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Fluctuations in Fruit Fly Population (*Bactrocera spp.*) and Its Relationship to Environmental Conditions in Red Guava Plantations in Sidoarjo Regency

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Abstract

Crystal guava (*Psidium guajava*) is a superior variety cultivated in Indonesia. A major constraint in crystal guava production is the high incidence of pest attacks, particularly from fruit flies. This study was conducted in a red guava orchard located in Sidoarjo Regency and Jalan Simorejosari A IV/17 during the period from July to August. The research employed a survey method involving the installation of attractant traps and purposive sampling to collect infested fruit for host rearing. Both trapping and host rearing were used to monitor the fruit fly population. Trapping was carried out by installing attractant traps at five predetermined plots, positioned at a height of 1.5 meters and spaced 20 meters apart. Fruit fly rearing involved collecting infested fruit using purposive sampling from the same five plots, then incubating until adult flies emerged. The fruit fly species attacking the red guava orchard was identified as Bactrocera dorsalis. Independent t-test analysis revealed significant differences between the populations of trapped fruit flies and those obtained from host rearing. The emergence rate of fruit fly adults from host rearing exhibited a negative correlation with the trapped fruit fly population, described by the regression equation Y = 359.282 – 7.2146X. Path analysis indicated that rainfall positively correlates with temperature and humidity, while temperature negatively correlates with humidity. Additionally, rainfall and humidity negatively correlate with the trapped fruit fly population, whereas temperature shows a positive correlation.

Keywords: Abiotic, Bactrocera dorsalis, Fluctuation, Guava, Fruit Fly, Population

1. Introduction

Guava (*Psidium guajava*) is a horticultural product with high market demand. There are several guava varieties in Indonesia, namely red getas, pearl, pear, and crystal. The crystal guava variety is one of the superior varieties in Indonesia (Parameswara & Susanto, 2019). In 2021, Sidoarjo Regency produced 14,135 quintals of guava, while in 2022 it produced 15,953 quintals of guava seed (BPS, 2022).

Increased guava production in 2022 can be influenced by effective control techniques, which can drive production increases. One of the important pests of guava plants is the fruit fly, which reduces yields and even causes crop failure (Andrian, 2022). One important integrated pest management (IPM) effort for fruit flies is monitoring. Good and effective monitoring can make pest control more effective, efficient, and targeted (Handaru et al., 2019). Monitoring can be done by observing fluctuations in the field population of fruit flies. Biotic and abiotic factors Influence fluctuations in the field fruit fly population. Biotic factors include parasitoids as natural enemies, while abiotic factors include temperature, humidity, and rainfall (Meidi *et al.*, 2022; Susanto et al., 2017).

Observations of fruit fly population fluctuations are generally carried out using attractant traps baited with methyl eugenol compounds. These compounds are volatile and can attract male fruit flies because they are similar to the sex pheromone of female fruit flies (Ladja et al., 2018). Observations of population fluctuations can be made besides setting traps, such as through the host rearing method. Host rearing aims to determine the population of imago that appear (Alima et al., 2018). In host rearing, the

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aim is also to determine the presence or absence of fruit fly parasitoids; parasitoids that are often found to control fruit flies include Opius sp. And *Fopius sp*. Both parasitoids attack fruit flies at the egg, larva, and pupa stages (Meiadi et al., 2015; Muliani & Srimurni, 2022).

This study aims to determine the species of fruit flies that attack red guava plantations in Sidoarjo Regency, to determine the correlation between the trapped fruit fly population and the fruit fly population resulting from host rearing, to determine the presence or absence of fruit fly parasitoids, and to determine the Influence of abiotic factors on fluctuations in the fruit fly population.

2. Material and Methods

This research was conducted from April to June 2024, in a red guava plantation in Sidoarjo Regency and in Simorejosari A IV/17 Street, Surabaya.

2.1. Tools and Materials

The tools used in this research were a digital microscope, a thermohygrometer, a syringe, a heating soldering iron, scissors, a cutter, a filter, a 1.5-liter mineral water bottle, a brush, a pan, a stove, a plastic base, a 12-megapixel cellphone camera, and stationery.

The materials used in this study were 600 ml mineral water bottles, cotton, wire, petrogenol attractant, water, 70% alcohol, small bottles, gauze, sawdust, sugar, and a fruit fly identification guidebook (Suputa *et al*., 2006).

2.2. Research Methods

This research used a survey method. Quadratic plots were determined within a field, both inside and outside, to represent data on fruit fly catches and rearing of infested fruit obtained in the research area.

This study used attractant traps to capture fruit flies; the trap used was a mineral water bottle trap. The traps were installed on a guava plantation measuring 50m x 100m with 5 plots measuring 20m x 10m each. Ten bottles were installed on the guava plantation at a height of 1.5m. During the 6-week observation period, the traps installed on the 5 plots were replaced with cotton and given 0.2ml of methyl eugenol once a week, and the population of trapped fruit flies was counted.

Host rearing was carried out by collecting infested guava fruit samples from guava orchards using a purposive sampling method (Astriyani et al., 2016). During the 6-week observation period, infested fruit samples were collected from 5 predetermined plots once a week. Then the infested fruit samples were placed in a 1.5 liter mineral water bottle that had its top cut off and filled with sterile sawdust with a thickness of 3 cm as a place for the larvae that bounced from the infested fruit to turn into pupae, after which the cut part of the bottle was covered with gauze so that the imago of the fruit fly could not escape. Observations of fruit fly and parasitoid rearing were carried out daily to determine the development of larvae and pupae until they became imagoes of the fruit fly or parasitoid.

Fruit fly identification was performed by observing the caput, thorax, abdomen, legs, and wings of the fruit fly samples obtained from trapping and the results of host rearing from infested fruit samples using a digital microscope. Fruit fly identification was performed in accordance with the guidelines for fruit fly pest identification (Siwi *et al*., 2006).

2.3. Data Analysis

The populations of trapped fruit flies and imagos that emerged from the rearing host were subjected to a t-test to determine differences between the two factors and to a regression test to determine the relationship between the two factors. The abiotic factor data were subjected to a *path analysis* with the trapped fruit fly population to determine the effect of abiotic factors on the trapped fruit fly population.

3. Results and Discussion

3.1. Identification of Fruit Fly Species

Based on the identification results, the fruit fly species found in the red guava plantation is Bactrocera dorsalis. The characteristics *of Bactrocera dorsalis* found are the presence of black spots on the caput, having a black scutum, yellow lateral vittae and scutellum, black anal streak on the wings, and having a T pattern on the abdomen terga III - V. These characteristics are in accordance with research that has been done (Siwi *et al* ., 2006) .

3.2. Relationship between Fruit Fly Population, Host Rearing, and Traps

The emergence of imagos from host-reared individuals shows a difference in the number of individuals in the trapped fruit fly population. This difference is shown in Figure 2, which shows the difference in the number of individuals obtained. The results of the regression analysis show Y = 359.282 – 7.2146X, with R = 0.708, R2 = 0.502, and $p > 0.05$. The regression equation shows a negative relationship between the population of fruit flies from host rearing and the population of fruit flies from traps, so that the more imagoes of fruit flies are trapped, the fewer will emerge from host rearing.

The high population of trapped fruit flies is male fruit flies attracted by attractant compounds, so the male fruit fly population in the field will decrease. (Saputra *et al.*, 2024) stated that a high population of male fruit flies can cause an increase in the fruit fly population, because male fruit flies can mate with many female fruit flies so that the fruit fly reproduction rate becomes high and can increase the fruit fly population. If the male fruit fly population decreases, the reproductive rate will also decrease, potentially suppressing the fruit fly population.

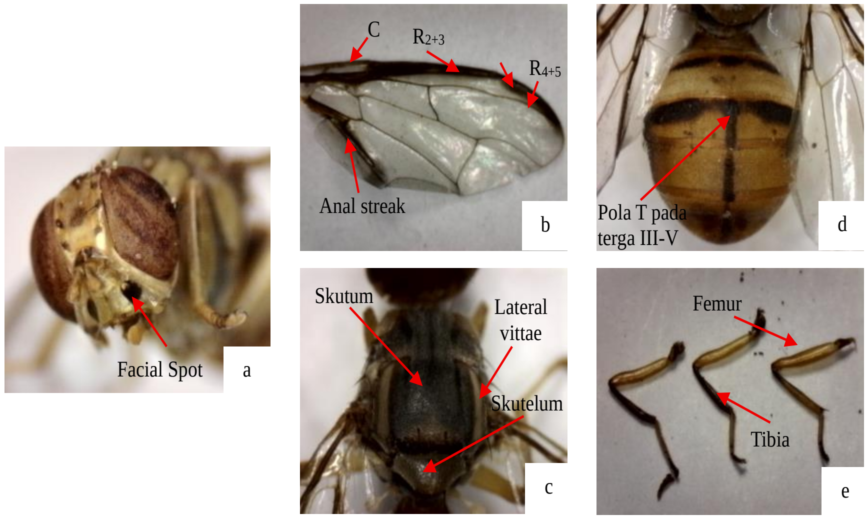

Figure 1. Morphology *of Bactrocera* dorsalis, a. caput, b. wings, c. thorax, d. abdomen, e. legs

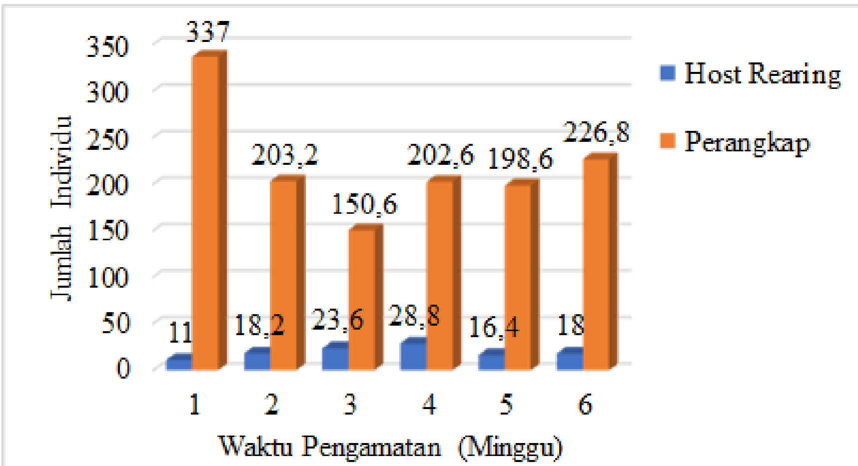

Figure 2. Average number of fruit fly imagos resulting from host rearing and trapping

Red guava plantations. The results of host rearing did not indicate any fruit fly parasitoids. Factors that can affect the presence of parasitoids include excessive pesticide use, which can kill parasitoids, and low fruit availability, which can make it challenging to find parasitoids (Indriyanti & Furqani, 2014; Riyanto et al., 2011).

3.3. Relationship of Abiotic Factors to Population Fluctuations

Based on Figure 3. It is known that in the first week the average fruit fly catch was 337, while in the third week it was 150.6. Rainfall is low because this study was conducted during the dry season, with an average temperature of 31-32 °C. The optimal temperature for fruit flies to breed is 20-28 °C, while the optimal humidity is 87% (Susanto et al., 2018; Syahputera et al., 2022).

Based on Figure 3.4, rainfall shows a positive relationship with temperature and humidity, with beta coefficients of 0.155 and 0.083, respectively. This relationship has an insignificant effect because the *p-value is* > 0.05; that is, when rainfall increases, temperature and humidity do not have a significant effect (Sartika et al., 2022). Temperature has a negative relationship with rainfall, as indicated by a beta coefficient of -0.549, and has a significant effect (p-value ≤ 0.05). When the average temperature increases, humidity decreases (Kahfi et al., 2023).

Rainfall has a strong negative relationship with the trapped fruit fly population, with a beta coefficient value of -0.498. High rainfall can reduce the population of trapped fruit flies (Putri et al., 2024; Susanto et al., 2018). Temperature has a weak positive relationship with the trapped fruit fly population, with a beta coefficient value of 0.049. An increase in temperature does not affect the trapped fruit fly population (Syahputera *et al.*, 2022). Humidity has a strong negative relationship with the trapped fruit fly population, with a beta coefficient value of -0.617. Research by Putri *et al*. (2024) indicates that high humidity can reduce fruit fly populations by preventing pupae from developing into imago.

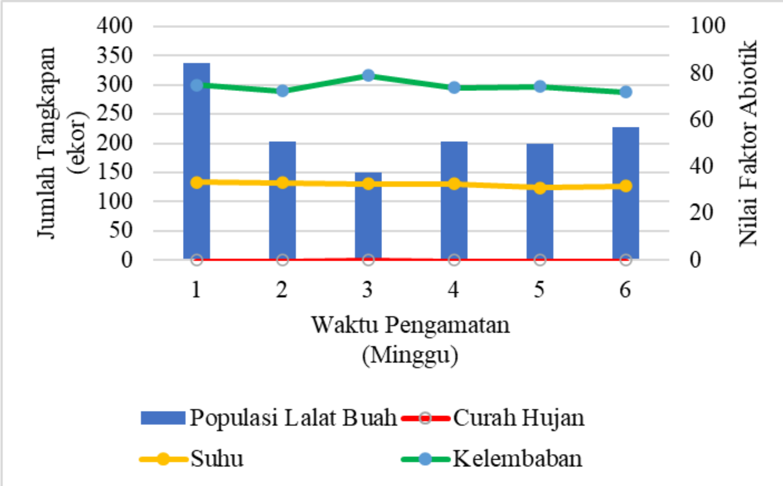

Figure 3. Relationship between abiotic factors: Rainfall (mm), Temperature (°C), and Humidity (%) against the fruit fly population trapped.

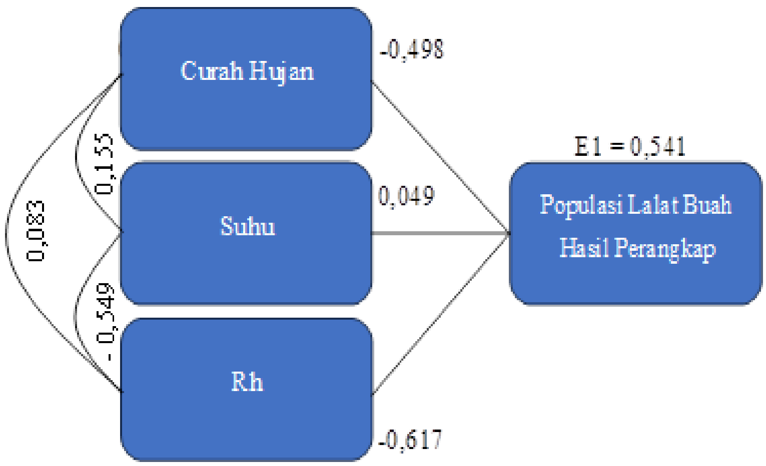

Figure 4. Path analysis of abiotic factors on trapped fruit fly populations.

4. Conclusion

The fruit fly species found in red guava plantations is Bactrocera dorsalis. The population of trapped fruit flies differed significantly from that of fruit flies emerging from rearing hosts. The emergence rate of adult fruit flies from rearing hosts was negatively correlated with the population of trapped fruit flies, and no fruit fly parasitoids were detected in the rearing hosts. Rainfall and humidity had a strong negative effect on the population of trapped fruit flies, whereas temperature had a weak positive effect.

References

Alima, R. H., Kuntjoro, S., & Ambarwati, R. (2018). Kemelimpahan lalat buah (Diptera: Tephritidae) yang menyerang jambu biji kristal (*Psidium guajava*) di Perkebunan Dlanggu, Mojokerto. *Lentera Bio*, *7*(2), 127-135.

Andrian. (2022). *Pola aktivitas harian dan dinamika populasi lalat buah (Bactrocera spp.) pada pertanaman jambu madu thongsamsi (Syzygium aqueum) di Desa Jati Kesuma, Kecamatan Namorambe, Deli Serdang* (Skripsi). Universitas Medan Area.

Astriyani, N. K. N. K., Supartha, I. W., & Sudiarta, I. P. (2016). Kelimpahan populasi dan persentase serangan lalat buah yang menyerang tanaman buah-buahan di Bali. *Journal of Agricultural Science and Biotechnology*, *5*(1), 19-27.

Badan Pusat Statistik. (2022). *Produksi buah-buahan jeruk besar, jeruk siam, dan mangga menurut kabupaten/kota dan jenis tanaman di Provinsi Jawa Timur (kwintal), 2022*. Badan Pusat Statistik.

Handaru, O. D., Witjaksono, W., & Martono, E. (2019). Study on the attractiveness of fruit flies *Bactrocera* spp. to mango fruit extract. *Jurnal Perlindungan Tanaman Indonesia*, *23*(2), 228-235.

Indriyanti, D. R., & Furqani, R. F. (2014). Keanekaragaman parasitoid dan predator *Bactrocera* (Diptera: Tephritidae) di Kabupaten Demak. *Agrineca*, *14*(2), 94-101.

Kahfi, M., Falgenti, K., Rizqi, L. D., Megawulan, D., Iqbal, M., & Furqon, F. (2023). Analisis pengaruh suhu udara rata-rata terhadap kelembaban di wilayah DKI Jakarta menggunakan regresi linear. *CENTIVE*, *3*(1), 1-10.

Ladja, M. G., Hindun, I., Sukarsono, Susetyarini, E., & Setyawan, D. (2018). Pengendalian lalat buah (*Bactrocera* sp.) secara biologi menggunakan attractant dan warna pada tanaman jambu biji (*Psidium guajava*). Dalam *Prosiding Seminar Nasional IV* (hlm. 246-250).

Meiadi, M. L. T., Himawan, T., & Karindah, S. (2015). Pengaruh *Arachis pintoi* dan *Ageratum conyzoides* terhadap tingkat parasitasi parasitoid lalat buah pada pertanaman belimbing. *Jurnal HPT*, *3*(1), 44–53.

Meidi, E., Pakpahan, Y. M., Nadia, Yuana, Dani, D. R., Nurfadila, Y., Nasution, M. P., Umayanh, A., Gunawan, B., & Arsi. (2022). Kelimpahan populasi spesies lalat buah (Diptera: Tephritidae) pada pertanaman jeruk di Ogan Ilir, Sumatera Selatan. Dalam *Prosiding Seminar Nasional Lahan Suboptimal ke-10*.

Muliani, Y., & Srimurni, R. R. (2022). *Parasitoid dan predator pengendali serangan hama* (N. S. Hapsari & R. R. Srimurni, Eds.; Edisi ke-1, Vol. 1).

Parameswara, Y. S., & Susanto, S. (2019). Perbaikan teknik pembrongsongan melalui aplikasi pestisida untuk meningkatkan kemulusan buah jambu kristal (*Psidium guajava* L.). *Buletin Agrohorti*, *7*(1), 62–68.

Putri, Y. D., Gunadi, R., Pranowo, D., Affandi, & Suputa. (2024). Population dynamic of fruit fly pests *Bactrocera* spp. in salacca orchard in relation to host plants and climate factors. *Agrivita*, *46*(1), 1–14. https://doi.org/10.17503/agrivita.v46i1.4257

Riyanto, Herlinda, S., Irsan, C., & Umayah, A. (2011). Kelimpahan dan keanekaragaman spesies serangga predator dan parasitoid *Aphis gossypii* di Sumatera Selatan. *Jurnal HPT Tropika*, *11*(1), 57–68.

Saputra, H. M., Rahmawati, V., Apriyadi, R., Henri, H., & Setiawan, F. (2024). Keanekaragaman dan kunci identifikasi lalat buah berdasarkan inang tanaman buah di Kabupaten Bangka, Bangka Belitung. *AGROSAINSTEK: Jurnal Ilmu dan Teknologi Pertanian*, *8*(1), 33–40. https://doi.org/10.33019/agrosainstek.v8i1.429

Sartika, W. D., Ginting, S. B. R., & Afriyanto, D. (2022). Distribusi lalat buah *Bactrocera* sp. (Diptera: Tephritidae) pada buah jambu biji di Kota Bengkulu. *Perlindungan Tanaman (SNPT)*, *1*, 128–144.

Siwi, S. S., Hidayat, P., & Suputa. (2006). *Taksonomi dan bioekologi lalat buah penting di Indonesia* (Diptera: Tephritidae). https://www.researchgate.net/publication/330102477

Susanto, A., Fathoni, F., Atami, N. I. N., & Tohidin. (2017). Fluktuasi populasi lalat buah (*Bactrocera dorsalis* complex) (Diptera: Tephritidae) pada pertanaman pepaya di Desa Margaluyu, Kabupaten Garut. *Jurnal Agrikultura*, *28*(1), 32–38.

Susanto, A., Natawigena, W. D., Puspasari, L. T., & Atami, N. I. N. (2018). Pengaruh penambahan beberapa esens buah pada perangkap metil eugenol terhadap ketertarikan lalat buah *Bactrocera dorsalis* complex pada pertanaman mangga di Desa Pasirmuncang, Majalengka. *Jurnal Perlindungan Tanaman Indonesia*, *22*(2), 150–158.

Syahputera, I., Permana, A. D., & Susanto, A. (2022). Fluktuasi populasi dan identifikasi lalat buah *Bactrocera* spp. pada pertanaman mangga varietas Gedong Gincu di Jatigede, Sumedang. *Jurnal Agrikultura*, *33*(1), 83–88.