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# The Ethnopharmacology, Phytochemistry, Pharmacology Activities of Yellow Velvetleaf Plant (*Limnocharis flava*): A Review

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## Abstract

Ethnopharmacology is a scientific study that connects a group of people, health, and the habits of the people who use traditional medicines and formulating traditional medication. The yellow velvetleaf plant is a type of plant that lives in water. This plant can be used as a vegetable for daily consumption by the community. The yellow velvetleaf plant is a plant of the *Alismataceae* family. This plant is ethnopharmacological, in which there is a pharmacological effect related to treatment and health maintenance for the community because it has chemical compounds such as saponins, steroids, phenol hydroquinone, and also mineral contents: *Phosphorus* (P), *Calcium* (Ca), *Potassium* (K), *Sodium* (Na), *Iron* (Fe), and *Zinc* (Zn). This review article discusses the chemical compounds in yellow velvetleaf plants and the pharmacological effects of yellow velvetleaf plants. In this review article, it is known that yellow velvetleaf plants, used by the community as a local vegetable, have chemical compounds that can produce pharmacological effects.

**Keywords:** Ethnopharmacology, Phytochemistry, Pharmacological Activities, Yellow Velvetleaf

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## 1. Introduction

Traditional treatment, which is carried out through medicinal plants in practice, has been practiced by the Indonesian people, especially in remote areas, since ancient times until now. It has been used in the community for treatment and health maintenance and is passed down from generation to generation. It passes the test of time and is inseparable from community life without being scientifically proven. Understanding the concept of sickness, health, and the diversity of plant species used as traditional medicine is formed through a socialization process that has been trusted and believed to be true from generation to generation [1].

Local vegetables are vegetables that can adapt to an area and grow well [2]. These plants grow naturally around the house's yard and are used as food for families. This local vegetable can also be used as a medicine whose properties are trusted from generation to generation. Consumption of local vegetables can improve public health and reduce the risk of disease [3]. Local vegetables have the potential to be developed and can overcome the problem of vitamin and nutritional deficiencies, especially for the lower-middle-class population [3]. Therefore, local vegetables are helpful as a source of vitamins, fiber, minerals, and antioxidants used by human health [4].

One of the local vegetables used by the community can be found in the yellow velvetleaf. The yellow velvetleaf plant is a plant of the *Alismataceae* family [5]. This plant is ethnopharmacological in which there is



a pharmacological effect that has a relationship with treatment and health care for the community because it has chemical compounds such as saponins, steroids, phenols, hydroquinone, and mineral contents: *Phosphorus* (P), *Calcium* (Ca), *Potassium* (K), *Sodium* (Na), *iron* (Fe), and *zinc* (Zn) [1].

Therefore, the purpose of this review article is to obtain information from yellow velvetleaf plants that are used as local vegetables by the community for their content of chemical compounds for the treatment and health care which produces pharmacological effects.

## 2. Data Collection

The data collection method used was a literature study of national and international journals published within the last ten years period (2010-2020) connected with the ethnopharmacology of the yellow velvetleaf plants. In the making of this review article, we searched data via online media with the keywords as follows: "Ethnopharmacology," "Yellow velvetleaf," and "*Limnocharis flava*." The search for the primary references of this review article was carried out through trusted websites such as *ScienceDirect*, *NCBI*, *ResearchGate*, *Google Scholar*, and other trusted journal databases.

## 3. Overview of Yellow Velvetleaf Plant

### 3.1 Description of Yellow Velvetleaf Plant

Morphology of Yellow Velvetleaf.

All year water herb, 25-50 cm high.

Roots: The fibrous roots have a thick and erect rhizome, immersed in mud and brownish white.

Stem: The stem of the yellow velvetleaf plant is round. The direction of the yellow velvetleaf's branch is vertical [6], and it has an upright trunk above the ground, not woody and green.

Leaves: Single-leaf rosette-shaped roots, long stalks and perforated, soft, 15-25 cm long, the shape of the strands is decorated, the arrangement of the leaves is curved and parallel, tapered ends<sup>7</sup>, blunt base, flat edge, 5-50 cm long, wide 4-25 cm and green.

Flowers: Compound flowers in the form of umbrellas located in the axillary of the leaves, consisting of 3-15 buds, 15-25 cm long, yellow stalks. Loose petals shaped like nails, green. White, yellow 3-stemmed stamens. The pistil is round, and the crown is open—the tip curves in yellow.

Fruit: *Buni* fruit, ovate, 1.5-2 cm in diameter, covered in green petals. Pseudo fruit with round, tiny, black seeds [5].

Yellow velvetleaf is a plant that grows wild in rice fields, swamps, or rivers, where its existence is often considered a weed [8]. The yellow velvetleaf plant is a plant of the *Alismataceae* family [5]. This plant has a fibrous root rhizome and has a hollow stem, and its leaves are pale green [9]. Yellow velvetleaf plants can be planted in conditions of even a little or a lot of waterlogging, and it is challenging to grow in drought conditions. Yellow velvetleaf plants are not affected by the amount of saturated, but yellow velvetleaf plants are affected by their plants and flowers by the unavailability of water [10]. The overview of the yellow velvetleaf plant can be seen in Figure 1 below.

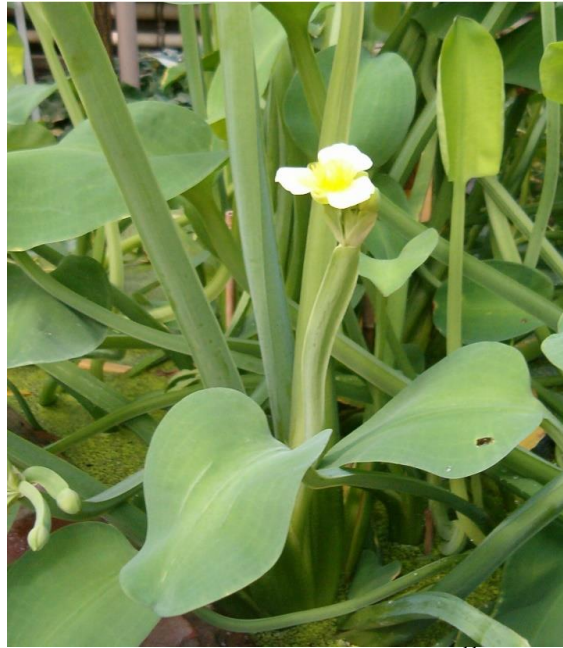


Figure 1. Yellow Velvetleaf Plant<sup>11</sup>

### 3.2 Classification of Yellow velvetleaf Plant [11]

Kingdom: Plantae

Subkingdom: Tracheobionta

Superdivision: Spermatophyta

Division: Magnoliophyta

Class: Liliopsida

Subclass: Alismatidae

Order: Alismatales

Family: *Alismataceae* [12]

Genus: *Limnocharis*

Species: *Limnocharis flava* (L.) Buchenau

As for the naming of the yellow velvetleaf plant, it can be known by common names, such as regional and foreign names, as follows [11]:

Common Name

Indonesian [7,11]

Batak: Haley

Melayu: Eceng

Javanese: Genjer, Centongan

Sundanese: Gendot, Saber

Malay: Sayur Air

English: Yellow Velvetleaf



#### 4. Ethnopharmacology

The yellow velvetleaf plant is a vegetable that grows in the wetland. The benefits of yellow velvetleaf plants are as follows [13]:

1. Yellow velvetleaf is helpful for people with hyperglycemia. The glucose content in yellow velvetleaf is very little, so it prevents an increase in the glycemic index.
2. Yellow velvetleaf is also beneficial for digestion because it contains fiber dissolved in water. It can relieve constipation and flatulence because the yellow velvetleaf plant is carminative.
3. Yellow velvetleaf contains a lot of beta-carotene, which in the body will be converted into vitamin A (retinol). Beta-carotene is helpful as an antioxidant that can maintain body immunity.
4. Maintain healthy skin that is often exposed to the sun, which has the potential for skin cancer
5. As a source of vitamin C. Vitamin C is an antioxidant that can protect the body from the influence of free radicals in the environment and keep the body resistant to pathogenic infections. The content of vitamin C in yellow velvetleaf leaves is 54 mg/100 grams.
6. Get rid of harmful fats. With sufficient vitamin C content, unhealthy fats will be bound and removed with the body's metabolic products.
7. Keep bones growing normally. It is because yellow velvetleaf plants contain lots of calcium, phosphorus, and iron. Calcium and phosphorus are macro elements necessary for bone formation<sup>14</sup>.
8. A source of phosphorus and calcium for older women, eating yellow velvetleaf is the right choice because yellow velvetleaf vegetables do not contain fat and cholesterol, which should be avoided as you enter old age.
9. Prevent anemia. Iron and vitamin A in the yellow velvetleaf plant helps to fulfill the production of red blood cells to prevent anemia.

Other Benefits of yellow velvetleaf:

Yellow velvetleaf plants have many benefits, including as an absorbent for heavy metals in the soil and as a medicine that has a lot of nutritional content [8]. Yellow velvetleaf is often used as a vegetable ingredient, especially the young leaves with unopened stalks and fruit. This plant is usually not eaten raw but heated over a fire or cooked for a short time. Processing of yellow velvetleaf as an appetite enhancer is by steaming fresh until half cooked and then consumed with other foods as *lalapan*. Apart from the leaves, young yellow velvetleaf flowers are also delicious for cooking. Yellow velvetleaf is suitable for stir fry, fresh vegetables, *pecel*, or a hodgepodge mixture. This vegetable is also rich in fiber which is good for maintaining the human digestive system tract. These vegetables can also increase appetite and are valid as animal feed [15]. There is no information on the dangers of consuming yellow velvetleaf as a vegetable or half-cooked vegetable. However, it is necessary to be careful in choosing yellow velvetleaf as food. Ensure these plants come from clean and healthy land because these plants can absorb heavy metals such as mercury, which does not dissolve in our bodies when eaten [7]. This plant can also help purify water contaminated with heavy metal waste [16]. The ethnopharmacological study is a study of plants' use by certain ethnicities used in medicine [17]. Ethnopharmacology is defined as a multidisciplinary study that studies the components of biologically active compounds used in traditional medicine. Ethnopharmacology is a scientific study that connects a group of people, health, and the habits of people who use traditional medicine and its manufacturing method. Traditional treatment is a term applied to a pre-scientific medical system. It understands medical knowledge, including books, especially official publications, containing a list of medicines with their effects and instructions for use (pharmacopeia/medicinal plants book) that have been passed down from generation to generation from healers to physician [18].

#### 5. Pharmacological activities

##### 5.1 Hyperglycemia

Hyperglycemia is a medical condition in which an increase in blood glucose levels exceeds normal limits. Hyperglycemia is one of the typical signs of diabetes mellitus (DM). DM is a group of metabolic diseases characterized by hyperglycemia due to abnormalities in insulin secretion, insulin action, or both [19]. One way

to treat or prevent this disease is by consuming yellow velvetleaf vegetables, which have very little glucose content, to avoid an increase in the glycemic index [8]. The glucose value was 2.70% in fresh yellow velvetleaf, 3.42% for 3 minutes of steaming, and 5.31% in the steaming process for 5 minutes. The value of glucose in the steamed yellow velvetleaf increased. It is presumably due to a decrease in water content and other components [20].

## 5.2 Antioxidant

The antioxidant is the activity that can delay and slow down oxidation [21]. Yellow velvetleaf, as local vegetables, have the potential as medicinal vegetables because they contain several bioactive compounds, especially antioxidants that can eliminate free radicals in body cells. Phenolic compounds are compounds that can function as antioxidants [20]. This plant is considered a weed, but on the other hand, this yellow velvetleaf plant has nutritional content [1].

The testing of free radical scavenging activity of ethanol extract and fraction of n-hexane, chloroform fraction, and ethyl acetate fraction of *L. flava* was carried out using the DPPH ABTS method. DPPH is one of the most common methods to evaluate antioxidant activity, particularly for phenol or polyphenol compounds [22]. The smaller the IC<sub>50</sub> value, the higher the antioxidant activity. The results of the DPPH testing method by using the IC<sub>50</sub> (Inhibition Concentration 50) parameter, which means that as much as 50% of the sample was reduced and turned into diphenylpicrylhydrazine, which has non-radical properties. The IC<sub>50</sub> value in fresh yellow velvetleaf was 131 ppm [20]. This IC<sub>50</sub> value was lower than the study by Sakong *et al.*, which showed the total antioxidant activity of yellow velvetleaf leaves was 317 ppm [23]. The antioxidant activity of the sample was seen from the ES<sub>50</sub> (Effective Scavenging) value, namely the concentration of sample compounds that can capture DPPH free radicals by 50%. The ES<sub>50</sub> value obtained for gallic acid, ethanol extract, n-hexane fraction, chloroform fraction, and *L. flava* ethyl acetate fraction was 208.55; 2,128; 1,117 and 1,042 mg/mL. This study concluded that the activity of gallic acid as a free radical scavenger was much greater than that of the ethanol extract, n-hexane fraction, chloroform fraction, and ethyl acetate fraction of yellow velvetleaf [22].

The results of testing the antioxidant activity of yellow velvetleaf using the ABTS method (2,2'-azino-bis (3-ethyl benzothiazoline-6-sulfonic acid) obtained values of 900,845 ± 20,346 mM TEAC\*/g dry weight. The total phenol content of yellow velvetleaf plant extracts was 14 334 ± 0.463 mg GAE\*/g dry weight [24].

\*Trolox Equivalent Antioxidant Capacity (TEAC)

\*Gallic Acid Equivalent (GAE)

## 6. Nutritional contents

### 6.1 Vitamin C Content

Vitamin C content in yellow velvetleaf fresh is higher than after the steaming process. Its content of fresh yellow velvetleaf in dry weight was 46.63 mg/100 g. The vitamin C content decreased after steaming. The value of vitamin C in fresh yellow velvetleaf was 46.63 mg/100 g, dropped after 3 minutes of cooking to 43.81 mg/100 g, and at 5-minute cooking, it decreased to 37.34 mg/100 g. Steaming yellow velvetleaf for 3 minutes caused vitamin C levels to reduce by 6.05%, and at 5 minutes, steaming decreased by 20.06%. It showed that the longer the heating time causes the vitamin C content to fall [20].

### 6.2 Vitamin B<sub>1</sub> Content

Another vitamin in this yellow velvetleaf plant is Vitamin B<sub>1</sub> (thiamin). The levels of vitamin B<sub>1</sub> in fresh yellow velvetleaf plants are 0.121 mg/100 g. The benefits of Vitamin B<sub>1</sub> are to treat muscle nerve disorders, such as pain, rheumatism, treatment of Vitamin B<sub>1</sub> deficiency diseases, such as beriberi, fatigue, palpitations, and metabolic disorders [25].

### 6.3 Mineral Content

Mineral content is a nutrient that humans need to support the growth and development process by the body in small or small amounts. The mineral content of yellow velvetleaf can be seen in Table 1 below [20].

Table 1: Mineral Content of Yellow Velvetleaf

No.	Mineral composition	Value (mg/100 g)
1	Phosphorus (P)	3,858.55 ± 139.21
2	Calcium (Ca)	1,892.25 ± 1.86
3	Potassium (K)	6,786.18 ± 50.97
4	Sodium (Na)	574.34 ± 25.57
5	Iron (Fe)	1,924.69 ± 83.59
6	Zinc (Zn)	749.48 ± 18.19

The mineral content of the yellow velvetleaf plant stem is 16.38% greater than the leaves 12.40%. The mineral contents are also related to the fiber content of the cell walls of plant tissues. The content of pectic acid can form salts in plant tissues, including calcium and magnesium. The mineral composition of the yellow velvetleaf plant is calcium, phosphorus, iron, potassium, copper, magnesium, zinc, and sodium [27].

### 7. Phytochemical

The testing of bioactive components can be done by using the phytochemical test method. Phytochemical tests for medicinal plants are needed, it is used to determine secondary metabolite compounds found in medicinal plants that are not used or required for normal body function. However, it has a beneficial effect on health or has an active role in preventing disease in the community. Yellow velvetleaf is known to contain secondary metabolites, namely tannins, quinones, polyphenolic, flavonoids, steroids/terpenoids, sesquiterpenes, and monoterpenes [26]. The results of phytochemical testing can be seen in Table 2 below [20].

Table 2: The results of testing for phytochemical content in yellow velvetleaf

No.	Phytochemical Test	Reagents	Observation Results
1	Steroid	Chloroform, Anhydrous acetate, H <sub>2</sub> SO <sub>4</sub> sensitive t	Bluish-green color
2	Saponin	Hot water, HCl 2N	Foam
3	Phenol Hydroquinone	Ethanol 70%, FeCl <sub>3</sub>	Formed dark green
4	Flavonoids	Mg Powder, Amyl Alcohol	Amyl Alcohol Layer was not formed
5	Alkaloid	Wagner Reagent, Mayer Reagent, Dragendrof Reagent	No Brown, White and Red Deposits.

The results showed that the secondary metabolites found in the leaves of yellow velvetleaf are flavonoids, phenol hydroquinone, reducing sugars, and amino acid. The stem of the yellow velvetleaf plant contains secondary metabolites in the form of flavonoids, reducing sugars, and amino acids. The components of flavonoids and reducing sugars are the main bioactive components produced by yellow velvetleaf plants [27]. The total phenolic content was 5.4 mg GAE/g plants, and total flavonoids were 3.7 mg RE/g plants [20].



The chemical content is the chemical compound found in the yellow velvetleaf plant, which has nutritional value that can benefit public health. The following is a table of the chemical content of yellow velvetleaf plants [20].

Table 3: The Chemical Content of Yellow Velvetleaf

No.	Chemical content	Value (mg/100 g)
1	Moisture content	93.92 ± 0.13
2	Fat content	0.20 ± 0.00
3	Protein content	2.38 ± 0.01
4	Ash content	0.70 ± 0.14
5	Acid insoluble ash content	0.10 ± 0.00
6	Crude fiber content	1.31 ± 0.06
7	Glucose content	2.70 ± 0.00

The ash content was higher in stems than leaves. Limbs had an ash content of 38%, while the leaves had as much as 12.40%. The high ash content of the limbs is caused by some pectic acid and pectin acid, which forms the stem of the yellow velvetleaf plant [27]. High levels of ash can be caused by the high mineral content and soil and water where the plant grows [22]. The fat content in the leaves of the yellow velvetleaf plant is higher than that of the yellow velvetleaf plant. The fat content in the leaves in dry conditions was 7.95%, while in the stem, it was 5.62%. It is because glycolipid is the main component of the yellow velvetleaf plant leaf membrane [27]. The protein content is also higher in the leaves of the yellow velvetleaf plant than in the stems of the yellow velvetleaf plant. The protein in the leaves of yellow velvetleaf was 22.9%, while the limbs were 13.23% in dry condition. The amount of protein content in yellow velvetleaf leaves is due to many chloroplasts in the leaves [27]. The fiber content in standard yellow velvetleaf stems was 16.12%, while in leaf was 11.93%. The fiber content in the yellow velvetleaf stems is caused by the growth of the yellow velvetleaf stems resulting in a build-up of fibers in the limbs [27]. Fiber is needed to help digestion so that the digestive process can work optimally [28]. The fiber content is primarily found in the stem of the yellow velvetleaf plant compared to the leaves. It indicates that the total carotene content is higher in the leaves than in the limbs [27]. The results of the journal review study found that there were 219.01 µg/g carotenoids in the leaves of the fresh yellow velvetleaf plant and 92.99 µg/g in the stems—many in the leaves which cause dark green leaf color [29]. The beta-carotene content in yellow velvetleaf plants can decrease due to the steaming process during processing [20]. Yellow velvetleaf leaves and flowers contain high enough fiber (1.56% and 1.42%), protein (2.04% and 1.98%), and carbohydrates (3.16% and 2.98%). The amino acid analysis results showed that yellow velvetleaf leaves and flowers contained nine types of essential amino acids and eight non-essential amino acids [30].

## 8. Conclusion

An ethnopharmacology review of Yellow Velvetleaf (*Limnocharis Flava*) plants found that the plant is a type of local vegetable whose benefits are rarely known by the public. This plant contains phytochemicals and nutritional compounds that can be beneficial to health. This plant has pharmacological activity as antihyperglycemic and antioxidant. Therefore, this plant has the potency to develop as phytopharmaca.



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#### A Brief Author Biography



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