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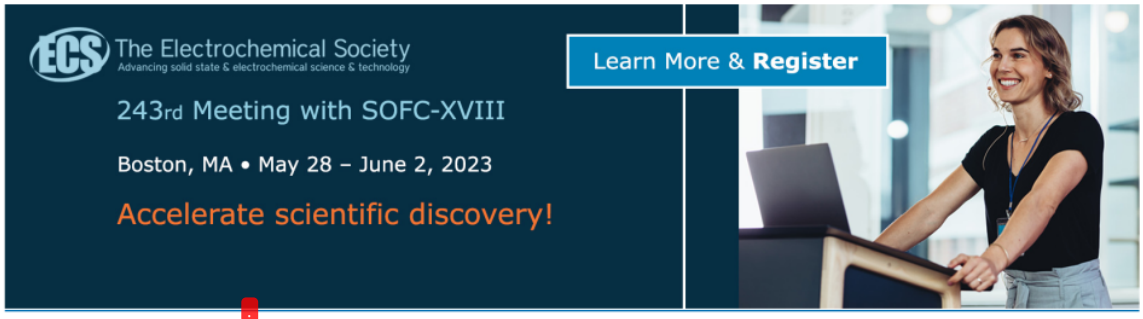

Phytochemical analysis of beneng taro (*Xanthosoma undipes* K.Koch) leaves: cultivation as raw material for biopesticides for eco-friendly agriculture

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Abstract. Beneng taro (*Xanthasoma undipes* K.koch) is a local wild taro which grows spreading the land area of Gunung Karang in Pandeglang District, Banten Province. Recently, the demand of Beneng taro tubers is increasing due to improvements in its utilization as a food crops. Therefore, Beneng taro is now being cultivated widely by the farmers. However, the use of Beneng taro is still focus on its tubers, while its leaves has not been utilized and only become an agricultural waste. The aim of research was to find out the chemical content of cultivated Beneng taro leaves as a raw material for biopesticide. The research was conducted from July to September 2018. The leaves sample of cultivated Beneng taro were taken from farmer's field in Juhut Village, Karangtanjung Sub-district. Phytochemical analysis was accomplished in the laboratory. Further, chemical content in the form of alkaloids, flavonoids, saponins, tannins, and oxalic acid were observed. The research result showed that there were negative content for alkaloids, flavonoids, saponins in Beneng taro leaves. The cultivated Beneng taro leaves positively containing tannins, and oxalic acid as much as 3448.20 and 8361.52 mg/kg, respectively. The chemical content of tannins in Beneng taro leaves indicated the potential use of Beneng taro as a raw material for biopesticide.

Keywords: Beneng taro, biopesticide, cultivation, leaves, phytochemical

1. Introduction

Beneng taro (*Xanthasoma undipes* K.koch) is a local wild taro which grows spreading the land area of Gunung Karang in Pandeglang District, Banten Province. Recently, the demand of Beneng taro tubers is increasing due to improvements in its utilization as a food crops. Therefore, Beneng taro is now being cultivated widely by the farmers surround Gunung Karang. The protein and carbohydrates content found in Beneng taro tubers is relatively high, thus makes this crop to be use as wide variety of food products. On the other hand, the Beneng taro also containing oxalic acid, the chemical that become a problem in food. The cultivated Beneng taro, however, reported has much lower oxalic acid than wild Beneng taro [1].

Recently, the variability of products made from Beneng taro is increasing, such as chips, brownies, beneng noodles, beneng ice cream, and many more [2]. The main plant organ of Beneng taro plants that has been commonly use is tubers. However, the leaves of this plant have not been utilized to date, thus becomes only organic wastes. To optimize the use of Beneng taro plants and to reduce the agricultural wastes, it is necessary to utilize Beneng taro leaves as a raw material for biopesticide. In general, biopesticides is defined as pesticides whose basic ingredients come from plants or plant parts such as

roots, leaves, stems, or fruits [3]. Additionally, the characteristics of biopesticide is to kill, to repel, act as anti-feedant, toxicant, and as growth inhibitors of insect.

Indonesia is a country that has the largest biodiversity in the world, second only to Brazil. Plants are storehouse of various chemical compounds that are rich in active ingredients, including secondary metabolic products. These compounds plays an important roles in the process of interacting or competing, including protecting themselves from interference or from competitors. Secondary metabolite products can be used as active ingredients of biopesticides.

Refer from various function of plants that have active ingredients on leaves as biological pesticides, it is important to know the chemical content of Beneng taro leaves and its potential use as raw material for biopesticide. The aim of research was to find out the chemical content of cultivated Beneng taro leaves as a raw material for biopesticide.

2. Material and Methods

The research was conducted from July to September 2018. Data collection was carried out by means of exploratory surveys which included interview and direct sampling from the field. Interviews were aimed at community leaders, users, or those who are familiar with Beneng taro plants. The leaves samples of cultivated Beneng taro were taken from farmer's field in Juhut Village, Karangtanjung Sub-district, Pandeglang Regency, Banten Province. A Phytochemical analysis was accomplished in the Bio-pharmachy Study Center Laboratory, Bogor, West Java. Further, chemical content in the form of alkaloids, flavonoids, saponins, tannins, and oxalic acid were observed. The results obtained were then analysed using quantitative descriptive analysis.

3. Result and Discussion

Based on the results of phytochemical analysis presented in Table 1, it is shown that there are negative results for flavonoids, alkaloids, and saponins for cultivated Beneng taro leaves. These results are different from previous research that show the results of phytochemical tests for Bogor taro containing anti-nutrients, including calcium oxalate, saponins, tannins, and flavonoids. The presence of these compounds shows that taro leaves and stems had the potential to be larvacides [4].

Table 1. Phytochemical content of Cultivated Beneng Taro leaves

Sample	Content	Result
Beneng Taro leaves	Flavonoid	Negative
	Alkaloid	Negative
	Saponin	Negative
	Tannin	3448.20 mg/kg
	Oxalic Acid	8361.83 mg/kg

Beneng taro leaves are positive in containing tannin with a yield of 3448.20 mg/kg. This shows the potential for Beneng taro leaves to be used as an ingredient for biopesticides. It was reported that the ingredients of *nginang* (Indonesian traditional chewing) in the form of betel, tobacco, gambier, and lime betel have the potential to be used as basic ingredients for environmental-friendly insecticides because they contain chemical compounds in the form of tannins of 67.65%, alkaloids of 1.43 %, and essential oil by 0.2%. These compounds can reduce the intensity of plants diseases such as leafhoppers, stink bugs, etc. by inhibiting the growth of adult insects and their larvae.

[2] reported that active substances that have the potential to be used as vegetable insecticides include alkaloids, terpenoids, phenolics, tannins, and other secondary chemicals. These chemical compounds affect the insect in the nervous or muscle systems, hormonal balance, reproduction, anti-feeding behavior, and respiratory system.

This research showed that the content of cultivated Beneng taro leaves have the potential of tannin compounds. The tannin compounds taste bitter which react with proteins, amino acids, and alkaloids which contain many hydroxyl and carboxyl groups to form strong and complex bonds with other proteins and macromolecules, making it very bitter in taste, thus not liked by insects that become pests

on plants. The presence of saponin and tannin compounds in maja fruit is one reason why it is highly recommended as one of the ingredients of vegetable pesticides.

In addition to the chemical content of tannin compounds found in cultivated Beneng taro leaves, oxalic acid content is also present in the leaves with a value of 8361.83 mg/kg. Oxalate is one of the plant metabolites that have unique role in plants. In plants, oxalate can be in the form of oxalic acid or in the form of calcium oxalate crystals [5]. Oxalic acid and its water-soluble salts can be dangerous, because these compounds are toxic. High levels of oxalic acid can cause death from digestive symptoms (abdominal cramps and vomiting) which are rapidly followed by circulatory failure and rupture of blood vessels [6].

The distribution of oxalic acid in plant parts is uneven. In general, the leaf part contains more oxalic acid than that in the stalk, whereas in *Poligonaceae*, the oxalic acid content in the petiole is almost double than that in the stalk. In addition, young leaves contain less oxalic acid compared to old leaves. For example, in *Chenopodiaceae* leaves, the content of oxalic acid can be doubled during the aging process [7]. According to [8] calcium oxalate crystals in taro are found in two forms which are druse (round shape) and raphide (like fine needles), which is about 80 to 85 percent of the total calcium oxalate content.

Furthermore, the research on the treatment of taro tuber extract on mice behaviour showed that mice were run after ate the taro tuber. This is, presumably, because taro tubers have an unpleasant odor which can be felt or tasted by mice after eating it. Taro is a weed plant that has a sharp odor, bitter taste, and gives itching sensation. The smell and itching stimulant of taro tubers are difficult to wash off, and to remove them repeated wash are necessary. This odor and itchiness is produced by calcium oxalate crystals and saponins which have a bitter taste that usually mice do not like [9]. In addition, according to [10] there are 2-3% essential oils, 20-60% starch, resin, oxalic acid in ginger rhizome extract (Zingiber officinale). The results of previous research in the use of red ginger rhizome extract with a concentration of 20% were very effective against the mortality of *xylostella plutella* larvae in cabbage plants. Various results of previous research that have been described concerning the content of oxalic acid in plants that provide an effect as a natural pesticide, whose characteristics are including reducing pest attacks, although it does not directly kill the target Plant Pest Organisms.

4. Result and Discussion

The research concluded that the chemical content in cultivated Beneng taro leaves are tannin and oxalic acid compounds. Thus, cultivated Beneng taro leaves is potentially to be use as a raw material for bio pesticide. Further research is needed to examine the Beneng taro leaf extracts and its effectiveness in controlling pest in the field.

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