Ethnobotany of Jonggol Plants (Erechtites valerianifolia Wolf.) on Communities in Traditional Markets in Malang City and Detection of Its Chemical Compounds

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Abstract. The increasing number of population causes increasing food needs too. The market is one place where food needs are available. One of the plants that has economic value and can be used is jonggol (Erechtites valerianifolia Wolf.). The objective of this study is to determine the morphology, forms of use and chemical compounds found in the jonggol plant. This research was conducted on October 2017 until March 2018. The methods used in this study were preliminary surveys, market area selection, morphological observations, interviews, chemical compound detection, and data analysis. The selection of market areas was carried out in 5 sub-districts of Malang City, with each sub-district selected by one market, they are Sawojajar Market, Sukun Market, Malang Big Market, Blimbing Market, and Dinoyo Market. The results of the study show that jonggol is a herbaceous plant. Jonggol has a taproot type with a hairy and grooved stem surface. The jonggol leaves are obovate, pointed ends, tapered base with a leaf surface with adaxial and abaxial hair. The flowers are cup-shaped compound flowers and they are located at the end of the stem. The petals are modified into pappus. The crown is reddish yellow, the pistil head is brownish red, and the stamens are purple. The fruit type is achene which is brown. Jonggol has a UVs value of 3.0 meaning that it is an important species or priority species, this is due to Jonggol plants often used as vegetables. Chemical compounds found in Jonggol plants are alkaloids, flavonoids, and steroids.

1. Introduction
Malang City is a city located in East Java Province, Indonesia. The city is located 90 km south of Surabaya and it is the second largest city in East Java after Surabaya [1]. Malang City has an area of 252.01 km². The population in 2010 was 820,243 people, consisting of 404,553 male inhabitants and 415,690 female inhabitants. The existence of a population that continues to increase annually, this results in increased food needs. The market is one place where food needs are available [2]. Moreover, by the existence of the market, people also know what plants can be utilized. People’s knowledge about the use of plants is very necessary for ethnobotany researchers [3].

Ethnobotany is the study of the relationship between humans and their environment which includes a system of knowledge about plant resources. Things that need to be studied in ethnobotany include the study of the use of plants as food, protection or houses, medicine, clothing, and traditional ceremonies [3]. Plants also have economic value, one of the plants that have economic value and can be used is Jonggol (Erechtites valerianifolia Wolf.). Jonggol is one of the families of Asteraceae which is a weed. Although jonggol is a weed, it is still often used by the surrounding community [4].
Jonggol (Erechtites valerianifolia Wolf.) is an herbaceous plant, it comes from Central and South America. These plants have a height of 50-100 cm, even in Australia, it is described as shrubs. The leaves is opposite, the lower leaf is larger than the top. The surface of the leaf and stem has hair. The flowers cluster together to form a small flower set. The flowers have pappus which is a modification of petals. Jonggol develops in disturbed conditions, it can flourish on the edge of the fields, on the roadside and in the garden. Generally, Jonggol is widespread in mountainous habitats in North America. Jonggol has economic and nutritional potential because it has a high vitamin A content [5].

Currently, the use of jonggol known only as vegetables. People’s knowledge of jonggol plants is very limited, so it is necessary to detect chemical compounds. The chemical compounds found it can provide better information later. The objectives of this study are to describe the morphology of the jonggol plant, to find out the use of jonggol plant by the people in Malang City, and to know the chemical compounds found in jonggol plant.

2. Material and Methods

2.1. Study Area
The research was conducted in 5 traditional markets, they are Sawojajar Market, Sukun Market, Malang Big Market, Blimbing Market, and Dinoyo Market (Figure 1). Identification of chemical compounds was carried out at the Biochemistry Laboratory, Chemistry Department, while identification of morphology and data analysis were carried out at the Laboratory of Taxonomy and Plant Development Structure, Biology Department, Faculty of Mathematics and Natural Sciences, Brawijaya University, Malang.

2.2. Selection of Market Areas
Malang City has several traditional markets spread across 5 sub-districts, they are Kedungkandang District, Sukun District, Klojen District, Blimbing District, and Dinoyo District. One district was chosen as a place for research. Selected markets were Sawojajar Market, Sukun Market, Malang Big Market, Blimbing Market, and Dinoyo Market. The choice of the market area was based on the number of sellers in the place, including Sawojajar Market (144 sellers), Sukun Market (115 sellers), Malang Big Market (914 sellers), Blimbing Market (250 sellers) and Dinoyo Market (989 sellers) [6].

2.3. Morphological Observation
Morphological observations were carried out in the Laboratory of Taxonomy and Structure of Plant Development. First, prepared tools and materials, they are two tweezers, stationery, calipers, ruler, millimeter paper, stereomicroscope, camera, book identification of flora of java. The sample was taken first in the field, they are in the forest of Mathematics and Natural Sciences of Brawijaya University,
Malang, because the sample must be fresh. Identification was done sequentially, starting from roots, stems, leaves, and flowers. At the root part, which needs to be observed are root length, type, and color. In the stem part, which needs to be observed are stem length, type, shape, surface, and direction of growth, for the stem surface, it was observed with a stereomicroscope to make it clear. In the leaves, which need to be observed are leaf shape, tip, base, the arrangement of leaf bones, edges, surface, color, and layout of leaves, to make it easier, it can be observed by using a stereomicroscope. In the part of the flower, which needs to be observed are the number of flowers, layout, type, symmetry, number of pistils, pistil color, pistil head color, and stamen color, this observation was done with a stereo microscope and tweezers. The observations were then photographed as documentation. The identified sample was then made as a herbarium as a collection.

2.4. Interview
Interviews were conducted in a free and semi-structured manner to find out the knowledge of the community and the form of utilization of the jonggo l plant for the people of Malang City. Interviews were conducted in 5 predetermined traditional markets, with 17 respondents in each market, so a total of 85 respondents. Respondents in this study were 10 sellers, 5 buyers, and 2 collectors. The selection of respondents during the interview was carried out regarding the age, it is conducted to adults. Interviews were conducted on the market because the bark plants are sold in the market, so it is easier to get information about their uses.

2.5. Sample preparation
The sample was taken in the field, which was precisely in the Mathematics and Natural Sciences Forest. The sample used must be still fresh. Therefore, it was not using samples from the market because it has withered. The leaves were dried using an oven at 60°C for two days. If the leaves were dry then it blended using a blender [7]. The sample powder obtained can be used for several identification tests of chemical compounds carried out at the Biochemistry Laboratory, Chemistry Department, Faculty of Mathematics and Natural Sciences, Brawijaya University, Malang.

2.6. Alkaloid test
Two grams of powdered samples were extracted using chloroform. The sample was then added with 10 ml of chloroform-ammonia and filtered. The filtrate obtained was added with H_2 SO_4 2M, it was homogenized until two layers were formed. The acid (colorless) layer was transferred into two new test tubes. Each solvent was tested using Mayer and Wagner reagent droplets. The results were categorized positively if the solvent forms deposits with yellowish white (Mayer) and brown (Wagner) [8].

2.7. Flavonoid test
The sample was immersed in N-Hexane and filtered. The residue was added with N-Hexane and filtered. This procedure was done repeatedly until the color of the filtrate turns colorless. The filtrate was added with methanol, filtered, then added HCl and Mg. If the filtrate formed a sorrel precipitate, the plant positively contains flavonoids [8].

2.8. Terpenoids and steroid tests
The sample was immersed in N-Hexane and filtered. The filtrate was then evaporated until residue was formed. The filtrate was added with chloroform 0.5 ml, anhydrous acetic acid 0.5 ml and H_2 SO_4 1-2 ml. If a reddish-purple precipitate was formed, then the plant positively contains terpenoids. Conversely, if it was green, the plant was positive for steroids [9].

2.9. Tannins and saponins test
The sample was immersed in N-Hexane and filtered. The filtrate was then evaporated until residue was formed. The filtrate was added with chloroform 0.5 ml, anhydrous acetic acid 0.5 ml and H_2 SO_4 1-
2 ml. If a reddish-purple precipitate was formed, then the plant positively contains terpenoids. Conversely, if it was green, the plant was positive for steroids [9].

2.10. Data analysis
Analysis of morphological observation data was carried out qualitatively, it was by using descriptive methods, in which the morphological structure of the jonggol plant was compared from the literature and from the field observations. The results of the identification of chemical compounds were analyzed qualitatively, This written any chemical compounds contained in it.

The results of interviews related to the utilization of these plants were analyzed quantitatively. Quantitative analysis was used to determine the value of use (use valuable) of a type of plant that was calculated using the UVs (Use Value) method. Usability values can be determined by equation 1 as follows [11]:

\[
UV_s = \sum_{i} UV_is / i_s \quad \ldots \ldots \ldots \ldots (1)
\]

Where:
- \(UV_s\): Use valuable of s type on the whole
- \(UV_is\): Use valuable of s type which was determined by the informant i
- \(i_s\): the total number of respondents interviewed for s type

According to Batubara et al. (2017) \(UV_s = 0\), it means that species not used; \(0<UV_s<3\): secondary species, species were not the priority; \(3\leq UV_s \leq 6\): important species, priority species; \(6<UV_s\leq 9\): very important species.

3. Result and Discussion

3.1. Morphological Description of Jonggol Plants
Jonggol plants are included in the family Asteraceae. Asteracea is a plant whose variety varies and its distribution is wide, especially in the tropics and subtropics area [12]. The world Asteraceae plant consists of 1,600-1,700 genera covering 24,000-30,000 species [13], while in Java, it consists of 107 genera which includes 235 species [14]. The Asteraceae family has the characteristic of having a middle flower (disc) and edge flower (ribbon).

Jonggol is a herbaceous plant. Jonggol roots are taproots, 11.1 cm long and yellowish white (Figure 2a). The stem is a wet stem, with a stem length of 36.5 cm, has a hairy, grooved stem or has lines that are arranged longitudinally and they are green (Figure 2b).

![Roots and stems of Jonggol: (a) roots and (b) stems](image)

Jonggol leaves are single leaves, green, obovate with pointed leaf tips, tapered leaf base (Figure 3a), pinnate leaf arrangement (Figure 3b), jagged edges, hairy leaf surface adaxial, and abaxial (Figure 3c) with layout leaves on the stem which is interspersed.
Figure 3. Jonggol leaves: (a) shape, (b) arrangement of leaf bones and (c) adaxial surface

Jonggol flower is a cup-shaped compound flower and it is located at the end of the stem (Figure 4a). Hairy flower stalks have bractea arranged in two circles (Figure 4b). The outer bractea is green with a brownish red tip with a pointed tip. The second bractea is longer, green in color with a pointed tip and it is brownish red in color. The petals are modified into pellets, white in color and numerous (Figure 4c). A reddish yellow crown forms a tube (Figure 4d). The pistil's head is brownish red with a yellowish white pistil, the stamens are purple and merge with each other (Fig. 4e). Jonggol has achene brown type (Figure 4f), it is attached to the receptacle.

Figure 4. Jonggol flowers: (a) location of flowers, (b) bractea, (c) pappus, (d) petal, (e) pistil and stamens, (f) achene

Jonggol plant has a grooved surface that looks very clear. Jonggol has ½ - 4 cm leaf stalks, oval leaf shape with jagged edges. Jonggol has reddish or purple hair on the top and white on the bottom 8-10.
mm long. The petals is yellowish with the top reddish or purple. Achene is 3 mm in size, brown in color and has a pellet on top of it. Jonggol is widespread and native to America and it is a weed [14].

3.2. Utilization of Jonggol Plant
Jonggol is a plant from the family of Asteraceae which is considered a weed, which can grow at undesirable times and places. Weeds can be interpreted as unwanted plants on a plantation, agriculture or from cultivated plants. [15] The people of Malang City generally use jonggol as vegetables, vegetables fresh vegetable, and pecel. Until now, there have been no people who use the Jonggol for other uses, even though its existence has been widespread in nature. Buyers generally use jonggol as a vegetable and the most used part is the young stem and leaves. However, there are also buyers who make jonggol as a vegetable with their young flowers.

Not all vegetable sellers in the traditional market in Malang City sell jonggol, only a few sellers sell these plants. The seller does not get it from the collector but takes it himself in the garden or around his residence. Jonggol usually is sold at a price of Rp. 2000,- per bundle. Until now, it was not yet known whether or not there was jonggol cultivation, because usually collectors also took around their homes and then sold it to vegetable vendors on the market. According to collectors, it is easy to find and easy to pick because it belongs to herbaceous tablets.

Based on the results of interviews with the community about the use of jonggol, then it is calculated and obtained a UVs value of 3.0. This value shows that jonggol plants are important species or priority species. This is because jonggol plants are often used as vegetables, in other hands, there are no other forms of utilization.

3.3. Jonggol Chemical Compounds
The results show that the chemical compounds contained in the jonggol plants are alkaloids, flavonoids and steroids (Table 1). The results are positive when alkaloid compounds formed yellowish white deposits for Mayer reagents and brown for Wagner reagents. flavonoids are said to be positive when forming sorrel deposits. The steroid test is said to be positive when it forms a green deposit. The terpenoid test, tannin, and saponin show a negative result because there is no appropriate color change (Figure 5).

| No | Group of compounds | Result |
|----|-------------------|--------|
| 1  | Alkaloids         | +      |
| 2  | Flavonoids        | +      |
| 3  | Terpenoid         | -      |
| 4  | Steroids          | +      |
| 5  | Tannin            | -      |
| 6  | Saponin           |        |

Description: (+) positive (-) negative
The results show that the leaves of jonggol positively contained alkaloid compounds, this can be seen from yellowish-white deposits in Mayer's reagents and brown deposits in Wagner reagents. Extracting a plant depends on the texture and water content of the extracted plant material and the types of compounds to be isolated [16]. Alkaloids can be found in plant parts such as roots, stems, leaves, and seeds. Alkaloids in plants function as poisons that can protect them from insects, growth regulators, and store compounds capable of supplying nitrogen and other elements needed by plants [17].

Alkaloids are an organic base containing elements of nitrogen (N) generally derived from plants, which have strong physiological effects on humans. The use of alkaloid compounds in the field of

Figure 5. Result of jonggol chemical compounds:
(a) alkaloids, (b) flavonoids and (c) steroids
pharmacology is to stimulate the nervous system, increase blood pressure, and fight microbial infections [18].

Jonggol leaves also positively contain flavonoids, this can be seen from sorrel deposits when added with HCl and Mg. The red color in the flavonoid test is caused by the formation of flavyllum salts [19]. Flavonoids are widespread in plants and have many functions. Flavonoids are plant pigments to produce the colors of flowers red or blue and make yellow pigmentation on the petals that are used to attract pollinators. Flavonoids are almost present in all plant parts including fruit, roots, leaves, and outer bark [20]. The benefits of flavonoids include protecting cell structures, increasing the effectiveness of vitamin C, anti-inflammation, preventing bone loss and as an antibiotic [21].

Flavonoids are one of the secondary metabolites contained in plants. Flavonoids for plants have a function to protect themselves from diseases and the surrounding environment. The function of flavonoids for the human body is to prevent cardiovascular disease because flavonoids are phenolic compounds that have antioxidative properties that play a role in preventing cell damage by reactive free radicals [22].

In addition, the leaves of jonggol also contain positive steroids and negatively contain terpenoids, this can be seen from the green deposits. Steroids are secondary metabolites with a variety of important biological functions that are widespread in both plant and animal tissues. Steroids found in animals generally act as hormones, while synthetic steroids are widely used as medicinal ingredients [23].

Steroid compounds are widely used in the world of medicine and contraception, they are, androgens are steroid hormones that can stimulate male sexual organs, estrogen can stimulate female sexual organs, adrenocorticoids can prevent inflammation and rheumatism [24]. Steroids are compounds found in plants, which consist of various types [25].

Steroids play an important role in the body in maintaining the balance of salt, controlling metabolism, and improving the functioning of sexual organs as well as differences in other biological functions between sexes. Human bodies produce steroids naturally, which are involved in various metabolic processes [26].

4. Conclusion

Jonggol is a herbaceous herbal plant. It has taproot with a hairy and grooved stem surface. The jonggol leaves are obovate, pointed ends, tapered base with a leaf surface with adaxial and abaxial hair. The flowers are compound flowers that are cup-shaped and they are located at the end of the stem, having bractea arranged in 2 circles. The petals are modified into pappus. The crown is reddish yellow, the pistil head is brownish red and the stamens are purple. The fruit type is achene which is brown. Jonggol has a UVs value of 3.0 meaning that it is an important species or priority species. This is because jonggol plants are often used as vegetables, in other hands, there are no other forms of utilization. Chemical compounds that of jonggol plants are alkaloids, flavonoids, and steroids.

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