International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.4, pp 513-521, 2017

The Application of Mahoni, Lansium Domesticum and Lasium Parasiticum Leaf from Gorontalo as Natural Pest Insecticide on Soybean Plant

OpirRumape[1], Wenny J. A. Musa[1], Jefry Sembiring[2]

[1] Department of Chemistry, Faculty of Mathematics and Natural Science: University of Gorontalo, Indonesia
[2]EntomologyStudy Program, Sam Ratulangi University, Manado. Indonesia

Abstract : Vegetable insecticide testing is an important step that needs to be done in finding new plant-based insecticides as a means of monitoring the bioactivity of the test material in the process of isolation of the active compound. This study aims to apply the results of the previous studies that is to apply the isolates of the three species of plants from Gorontalo that contain secondary metabolites which are alleged to have bioactivity as a natural insecticide,i.e.Mahogany *(Swietenia mahagoni* Jacq).

Langsat *(Lansium domesticum* Corr) and Duku *(Lansium domesticum* Corr.). This research uses contact method that is the feeds are dipped in a solution formulation. The tests are conducted to determine the inhibitory of eating activity *(antifeedant)* of insects *Spodoptera litura* and *Epilachna varivestis* which are the major pest of soybean plants.

The isolate test results of mahogany leaves for the three fractions: methanol, ethyl acetate and n-hexane, show that the higher value of the eating activity inhibition, the higher isolates concentration will be also and the fractions that give highest inhibition is the ethyl acetate fraction of 71% followed by the methanol fraction which reaches 65 % and the lowest fraction is n-hexane of 62%.

At the langsat leaf isolate testing, the test result data for the three fractions methanol, etyl acetate and n-hexane show that the higher inhibition of eating activity, the higher the concentration of isolates will be, and the fraction that gives the highest inhibition value is the ethyl acetate fraction of 71% followed by the methanol fraction of 65% and the lowest fraction is n-hexane of 62%.

The duku leaf isolate testing result for the three fractions methanol, ethyl acetate and n-hexane show that the inhibition of eating activity as occurred in two previous isolates that is the higher inhibition value, the higher the isolate concentration will be, where the fraction that givethe highest inhibition value is ethyl acetate fraction of 70% followed by the n-hexane faction of 67% and the lowest is methanol fraction of 62%. In general, among the isolates of three leaves (mahogany, langsat and duku) which are applied to the larvae *Spodoptera litura*, the one which gives the highest eating activity inhibitory is on mahogany leaf isolate at the ethyl acetate fraction followed by methanol fraction, particularly the application results at *Spodoptera litura* larvae.

Keywords : Applications, Isolate, Antifeedant, Natural Insecticide.

I. Introduction

Vegetable insecticide testing is an important step that needs to be done in finding new plant-based insecticides as a means of monitoring the bioactivity of the test material in the process of isolation of the active compound. The bioactivity testing needs to be designed properly to provide accurate data on the bioactivity of the test material.The increasing utilization of pesticides in agriculture and local activities for controlling pests is vastlypolluting the environment day after day(Singh et al.,1994 in Aljahawey at al) [1]

The unwise use of insecticides will have no impact on the environment and public health, especially the farmers. On the other hand the problem of insect pests will always participate in the process of agricultural production so that the control technology of plant pest in the field is indispensable. While the demands of consumers today are paying more attention to the health of the body and the environment that demands more safe agricultural products to eat and also when in production on the field so it does not interfere with the health of the environment. Therefore, it requires of the comprehensive approach that can bring together two interests, i.e. between producers (agricultural actors) in the control of insect pests and consumers in terms of getting safe agricultural products for consumption.

To get the effective, efficient, and secure insecticides, it needs comprehensive and targeted study that will produce a ready-made formulation by agricultural actors.The botanic insecticides formulation is simply expected to be the forerunner to the industrial development of insecticide plant that is environmental on a large scale and will be able to compete with the formulation of synthetic active insecticide with the condition that the botanic insecticides have competitive efficacy and prices, practical in use, and most important is safe for human healthof the user.

The botanic insecticides or natural insecticide can be applied using a variety of ways, i.e. testing in the laboratory and direct testing in the field on the plant directly. In the laboratory, it is by dipping the leaves of the host plant into the dosage then it is given to an insect that has fasted for a few moments. The application in the field is conducted by using a sprayer such chemical pesticides in general. In order to obtain the good result of natural or botanical pesticide spraying, the granular spray should be directed to the plant pests or diseases where the target is located.

Various extracts have bioactivity as killer or cause mortality on insects, and there are also some giving the effect on the inhibition of eating activity or the physiology effect on the insect pests with varying inhibitionintensity. Some of the compounds that inhibiteating activity of insects are alkaloids, terpenoids, flavonoids[2]. Test results biolarvasida activity on the larvae of Ae. aegypti showed that the methanol extract of the seeds hutun active as larvicidal agent and effectively kill the larvae of Ae. aegypti with the concentration mortality LC_{50} = 35.572 ppm[3].Based on the research and identification, it finds the active secondary metabolites compound as antifeedant on insect E.varivestis which is environmentally friendly [4].

Mahogany extracts given in *xylostella* larvae give inhibition on eating activity or as Antifeedant[5].Therefore, it is necessary for conducting the application of active compounds isolation result from various plants for the development of these products. In order to develop natural insecticide products that have been obtained from previous research, it needs to be applied in order to know the effect and the nature so that it can be used in order to answer the problems often faced by the actors of agriculture and by the use of products produced, the health and the environment can be guaranteed. On the other hand, the use of the product of the study will make science developed because the result is always applied and updated and more enriched.

In the previous research, various methods and processes had been carried out and obtained the active isolates but the end result (isolate) has not been applied yet in insecticidal way on insect pests. The previous research had obtained the active compounds from the phytochemical test and active test at the fractionation process. But the end result needs to be applied on the pest insect and directly applied in the field on the host plant.

In the test that is going to be conducted aims at toxicity test, i.e. bioassay test, to observe the insect Antifeedant (inhibitory of eating activity). This test is done on the previous testing phase and obtains the information that the langsat and dukuplant which have the same family and contains secondary metabolites, alkaloids and saponinstype whether they are effective to kill or cause the mortality of the pests. While at the mahogany plant which is also from the same family, i.e.Meliaceae family,it is identified to contain secondary

metabolites of flavonoids and saponins whether it can lead to the inhibition of feeding activity and has an effect on other activities of the growth of insects[6].

Departing from some opinions and the results of the previous studies, the author intends to conduct the application of the previous study result to develop further the research results for obtaining the suicide (mortality) power data on insects and see the inhibitory of insects eating activity (antifeedant) by applying several variations concentration in order to obtain the effective concentrations to control pests.

II. Material and Methods

A. Sample Preparation

The isolate samples of mahogany, langsatand duku leaves, which are obtained from the previous study, are applied to the test insects,i.e. *Spodoptera litura* and *Epilachna varivestis* through host plants by the method of contact, in this case,the test larvae feed leaves are dipped in a solution of the mahogany, langsat and dukuleaf isolates, then given to larvae that have fasted for 6-7 hours and the observations are made conducted 24 hours after application. The purpose of the application is, firstly, to determine the bioactivity of mahogany, langsatand dukuleaf isolate whether it can inhibit the activity of eating insects that become pests on soybeans. Secondly, it is to observe whether there are differences in inhibition of isolate on insects which are monopag the polypag. The used method is contact method in which the leaves smeared or soaked in stockmaterial that have been created in the form of a solution whose the concentration varies ranging on 0%, 1%, 2.5%, 5%, 7.5% and 10%. The observations are conductedat 24 hours after application.

III. Results and Discussion

1. The testing of Mahogany, Langsat and Duku isolate on insect *Spodoptera litura*

a. Test Results of Mahogany Leaf Isolate

The mahogany isolate test, for methanol fraction, with variation of the existing concentration gives Antifeedant value: at concentration of 1%, it gives inhibition of feeding activity of 30%; at concentration of 2.5% it gives 42% inhibition; subsequently at the concentrations of 5% it gives 50% inhibitory value; at the concentration of 7.5% it gives inhibitory value of 60%, while at the concentration of 10% the value of inhibition is 65%.

On the ethyl acetate fraction test with various concentration it obtains 47% for isolate of 1% and 57% to isolate concentration of 2.5%; inhibition value of 62% at isolate concentrations of 5%; value of 67% at concentration of 7.5% while the isolate concentration of 10% gives inhibition value of 71%.

Furthermore, the mahogany fraction isolates test of n-hexane gives a value of 25% at concentration of 1%; 49% at concentration of 2.5%, 54% at concentration of 5%; 51% at concentration of 7.5% and 62% at concentration of 10%.

From the test result data of mahogany leaf isolate for three methanol ethyl acetate and n-hexane fractions show that the inhibition value of the eating activity is higher with the higher the concentration of isolates and the fraction whichgives the highest inhibition value is ethyl acetate fraction of 71% followed by the methanol fraction that reaches 65% and the lowest fraction is n-hexane of 62%.

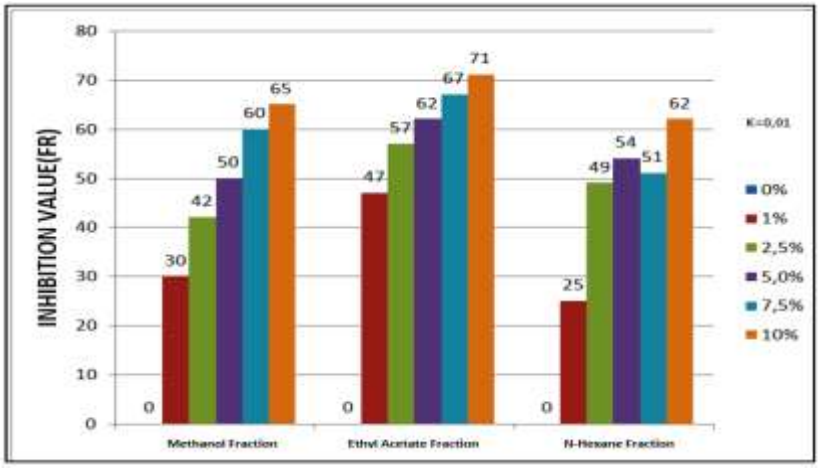

Figure 1.FractionateBiological Test Results of Mahogany Leaf on *Spodoptera litura* first, second and third treatment

b. Test Results of Langsat Leaves Isolate

The langsat isolate test, for the methanol fraction, with various concentration gives Antifeedant values: at concentration of 1%, it gives feeding activity inhibition of 39%; at concentration of 2.5% it gives 49% of inhibition; subsequently at concentrations of 5% it gives inhibition value of 55% and at concentrations of 7.5% it gives inhibition value of 66% while at concentration 10% it gives the inhibition value of 67%.

On ethyl acetate fraction test with concentration variation, it obtains 30% for isolates of 1% and 43% for isolate concentration of 2.5%; inhibition value of 59% at isolate concentrations of 5%; value of 60% at concentration of 7.5% while the isolate concentration of 10% give inhibition value of 69%.

Furthermore, the langsat isolates test of of n-hexane fraction gives value of 37% at concentration of 1%; 53% at concentration of 2.5%, 61% at concentration of 5%; value of 64% at concentration of 7.5% and 67% at concentration of 10%.

From the test result data of langsat leaf isolate for three ethyl acetate and n-hexane methanol fraction show that the value of eating activity inhibition is higher with the higher isolate concentration and the fraction that give the highest value of inhibition is ethyl acetate fraction of 71% and followed by the methanol fraction that reaches 65% and the lowest fraction is n-hexane of 62%.

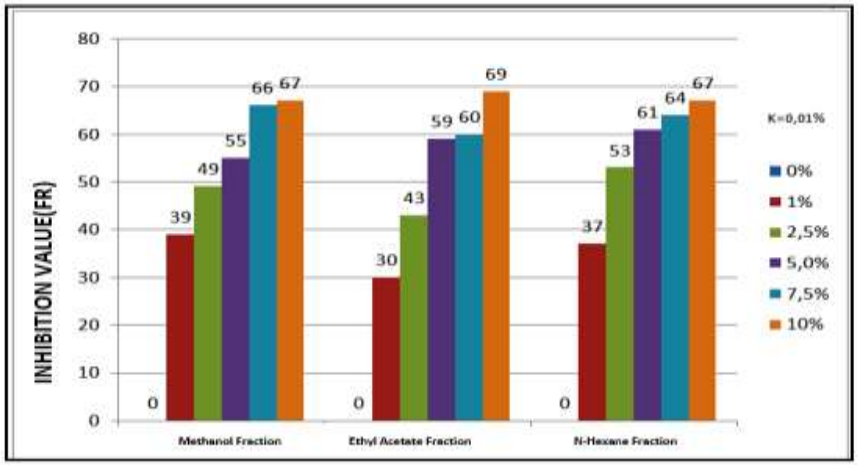

Figure 2.The Graph of Langsat Leaf Isolate Biological Test Results at first, second and thirdtreatment

c. The Test Results of Duku Leaf Isolate

The duku isolate test for the methanol fraction with various concentration gives Antifeedant value: at concentration of 1%, it gives feeding activity inhibition of 32%; at concentration of 2.5% it gives inhibition of 51%; at concentrations of 5% value it gives inhibition of 57%,at concentrations of 7.5% it gives inhibition value of 59% while at concentration of 10% it gives the inhibition value of 64%.

On the ethyl acetate fraction test with concentration variation, it obtains value of 34% for isolates of 1% and 57% for isolate concentration of 2.5%; inhibition value of 63% at isolate concentrations of 5%; value of 67% at concentration of 7.5% while the isolate concentration of 10% gives inhibition value of 70%.

Furthermore, the dukuisolates test of n-hexane fraction give value of 48% at concentration of 1%; 55% at concentration of 2.5%, 60% at concentration of 5%;value of 63% at concentration of 7.5% and 67% at concentration of 10%.

The test result data of duku leaf isolate for three methanol ethyl acetate and n-hexane fraction show that the inhibition of feeding activity as occurred in both isolates before is higher with the higher inhibitory value and higher isolate concentration, and the fraction which gives the highest inhibition value is ethyl acetate fraction of 70% followed by the n-hexane fraction of 67% and the lowest is methanol fraction of 62%.

In general, the isolate of three leaves (mahogany, langsat and duku) which applied to the larvae *Spodoptera litura* gives the highest eating inhibition value at the mahogany leaf isolate in particular the results of the application on the larvae of *Spodoptera litura*. More clearly it can be seen in Figure 3.

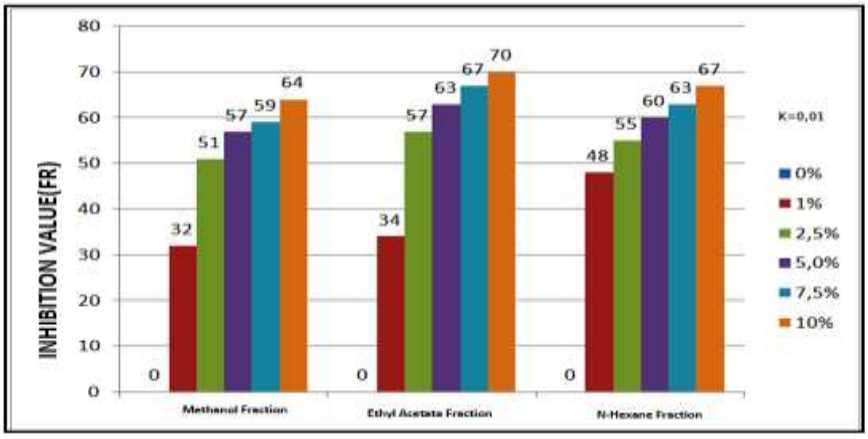

Figure 3. Results Biological Test on *Spodoptera litura* Fractionate Duku treatment first, second and third

2. Thetest of Mahogany, Langsat And Duku Isolate On Insects *Epilachna varivestis*

a. The Test Results of Mahogany Leaf Isolates on Insects *Epilachna varivestis*

The mahogany isolate test on *Epilachna varivestis* larvae for the methanol fraction with various concentration gives Antifeedant values: at concentration of 1%, it gives feeding activity inhibition of 36%; at concentration of 2.5% it gives inhibition value of 46%; at concentrations of 5% it gives inhibition value of 62%; at concentrations of 7.5% it gives inhibition value of 68%;while at concentrations of 10% it gives inhibition value of 73%.

On ethyl acetate fraction test with various concentrations, it obtains value of 37% for isolate of 1% and 53% for isolate concentration of 2.5%; inhibition value of 73% at isolates concentrations of 5%; inhibition value of 80% at concentration of 7.5%; while the concentration of 10% gives inhibition value of 81%.

Furthermore, the mahogany isolate test of n-hexane fraction gives a value of 25% at concentration of 1%; 41% at concentration of 2.5%, 54% at concentration of 5%; 54% at concentration of 7.5% and 62% at concentration of 10%.

From the test result data of mahogany leaf isolate for three fractions of methanol, ethyl acetate and n-hexane, it shows that the inhibition of the eating activity is higher with the higher concentration of isolates and the fraction which gives the highest inhibition value is ethyl acetate fraction of 71%, followed by the methanol fraction that reaches 65 % and the lowest fraction is n-hexane of 62%.

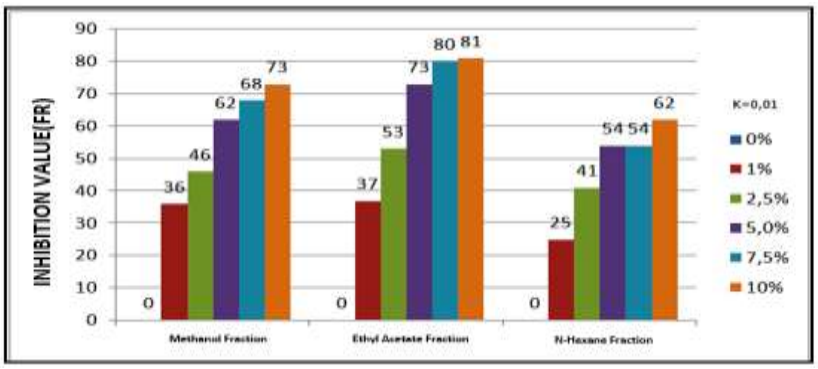

Figure 4.The Biological Test Results of Mahogany Leaf Fractionate on *Epilachna varivestis* at First, Second and Third Treatment

b. The Langsat Leaf Isolates Test Result on *Epilachna varivestis* Larvae.

The langsat isolate test for the methanol fraction with various concentration gives eating activity (Antifidan) inhibitory value, i.e.: at concentration of 1% it gives eating activity inhibition of 32%;at concentration of 2.5% it gives inhibition value of 47%;at concentrations of 5% it gives inhibition value of 59%; at concentrations of 7.5% it gives inhibitory value of 65%; while at concentration of 10% it gives inhibition value of 69%.

On ethyl acetate fraction test with various concentrations, it obtains the value of 29% for isolate of 1% and 37% for isolate concentration of 2.5%; the inhibition value of 51% at isolates concentrations of 5%; the value of 65% at concentration of 7.5% while the isolate concentration of 10% gives inhibitory value of 73%.

Furthermore, at the mahogany isolate test,the fraction of n-hexane gives a value of 24% at concentration of 1%; 38% at concentration of 2.5%, 47% at concentration of 5%; 59% at concentration of 7.5% and 66% at concentration of 10%.

From the test result data of mahogany leaf isolate for three methanol, etyl acetate and n-hexane fraction, it shows that the inhibition of eating activity is higher with the higher concentration of isolates and the fraction that gives the highest value of inhibition is ethyl acetate fraction of 73% followed by the methanol fraction which reaches 69% and the lowest fraction is n-hexane of 66%.

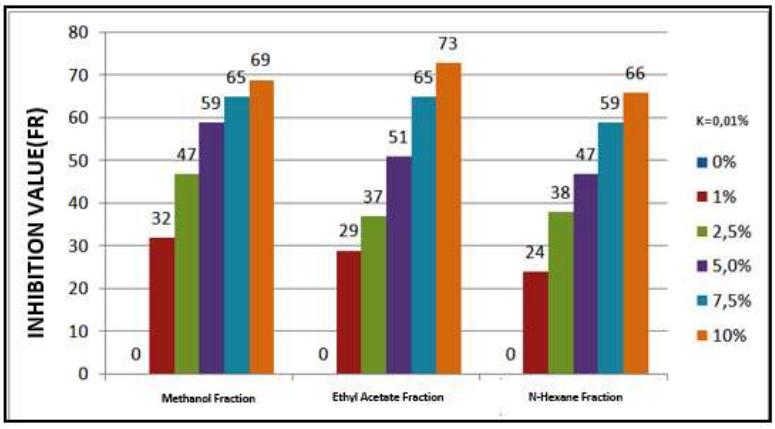

Figure 5.The Fractionate Biological Test Data of Langsat Leaf on *Epilachna varivestis* at first, second and third treatment

c. The Isolate Test Results of Duku Leafon *Epilachna varivestis* Larvae

The duku isolate test for the methanol fraction with various concentration gives antifeed antinhibitory value, i.e.: at concentration of 1% it gives eating activity inhibition of 19%; at concentration of 2.5% it gives eating activity inhibition value of 33%;at concentrations of 5% it gives eating activity inhibition value of 47%; at concentrations of 7.5% it gives eating activity inhibition value of 54%; while at concentration of 10%, the inhibition value is 64%.

On ethyl acetate fraction test with various concentrations, it obtains 29% at isolate of 1% and 40% at isolate concentration of 2.5%; the inhibition value of 49% at isolates concentrations of 5%; the value of 63% at concentration of 7.5%; while at isolate concentration of 10%, the inhibition value is 68%.

Furthermore, at the mahogany isolate test, the n-hexane fraction gives value of 24% at concentration of 1%; 39% at concentration of 2.5%, 49% at concentration of 5%; 62% at concentration of 7.5% and 65% at concentration of 10%.

The mahogany leaf isolate test result data for three methanol, ethyl acetate and n-hexane fraction show that the inhibition of the eating activity is higher with the higher concentration of isolates and the fraction that gives the highest value of inhibition is ethyl acetate fraction of 68%, followed by the fraction of n-hexane which reaches 65% and the lowest is methanol fraction of 64%.

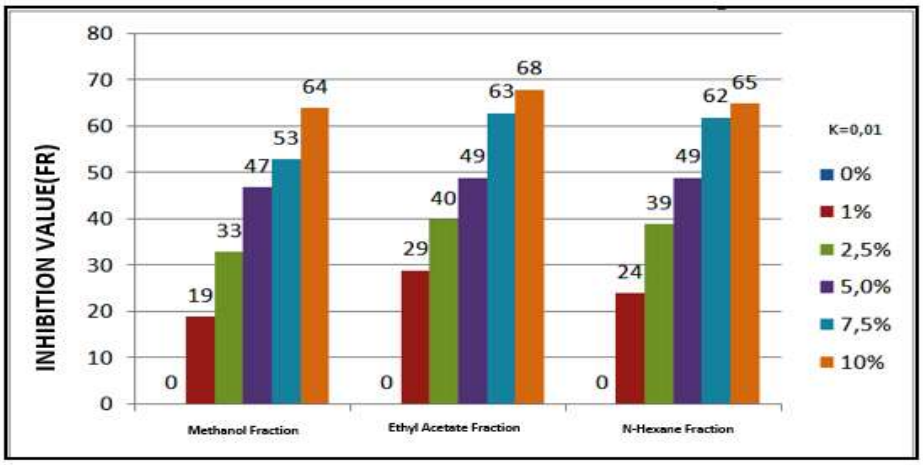

Figure 6.The Fractionate Biological Test Data of Duku Leaves on the *Epilachna varivestis* at First, second and third treatment

Based on the test results of mahogany, langsatand duku leaf isolate on *Spodoptera litura* insects and *Epilachna varivestis* insect above, it can be explained that the higher the concentration is, the higher the eating inhibition value will be.

Considering from the isolate toxicity of the three crops ,the mahogany leaf isolate gives the highest eating inhibition value at ethyl acetate fraction which are tested on *Epilachna varivestis* larvae of 81%, followed by Langsat leaf isolate leaf of 73% and the lowest is dukuisolates of 68% on ethyl acetate fraction at concentration of 10%.

At the tests on *Spodoptera litura* insect, the inhibition value is lower than the test results on the *Epilachna varivestis* larvae. This is reasonable because of differences in the nature of the *Spodoptera litura* insect which is polypagso that it is more resistant to toxicity compared to *Epilachna varivestis* which has lower resistance because it is monopag. This is according to a statement by Prijono [5]that the polypag insects *(Spodoptera litura)* is more resistant to various types of vegetable insecticides compared with the non polypag insects such as beetles *(Epilachna varivestis)*. Even the types, species, strains and development phase of the insect greatly affect the test results[7].

These test results indicate that the compounds which have bioactivity as Antifidan are semi-polar or polar.It is proved that the ethyl acetate and methanol fraction is dissolve the bioactive compounds in the three

crops leaves more. On the other hand,it is presumed that the antifeedant compound contained in castor leaf and bean is a polar compound because generally a polar compound reacts with polar compounds. This is indicated by higher eating activity inhibition on methanol fraction.

When associated with concentration variation at each treated fraction, it turns out that the differences in the concentration gives effect on the eating insect inhibitory activity. The results of the test show that the eating inhibition values at each fraction at concentration of 10%, 7.5% and 5% show significant inhibition value; while at concentration of 2.5% and 1%,the inhibitory decreases far enough.

The action mechanism of antifeedant compounds has not known until now clearly, however, there is a fact in this study relating to the interaction of Antifidan compounds found that the observation result shows that there is interaction of secondary metabolites such as flavonoids, terpenoids, saponins contained in the mahogany, langsatand duku leaves that apparently gives interaction or there occurs eating activity inhibitory for test insects *(Spodoptera litura* and *E. varivestis).*

Another fact is reported by Gershenzon and Croteau (1984) in Langenhein[8]that there is interaction of few compounds such as terpenoids with sensory receptors of insects. The eating Inhibition of azadirarakhtin which is a compound from terpenoids class (20 C atoms, and triterpenoid 30 C atoms) has been known to be associated with gustatory nerve of Lepidoptera larvae [9]. This can occur in insects due to the insect feeding behavior is guided by sensory information, in studying the perceptive stimuli so that it may help in identifying chemical compounds produced by plants that can be used as Antifeedant[10].

IV. Conclusions and Suggestions

A. Conclusion

a. Based on these results it can be concluded that the active isolates results of this study have the ability to inhibit the eating activity of insects either on the *Spodoptera litura* larvae or on *Epilachna varivestis* larve which showed with the inhibition value of 71% at mahogany leaf isolate, 69% at langsatisolate and 70% at duku isolates while for the test results on *Epilachna varivestis* insects, it obtains the eating activity inhibition of 81%at mahogany isolate,73% at the langsat isolates and 68% at duku isolates.
b. The effective concentration variations that can be used for pest controlling as Antifeedant of the mahogany, langsat and duku leaves is at concentration of 10% in ethyl acetate fraction for each isolate.
c. The application results of the isolates plant of mahogany, langsat and duku indicates that the application on *Epilachna varivestis* insect is higher than the inhibition value on *Spodoptera litura.*

B. Suggestions

It is recommended to conduct testing until a few days to see the development of larva, pupa until adult insects to see the effect of the inhibition on the development of insect life.

References

1. Mustafa Hamed Omar Aljahawey, Setyawati Soeharto, Hidayat Sujuti. 2015. The Effect of Ginger Extract (Zingiber officinale Roscoe) on Male Leydig Cell and Testosterone Level in Carbofuran-induced Rat. International Journal of PharmTech Research. Vol.8, No.5, pp 879-888
2. Harborne, J.B. 1987.Phytochemicals method. How to Analyze Guidance Modern Plant. Second Edition. Publisher ITB Bandung.
3. Alfrits Komansilan, Ni Wayan Suriani.2016. Effectiveness of Seed Extract Hutun (Barringtonia asiatica KURZ), on LARVA Aedes aegypti Vector Disease Dengue Fever. International Journal of ChemTech Research.Vol.9, No.04 pp 617-624
4. Opir Rumape. 2014-2015. Isolate Bioactivity of Castor Leaf (Ricinus communis L) as Antifeedant on Beetle Epilachna varivestis Mulsant. International Journal of ChemTech Research Vol.7, No.5, pp 2244-2250
5. Prijono, D.D. 2008.Botanical Insecticides. Principles, Utilization and Development. Department of Plant Protection. Faculty of Agriculture IPB. Bogor

6. Subiyakto & Sri Muliyanningsih. 2014Pesticide Plant. First Edition, Publisher.PT. AgroMedia Pustaka. Jakarta
7. Busvine, 1980. Recommended Methods for MeasuremEntomol of Pest Resistance to Pesticides, Rome: FAO
8. Langenhein JH. 1994. Higher plant terpenoid: a phyocentric overview of their ecological rolkes. J. Chem Ecl 20:1223-1271.
9. Simmond and Blaney, 1984. Some neurophysiological effects of azadirachtin on lepidopterous larvae and their responses, pp. 163-179. In Schmumetterer H& Ascher KRS (eds.) Natural Pesticides from the Neem Tree and Other Tropical Plants. Prooceding of 2nd Int. Neem Conf. GTZ. Germany. 587p.
10. Schoonhoven L.M. 1986. Perception of antifeedant by lepidopterous larvae, pp. 129-132. *In* R. Greenhalgh and Roberts T.R (eds.) Pesticide Science and Biotechnology. 6 th IUPAC Congress of Pesticide Chemistry Blackwell Scientific, London. 604

*****