 75.6% and the lowest was 8.4% with an average of 37.06%. The highest sex ratio of *B. mcgregori* was 0.88 and the lowest was 0.61 with an average of 0.78. The attack of *B. mcgregori* fruit flies on melinjo fruit was the first report in South Kalimantan.

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Introduction

The production of melinjo in Indonesia in 2014 was 197.647 tons and the harvested area was 15.383 ha with an average production of 12.85 tons/ha (Kementan / Ministry of Agriculture, 2015). The production of melinjo in Tala Regency in 2015 was 213.3 tons from the harvested area of 63.856 ha with an average production of 33.40 tons ha^{-1} (BPS, 2016) although melinjo plants were often attacked by various pests.

One of the pest problems encountered in the cultivation of melinjo plants (*G. gnemon*) is fruit fly pests from the *Bactrocera mcgregori* species (Bezzi). This fruit fly is found in Indonesia, Singapore and the Philippines. The *B. mcgregori* (Bezzi) is a species of fruit flies that attacks melinjo plants (Siwi *et al.*, 2006). The presence of the fruit fly larvae on melinjo fruit peels has not been considered to cause economic losses because the utilization and selling price of melinjo peels are quite low. The melinjo peel is useful as an antioxidant which is efficacious to increase endurance and natural antimicrobials because it contains phenolic proteins and flavonoids (Santoso *et al.*, 2010).

The attack of *B. mcgregori* fruit flies only causes damage to the fruit peel tissue. Presently the *B. mcgregori* fruit flies are known to be monophagic and only attack melinjo plants. Studies on this species are still very small (Saragih, 2017). Research about fruit flies on melinjo plants in Tanah Laut Regency which is the largest producer of melinjo in South Kalimantan has not been conducted and it is not known what kind of fruit flies attacking the melinjo. The purposes of this present study are to identify the species of fruit flies attacking melinjo plants in Damit Village, Batu Ampar Sub-district, Tanah Laut Regency, and to find out the abundance and sex ratio of the species population.

Materials and method

The study was conducted at the Entomology Laboratory of the Faculty of Agriculture, Lambung Mangkurat University, Banjarbaru, in March-April 2018. The sampling of melinjo fruit was carried out in 5 different points (Indriyanti *et al.*, 2014) with the distances adjusted to those in the location of study (Damit Village). The sampling of 250 pieces of melinjo fruit was conducted in each observation with three replications at the same location, with a 1-week lag from the first sampling.

At each point, the attacked fruit showed the symptom in the form of black spots on the melinjo fruit either falling from the tree or not. The symptomatic melinjo fruit was put into 5 plastics, each containing 10 pieces of fruit, labeled and then taken to the Entomology Laboratory and then moved into plastic jars with the bottom filled with wood sawdust and covered with gauze, and tied using raffia or rubber bands. Rearing was carried out for 22 days until the fruit fly imagoes were obtained (Larasati, 2012).

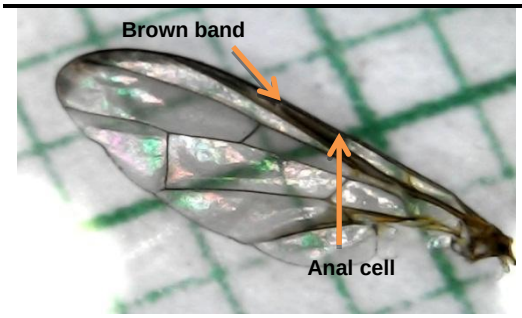
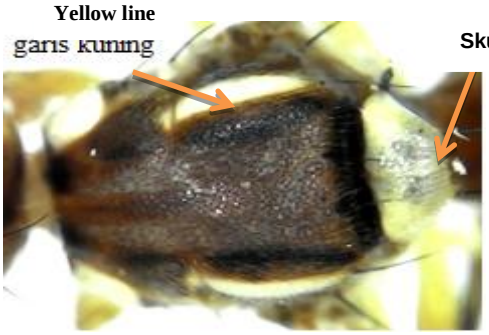
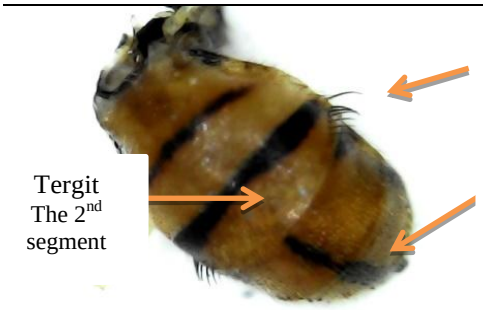
The fruit fly imagoes were preserved by putting them into a glass bottle containing alcohol. The imagoes were then identified for the type, abundance and sex ratio. The identification was carried out by observing the morphology of the wings, thorax and abdomen of fruit flies using a microscope and books (Siwi *et al.*, 2006).

Results and discussion

The fruit flies attacking the melinjo fruit were only one species. The results of the identification of fruit flies attacking melinjo fruits along with their morphology can be seen in Table 1.

The fruit flies found in melinjo fruit in Damit Village were only one species, namely *B. mcgregori*. According to Larasati *et al.* (2016), *B. mcgregori* is found only in melinjo fruit and is monofag. *B. mcgregori* is found in the melinjo varieties with large fruit (Yong *et al.*, 2014). The fruit flies are found in the Philippines, Singapore and Malaysia, and Nicobar Island (Hardy, 1973; Yong, 1994; Ranganath and Veenakumari, 1999; Yong *et al.*, 2014). This current report is the first report of the presence of *B. mcgregori* fruit flies attacking melinjo fruit in South Kalimantan.

Table 1. Morphological characteristics of B. *mcgregori* fruit fly.

Morphology	Note
 a	On the wing there is a brown band on the costa line from the base of the upper wing to the tip of the wing passing through R_{4+5} and the brown band on the anal cell.
 b	On the thorax there are yellow lines on the right and left sides of the back, and the scalp is also yellow.
 c	The abdomen has a yellowish brown color. There is a black line extending sideways on the second segment, and there is no black line extending to the next segment, but in the fourth segment there is a black line extending downward and there is a bump on the third segment.
 d	There is no facial spot on the face.
 e	The body size of this fruit fly is smaller compared to other *Bactrocera* species.

Morphologically, *B. mcgregori* has distinctive characteristics that differentiate it from other types of *Bactrocera*. Its body size is smaller compared to *B. albistrigata*, *B. carambolae*, and *B. papayae* (Isnaini, 2013).

The size of its body, if measured from the head part to abdomen, is 5 mm. (Table 1e). In addition to the body size, the color and the pattern on the abdomen and thorax of *B. mcgregori* does not have a special pattern, only in the form of a black line which is broken on the third segment and there are 7 pectan in the third section. Thorax is dominated with yellow, while in the abdomen it is pale reddish (Siwi *et al.*, 2006).

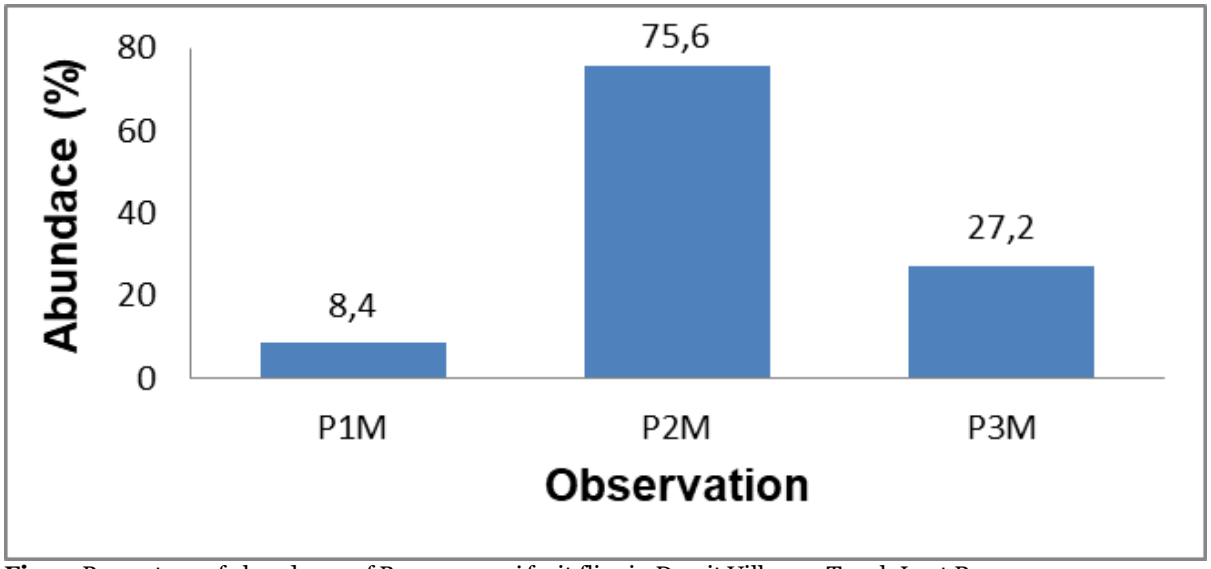


Fig. 1. Percentage of abundance of B. *mcgregori* fruit flies in Damit Villange, Tanah Laut Regency.

Abundance

The abundance obtained from each observation was very different. The highest abundance was seen in the second observation (P2M) which was 75.6% and the lowest abundance was found in the first observation (P1M), 8.4% (Figure 1). The average abundance of all observations was 37.06%.

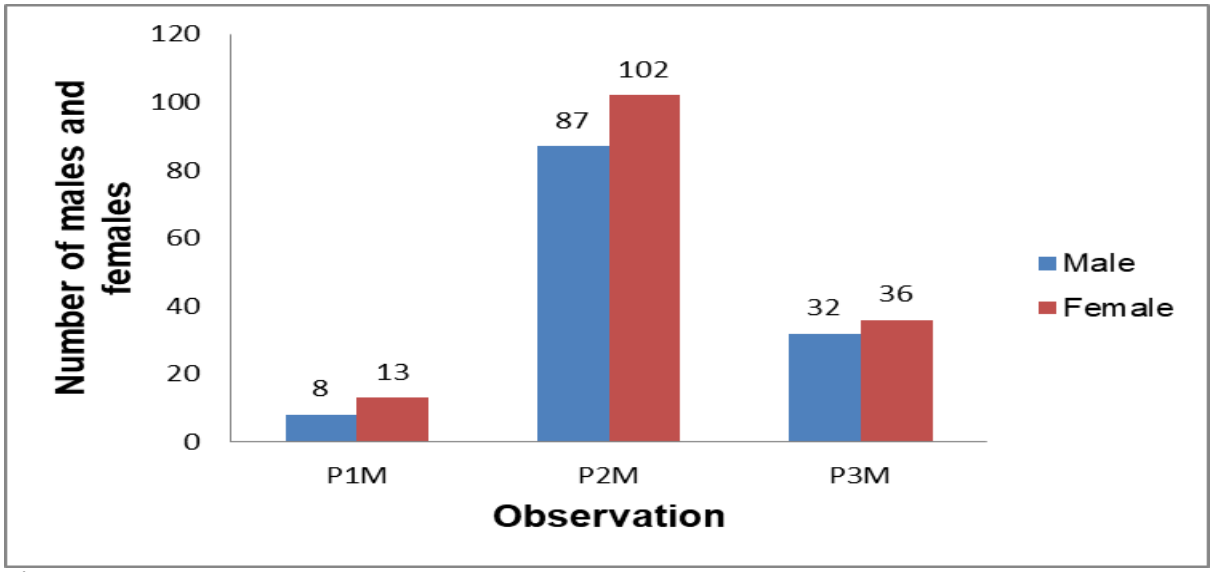


Fig. 2. Number of males and females of *B. mcgregori* in melinjo plants with the attacked fruit sampled three times in Damit Village

The number of fruit flies in each observation was strongly influenced by natural enemy factors namely parasitoid and not hatched pupae.

The high abundance in P2M observation was because the number of parasitoids found in these observations was very low with the ratio of fruit fly to parasitoid, 1: 3, while the low abundance in P1M observation was due to the large number of parasitoids with a ratio of 1: 7. Parasitoid larvae and pupae develop inside fruit fly larvae so that larvae or pupae of fruit flies die before becoming imagoes. Sota and Mogi (1996) state that the population of fruit flies is influenced by biotic factors especially feed and its natural enemies, and physical factors such as climate, bulk rain and temperature. According to Hasyim *et al.* (2008) the population of fruit flies on the land will increase due to an increase in rainfall and temperature.

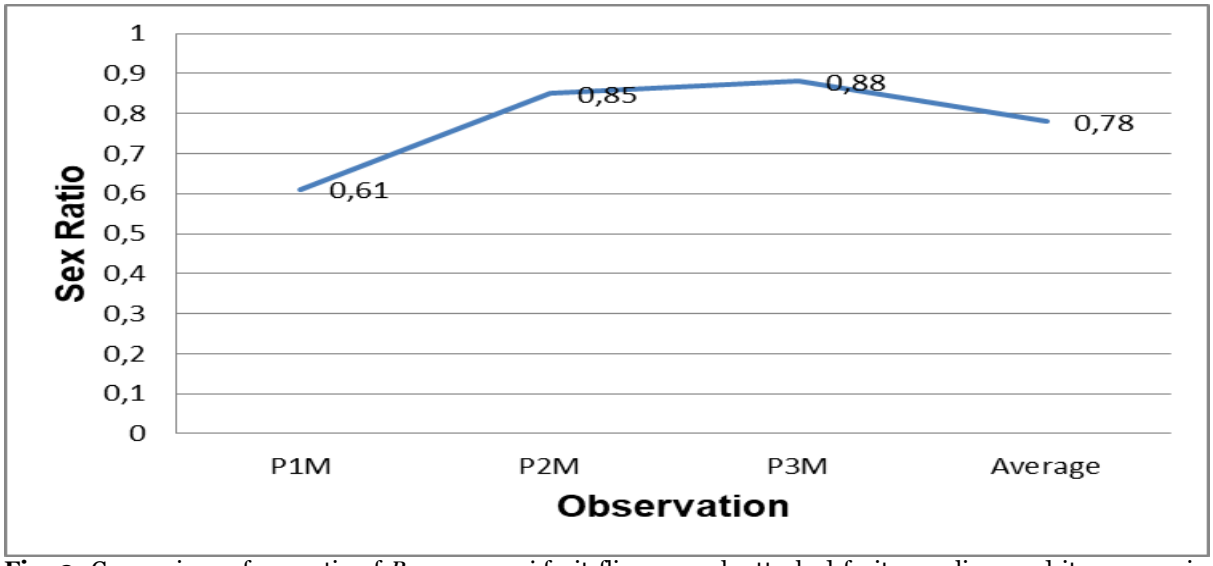


Fig. 3. Comparison of sex ratio of *B. mcgregori* fruit flies on each attacked fruit sampling and its average in Damit Village.

Based on the observations, an increase in the number of the fruit fly population will be followed by a decrease in the number of parasitoids. This is contrary to Laba and Kartohardjono's (1998) statement that if the population of fruit flies increases, the parasitoid population will increase as well as, and vice versa.

Melinjo fruit that is ripe and deciduous has a thin peel texture and is easily attacked by fruit flies. The abundance of *B. mcgregori* in melinjo is categorized into the high category with an average abundance of 37.06%. This is stated by Krebs (1989) in Ismawan *et al.* (2015) that this abundance is included in the high range which is greater than 20%. However, this abundance does not affect the economic value of melinjo fruit because the utilization of melinjo peel is still less and only the seeds have the high economic value (raw materials for making salted or sweet chips/emping). Melinjo trees on the research land were intentionally planted in a row with an area of ± 0.5 ha. The number of trees, either large or small, did not affect the ability of *B. mcgregori* to attack these plants (direct observation in the field).

Sex Ratio

In the study, there were more female fruit flies compared to male fruit flies.

The male and female fruit flies emerging from the attacked melinjo fruit showed the highest number in the second observation (P2M) with the number of males and females of 87 and 102, respectively. Meanwhile the lowest number of fruit flies was in the first observation (P1M) with the number of males and females of 8 and 13, respectively. The average number of males and females found in the observations 1, 2 and 3 were 42 and 50, respectively (Figure 2).

The comparison between the sex ratio of male and female fruit flies from the first observation to the third observation was very different (Figure 3).

The lowest sex ratio was 0.61 at the first observation, which increased to 0.88 at the third observation. If all is averaged, the sex ratio of male to female fruit flies is 0.78.

In this case the number of female flies is more than male flies because *B. mcgregori* can experience parthenogenesis (females can produce eggs without being fertilized by males and can hatch them into new individuals), so the population will not be affected if there is a lack of males.

The more the number of females is, the more likely the population of *B. mcgregori* will increase. This result is consistent with Isnaini's (2013) study in Demak Regency revealing that the most found fruit flies were females, so the more females, the more the population would increase.

It is suspected that the more eggs were placed on the attacked fruit. According to Indriyanti *et al.* (2014) the comparison between the sex ratio of *Bactrocera* spp. showing more females than males indicates that the population will increase. Meanwhile, the relationship of mating in *Bactrocera* spp. is polygamy, so the males can fertilize more than one female.

If it is seen from the contents of melinjo fruit such as high carbohydrate and protein, the two contents, especially carbohydrate which is a source of energy for fruit flies and sugar such as sucrose can stimulate the eating desire of the fruit flies (Susrama, 2017).

Due to its small body size compared to phytophagic insects (orthoptera, lepidoptera and coleoptera), the fruit fly requires higher carbohydrates compared to proteins and amino acids; therefore, melinjo fruit strongly supports the proliferation of *B. mcgregori* fruit flies. Generally, the fruit flies are found to attack when the fruit is nearly ripe or matured.

Conclusion

The species of fruit flies found in melinjo fruit is only one species, namely Bactrocera mcgregori, while the abundance category of fruit flies is categorized into high categories with an average abundance of 37.06% and an average sex ratio of males to females 0.78 (More female than male fruit flies).

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