



## The Effectiveness Test of Basil Leaf Extract and Bilimbi Fruit in Control of Cocoa Sucking Pests (*Helopeltis* spp.)

Apriyeni Pasaribu\*, Albertus Sudirman, Bambang Utoyo  
Politeknik Negeri Lampung, Lampung, Indonesia

\*Corresponding author: [apriyenip@gmail.com](mailto:apriyenip@gmail.com)

### ABSTRACT

*Helopeltis* spp. is a major pest of plantation crops, especially on cocoa plants. This pest attacks the fruit and shoots of cocoa plants by sucking the liquid from plant parts which cause fruit rot and reduces production. Control that is often done by farmers is by using synthetic insecticides. The use of synthetic insecticides in controlling pest attacks turns out to have a negative impact on the surrounding environment and even on its users, so we need an alternative that does not have a negative impact such as environmentally friendly vegetable insecticides. There are many plants that have the potential as vegetable insecticides such as basil and starfruit. The purpose of this study was to obtain the best extract from basil leaf extract, star fruit wuluh, and the combination of the two extracts against the mortality of *Helopeltis* spp. The research was carried out at the Plant Laboratory II, Department of Plantation Cultivation, Lampung State Polytechnic, from November 2020 to February 2021. This research was conducted using a Randomized Block Design with 4 treatments and 6 replications so that there were 24 experimental units. Each experimental unit contained one treatment and 11 *Helopeltis* spp. This research was finding that the highest mortality at 4 DAA was found in the combination treatment of basil leaf extract and starfruit with a mortality percentage of 33.33%. The highest mortality in this study was 45.45% at 6 DAA treatment with a combination of basil leaf extract and star fruit, meaning that the treatment in this study was considered less effective. This research conclude that the combination of basil leaf extract and star fruit is able to control cocoa fruit-sucking pests (*Helopeltis* spp.) with a mortality of 45.45%.

**Keywords:** aromatic; fruit rot; Hemiptera; plantation crops; Rubiaceae.

**Cite this as:** Pasaribu, A., Sudirman, A., & Utoyo, B. (2023). The effectiveness test of basil leaf extract and bilimbi fruit in control of cocoa sucking pests (*Helopeltis* spp.). *Agrosains: Jurnal Penelitian Agronomi*, 25(1), 5-8. DOI:<http://dx.doi.org/10.20961/agsjpa.v25i1.60333>

### INTRODUCTION

Cocoa pod-sucking pests (*Helopeltis* spp.) are the main pests of cocoa plants which can reduce cocoa production by 50-70% (Pasaru et al., 2014). Control of *Helopeltia* spp. can use environmentally friendly pesticides. Pest attack *Helopeltis* spp. can be detrimental to farmers. The control often carried out by farmers is to use synthetic insecticides because they are more practical and faster in killing pests. Until now, efforts to find control alternatives that are more effective, cheaper, safer, and environmentally friendly have become a top priority to reduce the negative impacts of the use of chemical pesticides. Using plant-based pesticides using plant materials that are easily found in nature, easy to make, easy to apply, and do not leave dangerous chemical residues is one option. Vegetable pesticides are a type of pesticide whose basic ingredients come from nature, such as plants. This pesticide does not leave harmful residues on plants or the environment and can be made easily using cheap materials and simple equipment. Botanical pesticides are becoming increasingly popular along with increasing awareness of the negative effects of

using chemical pesticides.

The use of botanical pesticides is one form of effort to realize environmentally friendly agriculture. Vegetable pesticides are the best solution for controlling plant pests easily, cheaply, and safely. Although overall vegetable insecticides cannot act as a substitute for synthetic insecticides, at least they are able to reduce the use of synthetic insecticides. Basil leaves can be used as an alternative ingredient for vegetable pesticides. Vegetable pesticides can also minimize environmental pollution. Chemical compounds from basil leaves can kill pests on plants. According to Hadipoentyanti and Wahyuni (2008), basil leaves contain chemicals in the form of compounds. Basil leaves indicate the presence of content tannin 4.6%, flavonoids, steroids, eugenol, and essential oils (phenol). Starfruit is a plant that can also be used as a botanical pesticide. Based on research conducted by Fahrunnida and Pratiwi (2015), regarding the saponin content in the fruit, leaves and stalks of starfruit, it shows that the highest levels of saponin are found in starfruit. Saponin compounds can be used as insecticides with a mechanism of action, namely, they can reduce the

activity of digestive enzymes and food absorption so that saponins are stomach toxic. The purpose of this study was to obtain the best extract from basil leaf extract, star fruit wuluh and the combination of the two extracts against the mortality of *Helopeltis* spp.

## MATERIAL AND METHODS

The research was carried out at Plant Laboratory II, Department of Plantation Cultivation, Lampung State Polytechnic, from November 2020 to February 2021. The materials used in the research were basil leaves and star fruit, brown sugar, cucumber, bioactivator (EM4), clean water, and *Helopeltis* spp. 3rd instar nymph. The tools used in the research were measuring jars 16 x 9 cm, blender, digital scale, bucket, measuring cup, tray, knife, rubber band, fine sieve, small brush, stirrer, bottle, stationery. This research was conducted using a Randomized Group Design with 4 treatments and 6 replications and obtained 24 experimental units and from each experimental unit contained 11 *Helopeltis* spp. instar 3rd, then the total in experimental were 264 units nymphs required. If the results of the analysis of variance show a real difference between the treatments, a further test will be carried out with BNT at the 5% level.

## RESULTS AND DISCUSSION

Results of various types of mortalities from *Helopeltis* spp. (Table 1) shows that there is no significant difference between treatments. This means there is no effect on each 1 DAA (day after application) treatment. This is because the insecticide used is a vegetable insecticide whose raw materials are derived from natural ingredients. Sastrosiswojo (1991) states that vegetable insecticides/vegetable pesticides are insecticides that have a working power (mode of action) whose results cannot be seen directly. Insecticides need time to work to control their target pests. This is in line with the opinion of Thamrin et al. (2013), who stated that vegetable insecticides in general cannot kill insects directly, but function as repellents, antifeedants, and neurotoxins and destroy the hormonal system in the insect's body.

Based on the average mortality value of *Helopeltis* spp., 2 DAA showed that basil leaf extract and wuluh starfruit were not different from the control but were different from the combination of basil leaf extract and wuluh starfruit. The mortality of 2 DAA has shown the influence of insecticide treatment. However, death of the test insect pests was relatively slow because the mortality percentage was low at 2 DAA. Hartati (2012) stated that the vegetable insecticides applied are not persistent in the target area and environment, and cannot kill organisms quickly. Oka (2015) added that vegetable pesticides generally cannot kill directly.

Basil showed that it was not different from the extract of star fruit, but was different from the combination of basil leaf extract and star fruit and the control, while the combination extract of basil leaves and star fruit showed that it was not different from the extract of star fruit, but was different from the extract of basil leaves and the control. At 3 DAA the effect of botanical insecticides was also visible with an increase in the percentage of insect mortality which was higher

compared to 1 and 2 DAA. From the table of average pest mortality *Helopeltis* spp., the highest mortality value was found in the combination of basil leaf extract and star fruit with a percentage of 21.21%.

Based on the average mortality value of *Helopeltis* spp. 4 DAA of wuluh starfruit extract and the combination of basil leaf extract and starfruit fruit were not different but different from basil leaf extract and the control, basil leaf extract was different from wuluh starfruit extract and the combination of basil leaf extract and wuluh starfruit fruit and the control.

The highest mortality at 4 DAA was found in the combination treatment of basil leaf extract and starfruit with a mortality percentage of 33.33%. At 4 DAA, the mortality percentage began to increase compared to 1, 2, and 3 DAA. Differences in the mortality rate of vegetable pesticides are influenced by the origin of the raw materials and the nature of the easily decomposed compounds of a botanical pesticide. In accordance with Dadang and Prijono (2008), the content of active ingredients in the same plant often varies, this depends on the geographical conditions of the area of origin of the plant and the time of harvest of the part of the plant containing the insecticidal ingredient.

Based on the average mortality value of the cocoa pod-sucking pest *Helopeltis* spp. at 5 DAA basil leaf extract and wuluh starfruit extract were not different but different from the combination of basil leaf extract and wuluh starfruit fruit and the control, the combination of basil leaf extract and wuluh starfruit fruit was not different but different from basil leaf extract and the control. The mean value of 5 DAA (Table 1) showed a mortality rate ranging from 25.76 to 42.42%. Botanical insecticides don't always have to kill, they can also act as feeding inhibitors (antifeedants) or feeding repellents (repellents). This is in line with Sudarmo's (2005) statement that the mechanism of action of botanical pesticides is very specific, namely by disrupting the activity of the insect's nervous system, disrupting the insect's digestive system, reducing appetite, and damaging the insect's ability to eat.

Based on the results of the average mortality of 6 DAA for cocoa fruit sucking pests (Table 1). showed that the basil leaf extract treatment was not different from the wuluh starfruit extract but was different from the combination of basil leaf extract and wuluh starfruit and the control, while the wuluh starfruit extract was not different from the combination of basil leaf extract and wuluh starfruit but was different from the control.

Table 1 shows that the 6 DAA mortality values for cocoa fruit sucking pests' range between 28.79 to 45.45%. According to Prijono (2002), a plant-based pesticide is said to be effective if treatment with the plant-based pesticide results in more than 80% deaths. The highest mortality in this study was 45.45% at 6 DAA treatment with a combination of basil leaf extract and star fruit, meaning that the treatment in this study was considered less effective. Statistically it has been proven that the combination treatment of basil leaf extract and star fruit is the highest and is able to control the cocoa fruit sucking pest *Helopeltis* spp with a mortality value. 45.45%, but if the availability of the extract is very limited, the application with starfruit extract treatment is still quite capable due to the combination treatment of basil leaf

extract and star fruit and star fruit extract were not significantly different.

Several factors that cause the ineffectiveness of

Table 1. Mortality of *Helopeltis* spp. on 2-6 DAA

Treatment	Mortality (DAA)				
	2	3	4	5	6
Without botanical pesticide	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
Basil leaf extract	6.06 a	10.61 b	13.64 b	25.76 b	28.79 b
Bilimbi fruit	6.06 a	15.61 bc	25.76 cd	31.82 bc	36.36 bc
Basil leaf extract+ Bilimbi fruit	12.12 b	21.21 c	33.33 c	42.42c	45.45 c

level used, the more active ingredient content in the solution so that the toxic power of vegetable pesticides is higher. The higher toxic power can cause higher mortality. Chemical compounds that are stomach poisons enter the insect's body through food, thereby disrupting its digestive system. The absorption process mostly occurs in the middle digestive tract which is an organ that absorbs nutrients and is where the process of secretion of digestive enzymes occurs which ultimately causes a poisoning effect. This occurs because the middle digestive tract does not have a cuticle, whereas the front and final digestive tracts covered by cuticle.

If there is damage to the middle digestive tract, enzyme activity will be disrupted and the digestive process will not work optimally, therefore the insect's body metabolism will be disrupted (Sastrodiharjo, 1979; Danulusistyo, 2011). Mortality occurs due to the chemical content in basil leaves and star fruit. According to Simarmata et al. (2013), basil has bioactive compounds in the form of eugenol and methyl clavical. According to Gunawan (2011), basil leaves contain essential oils with eugenol as the main component. Eugenol can affect the nervous system which is unique to insects and is not found in warm-blooded animals. Basil plants contain saponins, alkaloids, tannins, steroids or terpenes, flavonoids, cardiac glycosides, resin (Daniel, 2006). The content of saponins, tannins and alkaloids mean that basil plants can function as a repellent because they have a bitter taste. The biological activity of essential oils against insects can be repellent, attractant, contact poison, fumigant, and reduce appetite (antifeedant), inhibits egg laying (oviposition deterrent), inhibits growth, reduces fertility, and acts as an anti-vector insect (Ridhwan, 2016). The chemical substances produced by the starfruit plant are saponins, alkaloids and flavonoids. according to the statement of Fahrnunida and Pratiwi, (2015) that the highest levels of saponin in starfruit are found in the fruit organs. Alkaloid compounds can degrade cell walls, thereby damaging digestive tract cells. Flavonoids are plant defense compounds that can inhibit the digestive tract of insects and are also toxic.

## CONCLUSION

The combination of basil leaf extract and star fruit is able to control cocoa fruit sucking pests (*Helopeltis* spp.) with a mortality of 45.45%.

## REFERENCES

Dadang & Priyono, D. (2008). Insektisida nabati: Prinsip, pemanfaatan, dan pengembangan. Departemen

botanical insecticides include concentration levels. Maheni (2001) stated that the higher the concentration

Proteksi Tanaman. Fakultas Pertanian. Bogor: Institut Pertanian Bogor.

Daniel, M. (2006). Medicinal plants chemistry and properties. Science Publisher: United States of America.

Danusulistyo, M. (2011). Uji larvasida ekstrak daun lidah buaya (*Aloe vera* L.) terhadap kematian larva nyamuk *Anopheles aconitus* Donitz. Skripsi. Fakultas Ilmu Kesehatan Masyarakat. Universitas Muhammadiyah. Surakarta (ID).

Fahrnunida & Pratiwi, R. (2015). Kandungan saponin buah, daun dan tangkai daun belimbing wuluh (*Averrhoa bilimbi* L.). Prosiding Seminar Nasional Konservasi dan Pemanfaatan Sumber Daya Alam.

Gunawan, E. (2011). Efek potensial larvasida kombinasi ekstrak daun kemangi (*Ocimum sanctum* Linn) dan biji jarak (*Ricinus communis* Linn) terhadap *Aedes aegypti*. Skripsi. Universitas Sebelas Maret. Surakarta.

Hadipoentyanti, E. & Wahyuni, S. (2008). Keragaman selasih (*Ocimum* spp.) berdasarkan karakter morfologi, produksi dan mutu herbal. *Jurnal Penelitian Tanaman Industri*, 14(4), 141-148.

Hartati, S. R. (2012). Prospek pengembangan minyak atsiri sebagai pestisida nabati. *Perspektif* 11(1): 37-43.

Oka, H. S. A. A. (2015). Pengaruh variasi dosis larutan daun pepaya (*Carica papaya* L.) terhadap mortalitas hama kutu daun (*Aphis craccivora*) pada tanaman kacang panjang (*Vigna sinensis* L.) sebagai sumber belajar biologi. *Bioedukasi (Jurnal Pendidikan Biologi)*, 6(1), 104-111.

Pasaru, F., Anshary, A., & Kuswinanti, T. M. (2014). Shahabuddin prospective of entomopathogenic fungi associated with *Helopeltis* spp. (Hemipter: Miridae) on cacao plantation. *International Journal of Current Research and Academic Review*, 2(11), 227-234.

Priyono, D. 2002. Pengujian keefektifan campuran insektisida: pedoman bagi pelaksanaan pengujian efikasi untuk pendaftaran pestisida. Jurusan Hama Penyakit Tumbuhan, Fakultas Pertanian. Institut Pertanian Bogor.

Ridhwan, M. & Isharyanto, I. (2016). Potensi kemangi sebagai pestisida nabati. *Serambi Saintia: Jurnal Sains dan Aplikasi*, 4(1), 11-20.

Sastroswojo, S. (1991). Trips on vegetables in Indonesia. In: N.S. Talekar. Trips in Southeast Asia. Proc. Regional Consultation Workshop Bangkok,

Thailand. AVRDC, Taiwan, ROC, 12-17.

- Sastrodiharjo, M. (1979). pengantar entomologi terapan. Penerbit ITB. Bandung
- Simarmata, J., Ningsih, Y. P. & Zahara, F. (2013). Uji efektifitas beberapa jenis atraktan untuk mengendalikan hama lalat buah (*Bactrocera dorsalis* Hend.) pada tanaman jambu biji (*Psidium Guajava* L.). *Jurnal Online Agroekoteknologi*, 2(1): 192-200.
- Sudarmo, S. N. (2005). A community-based approach to tourism in Indonesia (Doctoral dissertation, Victoria University of Technology).
- Thamrin, M., Asikin, S., & Willis, M. (2013). Tumbuhan kirinyu *Chromolaena odorata* L. (Asteraceae: Asterales) sebagai insektisida nabati untuk mengendalikan ulat grayak spodoptera litura. *Jurnal Penelitian dan Pengembangan Pertanian*, 32(3), 112-121.