Application Of *Titonia diversifolia* As A Biopesticide In Soybean Cultivation In Meureubo District, West Aceh

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Abstract

The tsunami that occurred in 2004 has changed various aspects of activities in West Aceh District. Particularly in the agricultural aspect, the damage occurred not only to cultivated land but also to the surrounding ecosystem. Particularly in the Meureubo sub-district there is a need for outreach to improve farming, where cultivated plants are often attacked by pests. So it is necessary to have proper and environmentally friendly control, one of which is by increasing the use of biopesticides derived from wild plants that are easy to find. Titonia is a flowering wild plant that has the potential to be a good source of nutrition for organic plants, T. diversifolia can be used as green manure, and there are several other studies which also state that titonia extract can be used as a vegetable pesticide in pest control. Using the direct field observation method, which aims to provide knowledge to farmer groups in Meureubo District, West Aceh to use Titonia as an environmentally friendly biopesticide in agricultural cultivation, where the future impact can restore the ecosystem on agricultural land by reducing the use of chemical pesticides. With the results of case study activities, namely biopesticide products that can be used by farmers, data on insects found on agricultural land, both pests, parasitoids, predators, and pollinators. The pests found on the cultivated land were Epilachna sp, Naupactus leucoloma, Piezodorus guildinii, Bemicia tabaci, Agromyza phaseoli, Nezara viridula, Spodoptera sp. By finding few types of pests, it means that the use of biopesticides can reduce the types of pests that attack agricultural land.

Keywords: *Biopesticide, integrated pest conttrol, wild plant.*

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INTRODUCTION

The impact of the tsunami that occurred in Aceh not only caused physical damage to buildings and roads, but also caused pollution to agricultural land due to seawater intrusion and the deposition of high-salt mud on the ground (Rachman et al, 2008). Improving post-tsunami soil fertility in Aceh Province is the main effort that must be carried out before the introduction of cultivated plant components (Zulham, 2008).

In addition to less than optimal land conditions, pest and disease attacks are inhibiting factors for shallot productivity (Nelly et al, 2015). Farmers are used to using pesticides but failure to deal with pests still often occurs (Radiyanto et al, 2010). Pesticides that are used excessively will have a very detrimental impact directly on the diversity of natural insects resulting in a resurgence. Insect identification studies are the initial stage in pest management, and can detect disturbances to existing ecosystem components in nature, so that natural balancing efforts can be made without the use of pesticides (Kaleb et al, 2015).

Titonia is a flowering wild plant that has potential as a good source of nutrients for organic plantings, where tithonia is usually used as green manure or planted as a side plant in planting areas. Desyrakhmawati et al (2015). Several other studies have also stated that titonia extract can be used as a botanical pesticide in controlling pests, one of which was an experiment by Kurniansyah (2010) showing that the content of T. diversifolia leaves was 3.06% N, 0.25% P, and 5.75% K and caused the intensity of pest attacks and lower pathogens and higher soybean production in plants. So far, Tithonia

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has been used as a source of soil organic matter because of its ability to accumulate high levels of essential nutrients such as phosphorus (P), nitrogen (N), potassium (K), calcium (Ca) and magnesium (Mg) in its body tissues (Jama et al. al. 2000). T. diversifolia contains compounds that are toxic to insects such as flavonoids, tannins, and triterpenes (Castano-Quintana et al., 2013).

Utilization of *T. diversifolia* as a source of nutrients in addition to fresh green manure or liquid green manure can also be in the form of compost (Hakim, et al., 2012). *T. diversifolia* is also useful for increasing soil fertility (Oelbermann et al., 2012), as a vegetable pesticide (Akpheokhai et al., 2012). The results of the phytochemical analysis of *T. diversifolia* biomass show that this plant can be used as a medicinal plant, because it contains chemical compounds of saponins, alkaloids, tannins, flavonoids, steroids and glycosides which play an important role in medicine (Essiett & Uriah, 2013). Another advantage of *T. diversifolia* biomass is that it has a high elemental K content. The experimental results of Kurniansyah (2010) showed that the content of *T. diversifolia* leaves was 3.06% N, 0.25% P, and 5.75% K and resulted in lower pest and pathogen attack intensity and higher soybean production in plants that received *T. diversifolia* compared to those that received C. Pubescens. Lack of basic information regarding biopesticides among farmers is the cause of the failure of crop cultivation systems on agricultural land.

MATERIALS AND METHODE

Experiment Site

This activity was completed in February 2023, located in the Farmer Group, Meureubo Subdistrict, West Aceh.

Materials and Tools

Materials and tools needed in carrying out this activity are as follows: *Titonia* wild plants, cow urine, spray equipment, buckets, and other supporting objects.

Research Procedure

The method that will be used to achieve the objectives of this activity is direct observation in the field, with activities namely: Providing information and counseling to farmers regarding: the process of making biopesticide from wild plants, and how it is applied to cultivated plants; Displays presentation of extension materials related to examples of biopesticides that are environmentally friendly and easy to find in agricultural ecosystems.

Research Implementation

The process of making biopesticides was also demonstrated by the implementing lecturers and students, As much as 10 liters of biourin fermented with A.chroococcum, put in a 20 liter bottle, then 1 kg of titonia extract which functions as a biopesticide is also put into the bottle, the bottle is closed for 1 week. After fermentation, the mixture is filtered and the filtered water can be used as a biopesticide. vegetable with an application dose of 10% solution, as can be seen in the following figure 1.

Figure 1. The Process of Making Biopesticides

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RESULT AND DISCUSSION

Plant Height

This study case Service activity was completed in February 2023, located in the Farmer Group of Meureubo District, West Aceh. This event was attended by farmer groups consisting of 20 farmers, 5 students, and 2 lecturer representatives as presenters. This event began with an opening from the representative of the Agrotechnology lecturer at Teuku Umar University who expressed his gratitude because the farmer group was chosen as the target for this study case service so that it was hoped that farmers would continue to be motivated to use environmentally friendly biopesticides, by utilizing wild plants around agricultural ecosystems. Then the event continued with the presentation of counseling material from the implementing lecturer.

The implementing lecturer provides information about when it is appropriate to use biopesticides, and observations are the main targets that need to be carried out by farmers before carrying out pest control. The students who were invited for this activity were also given the task of demonstrating how to monitor in the field and catch some insects on the cultivation land using insect nets.

Figure 2. Students Catch Insects and Monitoring

Insects found in agricultural cultivation areas were collected using a bottle containing 70% alcohol, and brought to the laboratory to be identified using an identification book. Can be seen in the following table 1.

Table 1. Morphologically Identified Insects

Species	Figure	Ecological role
1. *Epilachna* sp.		Pest
2. *Coccinella sexmaculata*		Predator

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3. *Coccinella transveralis*		Predator
4. *Verania lineata*		Predator
5. *Ropalidia fasciata*		Parasitoid
6. *Priocnemis* sp.		Parasitoid
7. *Naupactus leucoloma*		Pest
8. *Piezodorus guildinii*		Pest
9. *Bemicia tabaci*		Pest
10. *Agromyza phaseoli*		Pest

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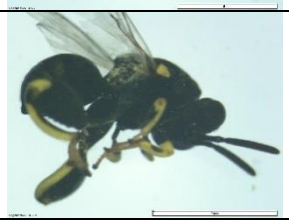
11. *Spodoptera* sp.		Pest
12. *Nezara viridula*		Pest
13. *Paederus fusipes*		Predator
14. *Hylaeus* sp.		Pollinator
15. *Trigona* sp.		Pollinator

The order Coleoptera usually has horn-like forewings, the two wings usually meeting each other forming a straight line down the middle of the back (Boror et al., 2005). According to Kalshoven, (1981) the mouth type in this order is the chewing type. The morphological characteristics of coccinellide beetles generally measure 0.25 cm -1.5 cm. The body of the coccinellid beetle is disc-shaped, oval to round and dorsally convex. The surface of the body is sclerotic. The dorsal surface of the body is bright yellow, orange, reddish with black spots. The ventral surface of the body is flat and pale in color. The number of abdominal segments and leg tarsus is often used to determine species characters (Nelly et al, 2015). Insects of the order Coleoptera found in the intercropping plots included those from the families Coccinellidae, Staphylinidae, Curculionidae. Most of the Coccinellidae family are predatory insects.

Having a pair of wings, having a membrane with a nervous system, the front legs are developed while the hind legs are reduced are characteristics of the Diptera order (Boror et al., 2005). The insects found belong to the Diptera order, including Agromyzidae, which are insect pests. Kalshoven (1981), explained that the characteristics of the order Hemiptera include having thick wings at the base and a membrane at the end (hemelytra) that overlaps at the other end, the beak emerging from the front or from behind the head. The families found were Pentatomidae and Aleyrodidae. The entire family found acts as a plant pest.

The Hymenoptera order has characteristics including front wings that are different in size from hind wings, sharp and vascular, antennae are usually bent, shaped like a club. Trigona sp. and Hylaeus sp. can be categorized as insect visitors and pollinators. These bees have a high number of visits to flowers. This bee was reported as the dominant pollinator on jatropha (Atmowidi et al. 2008). Trigona sp. is a bee with a small body size, body length 4-6 cm, head, thorax and abdomen black with transparent wings, does not have a stinger (Triplehorn & Johnson, 2005). The Lepidoptera order is an insect that is common and easy for everyone to recognize, because it can be immediately recognized by the scales on the wings that fall off like dust on one's finger when this insect is held. The type of mouth

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in this order is for sucking food (sponging). The order Lepidoptera is characterized by two pairs of widely closed wing membranes with overlapping scales, mouth parts in proboscis coils (extended mouth parts), antennae with many segments (Boror et al., 2005). The only family found was Noctuidae which acts as a plant pest insect.

CONCLUSION

This case study activity is a direct observation activity on soybean cultivation land with the application of biopesticides to reduce pest populations on agricultural land, thereby reducing the use of pesticides by farmers, as well as improving the economy of farmers in West Aceh.

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