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Bintaro (*Cerbera odollam*) Leaf Extract As a Potential Biological Pest Control toward *Spodopteralitura* F. Mortality

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ABSTRACT

Spodopteralitura F was one of the chili pests with its polyfag character. Pest prevention might be used in several way include bioinsecticide or biopesticide. Bintaro(*Cerbera odollam*) leaf extract as bioinsecticide was investigated in several concentrations which effectively suppress*S. litura* F. growth and its mortality toward chili plant (*Capsicum frutescens*).Maceration used as extraction method with methanol as polar solvent. Test run ran by given fodder leaves cayenne pepper which already dipped with*C. Odollam*to *S. litura* F as Immersion of leaves as testing method. *S.litura*. F Mortality and its developments were observed for 20 days. *S. litura* F were reached 75 % in mortality level, got weight loss, hampered their ecdysis period on 2-3 instar level either cocoon establishment due to 2% leaf extractdose of *C. odollam* giving during 8 days.

KEY WORDS: Bioinsecticide, *C. odollam, S. litura* F.

1. INTRODUCTION

Indonesia as tropical country has high diversity of plant. Various types of plants have been known as a biopesticides potentially because itcontains bioactive compounds for instance; saponins, tannins, alkaloids, phenolics, flavonoids, alkenyl and terpenoids[1]. Certain of plant able to against insects and might be affected them to die. Its mortality effect toward insect has potency to be used as a natural insecticide alternatively. *Cerbera odollam* or locally known as Bintaro in Indonesia was an insecticide plant, which spread out growing atMainland and places that does not regularly inundated the tides or the edge of the land, coastal swamp forest or on the beach and more into the land (800 m above sea level)[2]. Bintaro frequently planted at city garden, planted as main road green lines, decorative garden plant so that it had not much explore for commercial yet. Nevertheless, [3] GenusCerbera have capacity as antifungal, insecticide, antioxidant, and antitumor agent.

Insecticide agent may gain from Bintaro as it benefits to reduce agricultural damage and disadvantages due to pest invasion at horticulture and food crops, especially. This research took *Cerbera odollam* leaf extractas bioinsecticide, because it leaf was overflow than fruits and bark [4].For further exploration are needed to gain the bioinsecticide benefit which made from it leaves to against*S.litura* F larvae,so that, we aimed to investigate it in various concentration using the parameter of growth suppressing, mortality of *Spodoptera litura* F. under*Capsicum frutescens* leaves feed.

2. MATERIAL AND METHODS

The research design used was Complete Random Draft. Each concentration treatment was repeated four times with a single control. To understand the effect of the treatment on the observed parameters, the result is calculated by statistical analysis (ANOVA on (α) 0.05ranks of significant. Data followed by Duncan Multiple Range Test to compare which treatment is most effective among each treatment [5].

Preparation for planting

Preliminary preparation began with chiliseed soaked in a night [6]. Media cropping consisting of land and NPK fertilizer. Land added with NPK fertilizers and put in a tub cropping and blended as to equitable, each tub containing 3 kg media. Seedingapplied in browniesmethod which wasmixture of land and fertilizer laid in a tub; then land sliced into pieces and put at the box. Every box given three or four seeds chili. It watered 2 times a day [7].Seed chili in to 3 single leaves.

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Multiplication and *Spodopteralitura* F. Larvæ Maintenance

*Spodopteralitura*F. larvæ placed in toples that have been filled with feed, closed with gauze moved and saveit in the Laboratory. Larvae were refeed clean it jar every day using a brush. Daily observation used to observe larvae development. When cocoon had formed, remove ittoother container jarwhich more large with paper strain inside. Honeys feeding applied when cocoon or pupa has become imago (moth)(honey absorbedin cotton). When it has produces eggs, eggs will be moved to other jar. Larvae developmentswere observed every day. Mature larvae that molting (skin reforming) and change into second instar laid in separated jar.Secondinstar larvæas an object for testing[8].

Producing Bioinsecticide and its Exploration

Bintaro (*Cerbera odollam*) as much as 2000 grams obtained around ITS campus territory. Leaves washed with fresh water, aquades and dried at room temperature. They cut into small pieces and mashed it till form a powder. A fine powder divided into two (each 1000 g) and macerated use methanol asa polar organic solvents[8].It marinaded24 hours then filtered by using a Buchner funnel with filter paper [9]. Results of the solvent was evaporated by the extraction and crude extract is produced by a freeze dryer. It stored in the refrigerator until time to be used[10].

Testing Method

Leafdipping methods or immersion method leaves used as Testing method[9]. Ahealthy second instar larvae prepared and placed in a plastic jar and container for 1-2 hours without fed in advance prior fo testing [11].5 extract concentration that used were 0.5%, 1%, 1.5%, 2% and 2.5%. Cayenne Pepper leaves soaked in each subsequent solution concentration extracts for 10 seconds and dried at room temperature [12].5 grams treatment cayenne pepper leaf placed in a small jar with5 larvae instar 2 levels, with repetition as much as four times for each concentration and single control. Each larva displayed with the leaves soaked in pepper extract. Leaves (feed) were replaced with a fresh one, and either the jar was clean every 24 hours [13].Mortality, weight, and length of larvae were observed.

3. RESULTS AND DISCUSSION

Mortality

Research results that have been obtained, showed a mortality of larvae of *Spodopteralitura* F. due to addition of *Cerbera odollam* leaf extract treatment on feed larvae leaves cayenne pepper. Research results can be seen in Figure 1. In Figure 1. x axis States long days of observation and y-axis stated percent of mortality of larvae.

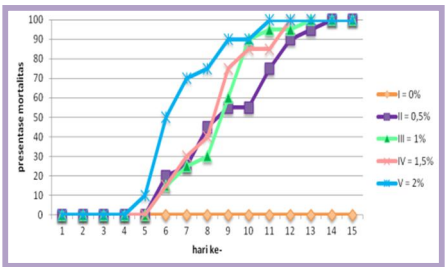

Figure 1.*Spodoptera litura* F. Larva mortality averagefed by *Cerbera odollam* leaf extract.

Day 1 until the day 4, granting *Cerbera odollam* extract leaves by concentration 0 %, 0.5 %, 1 %, 1.5 %, 2 % not affect it mortality. Because 2ioactive compound within extract was not widely accumulates in a body larvæ S. Litura F yet. But in bodylength, extract leaves *Cerbera odollam* had tended to influence significant start day 2.

On day 8 of *Spodopteralitura* larvae mortality observation, a comparison between the concentrations of 0.5%, 1%, 1.5% shown not real difference. This shows that 2% concentration more significant effect on the mortality of larvae of S. litura F. Compared to concentrations of 0%, 0.5%, 1%, and 1.5%.

Entering day 2 of the twelfth to the fifteenth day of the observations of mortality with administering concentration between 0.5%, 1%, 1.5% and 2% is not too different as a result. To determine the LC_{50} using the profit analysis so the LC_{50} value is obtained by 1.43894%, with the range between 1.33590%-1.55687%. It means that with a concentration of 1.5% able to kill 50% of the test insect

Based on the results presented show that starts from a concentration of 0.5% to 2% of *Cerbera odollam* leaf extract,most of all potentially as influential as biological pest control of *Spodoptera litura* F larvae mortality., seen also

that with the greater concentration and percent mortality are also getting bigger. This is in accordance with the [4] States that the higher the concentration of *Cerbera odollam* leaf extract, it toxicity also will be higher. So it can be said that the concentration was directly proportional to the magnitude of the percent mortality of *S. Litura* F. Of larvae.

Concentrationof 0.5%, 1%, and 1.5% can also be said to be influential as bio insecticide, according to [14] an insecticide is said to be effective in being able to turn off a minimum of 80% of the insects on the third test and the concentration (0.5%, 1%, 1.5%) deaths able to achieve 80% but with a different death day. Whereas at concentrations of 0% did not result in death of the larvae.

The death of the larvae of *Spodoptera litura* F. occurs due to stomach poisoning symptoms have been caused by bioactive substances of plants. It says poison the abdomen because toxic compounds enters into it body through the medium of food of it, which was leaves cayenne pepper. The death of the larvae with the symptoms of the body of it larva became soggy and easily damaged if touched also showed symptoms that occur due to the disruption of the digestive system. Insect digestive tract is divided into three parts, the front part of the intestine (foregut), central part of the intestine (midgut) and the rear section of the colon (hind gut). [15] States, the absorption of insecticides that have the effect of stomach poison mostly took place in the central part of the digestive tract (midgut).it is organ of enzymes secretion and nutrients are absorber-digestive enzymes. It has a structure that does not have a layer of cuticle, while in the front channels (fanoregut) and the end (hindgut) [16].If the middle section of the digestive tract is damaged then the enzyme activity will be impaired and the process of digestion was not optimum, in such conditions the body's metabolism of insects to be labil[16].

Middle intestine wall composed of cells of the epithelium that consists of two layers, which were the lipid and protein compounds scattered in certain parts. Overall, this was a lipophilic cell membrane. Where the damage starts when the swelling on the Middle intestine (midgut). Middle intestine will swell until it touches the walls of the body causing the membrane peritrofik aseluler cells detached from the midgut cells (intestine) and ultimately cells will separate from each other. With the separation of the cells can cause the larvae to be dead [15].

Middle intestine swelling caused due to alleged secondary metabolite compounds are flavonoids have hydroxyl groups which can bind to hydrophilic portion of the cell membrane. This flavonoid hydroxyl Bonds may cause damage to kalium-sodium (Na-K) pump so that the concentration gradient difference occurs between the outside and inside of cells that result in damage to the cell membrane. Hydroxyl Bonds of the flavonoids hydrophilic portion from the cell membrane will interfere with or inhibit cell membrane channel systems. It damaged to the cell membrane channel systems causes the membranes irregulating function of selective permeable membranes, thereby also affecting various enzymes. Inhibition of active transport membranes for transmitting nutrients, proteins, minerals, and inorganic acids may cause membrane permeability addition and affected in leakage of the contents of the cytoplasm [16].

Leavesof *Cerbera odollam* were used in this research. [19]*Cerbera odollam* leaf extract contained several compounds were secondary metabolites, namely flavonoids, tannins, saponins and steroid. Methanolwas solvent polar that used on the research this time to extract leaves of *Cerbera odollam* . Polar methanol drew out the compoun which contained in the leaves of *Cerbera odollam* . One of polar compounds contained in the leaves of *Cerbera odollam* allegedly was a flavonoid that is antimicrobial and antifeedant [17]. The antifeedant effects also contributed to the death of the larvae, as inhibition of the activity of insect feeding affected weak and eventually die for insect[17].

Mortality also occurred yet ofsaponineffect. It has decreased protease activity within iterstine channel and eventually affected the process of food absorption. As it cannot be absorbed and excreted in the form of stool. It was in accordance with the observations made, larvae administered treatment of *Cerberaodollam* leaf extract also looked to have a form insolid stool as shown in Figure 2.

Figure 2.*Spodoptera litura* F.diedand its stool

Impact for *Spodopteralitura*F.length

One of the parameters was tested to determine the influence of *Cerberaodollam*leaf extract feeding on the feed (leaves cayenne pepper) larvae of *Spodopteralitura* F. was the length of the body. The length of the body resulted from the granting of *Cerberaodollam*leaf extract can be seen in Figure 3.

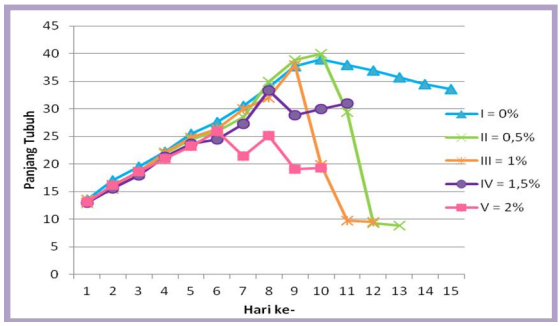

Figure 3.*Spodoptera litura* F., Length average fed by *Cerbera odollam* leaf extract.

On day 2 observations between 0% with 1% and 1.5% concentration there was a real difference. Significant influence of the concentrations of 1% and 1.5% of the body length of *S. litura* F. had shown. Yet between it concentration of 0.5% with four other did not differ markedly. Similarly, at a concentration of 1% when compared with concentrations of 0.5%, 1.5% and 2% e didn't look real difference.

Spodopteralitura F. mortality at day 6,between 0% and 1.5%, was resulted real different mortality in concentration. This means that the concentration of 1.5% provided a significant mortality effect compared with to 0%. But 1.5% compared with concentrations of 0.5%, 1%, 2% lookednot realdifferent. The influence of *Cerberaodollam* extracts giving compared with a 1.5% to 0.5%, 1% and, a 2% was not too different as a result.

There was no significant different on the seventh day of the tenth until the results of the *Spodopteralitura* F., of body length observation at all treatment concentrations.It had shown that in day 7 to 10 concentrations of 0%, 0.5%, 1%, 1%, 2% not significant effected inbody length of *S. litura* F. caused by *Cerberaodollam* leaf extract stress.

On the second day for the research had begun, extract leaves *Cerberaodollam* influenced was visible for the growth in body length of *S. litura* F. But it has not shown any mortality for allegedly compound a metabolite secondary that was found in extract leaves *Cerberaodollam* still a view in accumulation. So it has not reached the death stage only deduction length of the body of it larvæ was inflicted.

A metabolite secondary compounds contained inside extract leaves *Cerberaodollam* suspected was a compound of tannin that able to fasten protein through hydrogen bonds in digestive system that required insects for growth,thereby protein absorption in the digestive system had disturbed. It eventually affected the growth of*S. litura* F.,larvae [18].

Digestive enzyme deactivationmight be stimulated due to tannins occurrence, as in addition[19]. Secondary metabolite compounds contained in leaf extracts of bintaro (*Cerbera odollam*) who allegedly was also suppress the consumption of food because according to [22] insect recognized or felt the presence of unknown compounds (foreign compound) and it resulted in the refusal to feed or decreased activity feed on insects. The feeding activity affected growth rate and survival abilityand even cause any death.

Impact for *Spodopteralitura* F. weight

The parameters were observed in addition to the body length of *Spodopteralitura* F. as a result from the granting of *Cerberaodollam* leaf extract on feeding it (green pepper) can be seen in Figure 4.

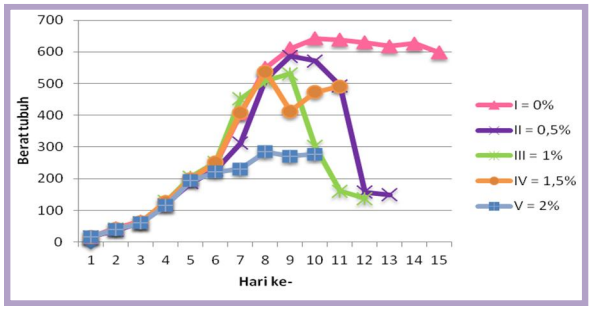

Figure 4.*Spodoptera litura* F. Weight average fed *Cerbera odollam* leaf extract.

There was a real difference on day 8, only between 2% with 0%, 0.5%, 1%, 1.5% concentration. That means that on the eighth day of a 2% concentration gavea significant influence on body weight of *S. litura* F. with the addition of *Cerberaodollam* leaf extracts through the media feed *S. litura* F. i.e. leaves cayenne pepper. It had seen a real

difference entering the second dayfrom12-15 day as results comparison shown between 0%, 0.5%, 1%, 1.5% and 2% concentrations. As it influenced of body weight of *S. litura* F., due to granting of *Cerberaodollam* leaf extract with media feed *S. litura* F. (leaves cayenne pepper).

Figure5. Died *Spodoptera litura* F., larvae (a) fed by*Cerbera odollam* leaf extract;
(B) it was live (0% concentration).

Phenol was contained within *Cerberaodollam* leaf extract, allegedly. It was a compound rolled asan insect repellent so causing disorder growth in *S. litura* F. it had also served as stimulant feed upon other insects [17]. It seen at picture 14, day 1-7had raised weight for larvæ*S. litura* F. yet It more absorbed toxic compound so caused an influenced on larvæ metabolism of the body and caused its death eventually.

4. Conclusion

The most effective concentration against *Spodopteralitura* F. motalitywas2 % concentration due on the eighth day, the percentage of it mortality reach 75%. It shows this concentration as thelowest rate in affected the length and weight of larvae body compared to the other concentration.Concentration of 0.5%, 1%, 1.5% were also potentially as a biological pest control because it also able to kill insect population above 50% level. LC_{50}calculated was obtained 1.43894%, it stated that start from 1.5% concentration may kill 50% of the test insect.

Acknowledgment

The authors declare that they have no conflicts of interest in the research.

5. REFERENCES

[1] Abdallah, E.M. 2011. *Plants: An Alternative Source for Antimicrobials.* Journal of Applied Pharmaceutical Science 01 (06); 2011: 16-20.

[2] Purwanto, Y.A., B.I. Setiawan, & K. Sunandar. 2011. *Pengembangan Tanaman Bintaro untuk Pemenuhan Bioenergi sebagai Kegiatan Tanaman Kehidupan HTI.* Makalah pada Seminar dan Lokakarya Nasional HTI sebagai Kegiatan Ekonomi Hijau Kerjasama Unsri, Sinar Mas Forestry dan BP2HP Wilayah V Palembang, Palembang.

[3] Yan, X., F. Tao, dan T. W. Ping. 2011. *Chemical and Bioactivity of Mangrove Plants in the Genus Cerbera.* Journal of Guangxi Academy of Science 2011-01.

[4] Utami, S. 2010. *Aktivitas Insektisida Bintaro (Cerberaodollam Gaertn) Terhadap Hama Eurema spp. Pada Skala Laboratorium.* Jurnal Penelitian Hutan Tanaman Vol. 7 No.4 Oktober 2010, 211-220.

[5] Lestari, G.M., Solichatun, danSugiyarto. 2008. *Pertumbuhan, Kandungan Klorofil, dan Laju Respirasi Tanaman Garut (Marantaarundinacea L.) setelah Pemberian Asam Giberelat (GA3).* Bioteknologi 5 (1): 1-9, Mei 2008, ISSN: 0216-6887.

[6] Agroinovasi. 2011. *Kiat Sukses Berinovasi Cabai.* Sinar Tani Badan Litbang Pertanian Edisi 2-8 Pebruari 2011 No.3391 Tahun XLI.

[7] Yunianti, R., S. Sastrosumarjo, S. Sujiprihati, M. Surahman, dan S.H. Hidayat. 2007. *Ketahanan 22 Genotipe Cabai (Capsicum spp.) terhadap Phytophthoracapsici Leonian dan Keragaman Genetiknya.* BuletinAgronomi (35) (2) 103 – 111 (2007).

[8] Asmaliyah, *et al.* 2010. *Uji Toksisitas Ekstrak Daun Nicolaiaatropurpurea Val. TerhadapSerangan Hama Spodopteralitura Fabricus (Lepidoptera: Noctuidae).*Jurnal Penelitian Hutan Tanaman Vol.7 No.5, Desember 2010, 253-263.

[9] Balfas, R. dan Mahrita Willis. 2009. Pengaruh Ekstrak Tanaman Obat Terhadap Mortalitas Dan Kelangsungan Hidup *Spodopteralitura* F. (Lepidoptera, Noctuidae).*Bul. Littro. Vol. 20 No. 2, 2009, 148 – 156.*

[10] Ningrum, Rosiati. 2012. *Studi Potensi Biofungisida Ekstrak Daun Bintaro (Cerbera manghas) Dalam Mengendalikan Jamur Patogen Phytophthora capsici Pada Tanaman Cabai Rawit (Capsicum frutescens LONGA).*Proposal Tugas Akhir. Jurusan Biologi Institut Teknologi SepuluhNopember, Surabaya.

[11] Wahyu, Ella Ratih. 2012. *Pemanfaatan dan Teknik Formulasi Nuclear Polyhedrosis Virus (NPV) Sebagai Agensia Pengendali Hayati Ulat Grayak (Spodoptera litura F.) Pada Tanaman Tembakau di Balai Besar Perbenihan dan Proteksi Tanaman Perkebunan, Surabaya.* Laporan Kerja Praktek. Jurusan Biologi Institut Teknologi Sepuluh Nopember, Surabaya.

[12] Chalista, Vivid. 2009. *Uji Toksisitas Potensi Insektisida Nabati Ekstrak Kulit Batang Rhiziporamucronata Terhadap Larva Spodopteralitura.*Skripsi.Jurusan Biologi Institut Teknologi Sepuluh Nopember, Surabaya.

[13] Rimbawani, Destya Dwi. 2009. *Uji Toksisitas Ekstrak Daun dan Biji Srikaya (Annonasquamosa L.) terhadap Mortalitas Ulat Grayak (Spodopteralitura).*TugasAkhir. Jurusan Biologi Institut Teknologi Sepuluh Nopember, Surabaya.

[14] Herminanto, Wiharsi, Topo Sumarsono. 2004. *Potensi Ekstrak Biji Srikaya (Annonasquamosa L.) Untuk Mengendalikan Ulat Krop Kubis Crocidolomia Pavonana F.* Agrosains 6 (1): 31-35.

[15] Hadi, M., U. Tarwotjo, R. Rahadian. 2009. *BiologiInsekta: Entomologi*.GrahaIlmu, Yogyakarta.

[16] Sastrodiharjo, S. 1979. *PengantarEntomologiTerapan.* Penerebit ITB, Bandung.

[17] Watinguli, T.W. 2004. *Uji Toksisitas Bioinsektisida Ekstrak Biji Mahkota Dewa (Phaleriapapuana Warb) terhadap Mortalitas Nyamuk Aedesaegypti Linn di Laboratorium*. Thesis Universitas Airlangga, Surabaya.

[18] Darmanto, Y. 2007. *PengaruhEkstrak Polar Bebek (Kalanchoedaigremontiara) terhadap Larva Plutellaxylustella.*Skripsi.JurusanBiologiInstitutTeknologiSepuluhNopember, Surabaya.

[19] Utami, S. 2011. *Bioaktivitas Insektisida Nabati Bintaro (Cerberaodollam*Gaertn.*) Sebagai Pengendali Hama Pteromaplagiophleps Hampson Dan Spodopteralitura.*Tesis. Sekolah Pasca Sarjana Institut Pertanian Bogor.

[20] Yunita, JEA., NH. Suprapti, JS. Hidayat.2009. *Ekstrak Daun Teklan (Eupatorium riparium) terhadap Mortalitas dan Perkembangan Aedes aegyptii.*HiomaVol 11 No 1: 11-17

[21] Munandar, K., A., Madyawati. 2002. *Uji Kandungan Metabolit Sekunder Daun Pseudocalymnaalliaceumdan Daya Antifeedantnya Terhadap Heliothisassulta Di Laboratorium*. Jurnal Berkala Penelitian Hayati, Desember 2002, Hal 15-19.

[22] Marwoto dan Suharsono. 2008. *Strategi dan Komponen teknologi Pengendalian Ulat Grayak (S. litura Fabricius) pada Tanaman Kedelai*. Balai Penelitian Tanaman Kacang-kacangan dan Umbi-umbian, Malang.