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The use of bangkal trees (*nauclea sp.*) in the perspective of wetland ethnics

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Abstract. Bangkal is an endemic plant of wetlands that has many benefits. This study aimed to examine the use of Bangkal in the fields of pharmaceuticals and cosmetics, environmental and industrial fields. the subject of the study was a species of *Nauclea orientalis* and *Nauclea latifolia*. The research methodology used was a literature study of related species. The results of the study showed that Bangkal trees had extensive distribution in wetlands, had complete morphology as woody plants and flowering. Bangkal trees had phytochemical compounds which are dominated by alkaloids, flavonoids, tannins, and saponins. Bangkal trees are also used as cultivation wood in the category of fast density with high density and as an erosion controller on the banks of the river.

1. Introduction

Bangkal Trees (*Nauclea sp.*) is a plants that spread throughout Indonesia whose spread covers all of Indonesia and in various parts of other continents and in other parts of the continent. The distribution area of this species in the world includes from Sri-Lanka, Indo-China, to Papua New Guinea [1]. In Indonesia, these plants are spread from Java, Kalimantan, Sulawesi, Maluku and Papua [2,3]. It shows that the high population and level of distribution of plants.

Bangkal Trees is the name of the people of South Kalimantan for this type of trees (*Nauclea sp.*). There are many names of other areas for these species, such as Gempol (Sunda), Klepu Sand (Java), and Lonkida (Sulawesi) [3,4]. Bangkal is a local name for plants in the genus name *Nauclea*, Rubiaceae family in the form of wetland habitat (freshwater swamps, riparian or floodplain) [5]. Bangkal has the most growing area in periodic flooded land. Bangkal adapts well in the swamp ecosystem [6,7], peatlands, forest along flowing rivers and flooded areas [6,8,9]. Bangkal is a plant that adapts well, especially in wetlands.

Indonesia has a vast wetland area. According to International Wetland (2009), the area of wetlands in Indonesia is more than 40 million hectares spread across various islands. South Kalimantan has more than 10 thousand hectares of wetlands. From the 13 types of wetland characteristics according to FGDC (2013), types of wetlands in Kalimantan include brackish, coastal strip, forested wetland, shrub, and river beds [5]. This is evidenced by the large number of areas affected by tides, periodic and permanent swamps and flowing rivers.

Bangkal is one of the resources utilized by the swamp community. This trees is a type of multipurpose tropical trees, namely as a wood producer to meet the needs of the timber industry [10],

medicinal ingredients [1], and as a crop for agroforestry, phytoremediation and rehabilitation of degraded land, especially wetlands [11–13].

Utilization of Bangkal trees is an example of local wisdom derived from community knowledge (ethnoscience). According to Ahimsa (2007) ethnoscience is a cultural paradigm in the form of the results of thought (science) which is implied in the habits of society for generations. This statement is reiterated in Muslim (2010) that ethnoscience is local knowledge which is only possessed by certain people. Ethnology in the field of utilization studies is based on the use of indigenous in the life of the people especially in South Kalimantan.

In Kalimantan this plant have high economic value. The bark is used for cold powder mixture while the wood is for building materials [5]. It shows the amount of Bangkal trees used by the society [14]. This species is used almost all parts of its body.

Bark and wood are just one example of the many uses of Bangkal trees. There are many studies evaluating the results of Bangkal plants internationally. However, the source of literature about this plant is limited in Indonesia. Therefore it is necessary to have a special study of Bangkal plants as a provider of additional information.

The purpose of this study is to examine the Bangkal trees and its use in the pharmaceutical and beauty, environment and industry. Through the literature review, scientific facts and reasons for the utilization of the part of the Bangkal plant by the society as local knowledge (ethnoscience), especially the wetland society. Another aim of this study is to add to the literature study on the summary of the results of existing research on Bangkal plants. The usefulness of research is as a source of information about the utilization of the Bangkal trees, which is seen from a scientific perspective with empirical evidence in the form of existing research.

2. Discussion

Based on the results of the literature study conducted there are three types of generalization of Bangkal plants, namely: (1) Bangkal plants can be used as phytoremediation agents of polluted wetlands based on their ecology; (2) Bangkal plants have phytochemical compounds that are predominantly used for medicine (pharmacological) and beauty (cosmetics); and (3) Direct physical use as a wood industry needs.

The Bangkal trees (*Nauclea*) is generally known and spread in two large species namely *Nauclea latifolia* and *Nauclea orientalis*. *Nauclea* sp. is a genus of the family Rubiaceae which has a characteristic, tap root with hairy root, green leaves, pinnate, thin soft flesh of leaves with rounded leaf stalks, stems vertically twisted and rounded, stemmed flowers sitting at the top of the base of the child leaves and fragrant when blooming [5].

2.1. Bangkal phytochemical compounds for treatment and beauty

Phytochemical compounds are chemical compounds derived from the extraction of plants and usually located in tissues throughout the body of plants with certain types and amounts. Phytochemical compounds in Bangkal trees are dominated by flavonoids, alkaloids, saponins, tannins and glycosides. Phytochemical compounds have been studied and are known to be contained in the body parts of the Bangkal plant.

The following are data that contain phytochemical contents contained in specific parts of the Bangkal plants *Nauclea latifolia* and *Nauclea orientalis*.

Table 1. Phytochemical Content in Parts of Bangkal Plants

Part of Plant	Contents	Reference
Root skin	Tannins, flavonoids, alkaloids, saponins, cardiac glycosides, terpenoids, steroids, carbohydrates, glycoalkaloids, indolo-quinolizinin, Vitamin A, vitamin C	[15–17]

Incrustation	Alkaloid, glikosida Jantung, terpen, saponin, tanin, flavonoid, antrakuinon, steroid, glycoalkaloids, asam hidrosianat, fenol kuinon, resin, Vitamin A, Vitamin C Dan, polifenol, karotenoid, limonoid, xanthonoids, balsam, phlobatannins	[16–20]
Leaf	Alkaloids, tannins, saponins, glycosides, anthraquinones, carbohydrates, flavonoids, phytates, isoflavonoids, phlobatnins, cardenolid, phenols, terpenoids, cardiac glycosides	[21–26]
Fruit	Tannins, alkaloids, flavonoids, saponins, phytates, cyanogenic glycosides, phosphates, anthraquinones, coumarin, monoterpenes, fatty acid esters	[27,28]
Root	Tannins, saponins, alkaloids, terpenes, cardiac glycosides, flavonoids, anthraquinones, sugars, alkaloid derivatives (strictosamide, vincosamide, pumiloside, quinovic acid glycosides), phenols	[29]
Skin	Monoterpenes indole alkaloids- nucleamides AE	[30]

Table 2. The Use of Chemical Compounds and Diseases That Can Be Cured

Reference	Contents
[31]	Therapeutic treatment
[32–34]	Malaria, leprosy, hypertension, digestive disorders, improving menstrual flow.
[35]	Tonic, antipyretic, antidepressant, analgesic, diarrhea and dysentery
[36]	Diarrhea, dental caries, oral infections, diabetes
[37]	Worm medicine, gastrointestinal cytoprotection in sheep
[22,38]	Fever, jaundice, malaria, diarrhea, dysentery, hypertension, diabetes and anti-bacterial.
[39]	Antimicrobial
[40]	Anti-inflammatory and edema in malaria
[29,36,41]	Hypertension, diabetes, anticonvulsant, antipyretic, analgesic, anxiolytic, and sedative

2.2. *Bangkal Trees As A Mixture To Make Cold Powder (Bangkal Powder)*

Bangkal powder is a product of etnosains Hulu Sungai society in South Kalimantan. It is one of a traditional face cold powder that has been used for generations. Bangkal powder manufacture using material from rice flour mixed with trees bark of Bangkal. The use of this powder has a cold sensation on the skin, it's believed to protect the skin from the sun, remove the black spots on the face, treat acne and eliminate red rash on the skin. The use of Bangkal powder from the knowledge society based on habit, then leads to a belief that is used for generations.

Phytochemical compounds contained in Bangkal trees bark has long been used. The people of South Kalimantan, especially in the Hulu Sungai, make the bark of Bangkal trees a mixture of cold powder. It has become a legacy for generations by the people of South Kalimantan. Traditional household scale production is most often found in the Hulu Sungai Tengah [5]. According to local people, using cold powder of a mixture of wood flour or tems Bangkal powder is believed to prevent sunburn, treat acne, whiten the face, and soften the skin.

Until now Bangkal pupur is still used for activities in the fields or as a cold powder at home. By the people of Hulu Sungai Tengah other than as cold powder, Bangkal bark is also used as a body scrub for traditional body care. Society's perception of the efficacy of Bangkal powder is indeed true that

bark from a Bangkal trees contains flavonoids which are used for SPF (Sun Protection Formula) material which prevents the negative effects of UV-B [39]. UV-B is the type of UV rays that cause sunburn also causes black spots on the face.

Bangkal trees bark does contain anti-UV compounds in the form of phenol hydroquinone, flavonoids, steroids, and saponins [17,18]. These compounds have the ability to protect the skin by sun exposure with the category of extra and maximum protection. The content of the Bangkal trees has similarities with the composition of phytochemicals that become compositions in the manufacture of skin care products. Herbal cosmetic products all take phytochemical extracts from plants. Phytochemical function itself as an antioxidant, antibacterial, anti-UV and as a sedative for the skin.

2.3. Bangkal Trees As Phytoremediation Agents of Polluted Wetlands

Polluted wetlands are areas of swamps, rivers, lakes that are polluted by heavy metals and acidic substances such as mine acid water. Wetlands have long been developed to reduce various industrial, mining and domestic activities [42]. Wetlands are lowlands that often become fields and reservoirs of water. This is the reason why wetlands are being studied for the remediation of water contaminated with acid mine or heavy metals [43,44].

The remediation process in wetlands naturally occurs with the help of plants called phytoremediation. This activity is based on the plant's high tolerance limits to the pH range of the habitat and the ability to accumulate contaminants. That foundation is the basis that not all plants can be used for phytoremediation.

The selection of the right plant type determines the success of the phytoremediation process [45]. Appropriate plant indicators for phytoremediation in wetlands especially swamps are adaptive plants at low pH (acid), toxic to heavy metals and their ecology is resistant to permanent or periodic swamp inundation [6]. One of the plants that has the potential as a phytoremediation agent is a Bangkal trees (*Nauclea* sp.).

Bangkal has a fairly wide distribution area compared to other types of wetland plants which usually have a narrow ecology [46]. Bangkal has the most growing area in periodic flooded land. Bangkal adapts well in the swamp ecosystem [6,7], peatlands, forest along flowing rivers and flooded areas [6,8,9]. Bangkal is a plant that adapts well in wetlands, especially swamps.

Lonkida (Bangkal) including multipurpose plants (land rehabilitation, medicine and wood production), this type qualifies as an agent of phytoremediation because adapt well in conditions puddle (peatland) [13] and has the ability to accumulate heavy metals in stagnant roots. Bangkal has the potential as a fitoremedian of acid mine water with alkaloid compounds contained in it [6]. Phytoremediation by Bangkal is carried out by the process of rhizofiltration and symbiosis with Arbuscular mycorrhizal fungi as phytostabilization. Bangkal is tolerant of heavy metal toxicity, and is able to absorb and accumulate Fe>Mn>Zn>Cu>Pb>Cd.

Other studies have shown that Bangkal is also resistant to Hg in the wild. Bangkal have high levels of resistance to Hg of >70% and thus potentially heavy metal contaminated land in the form of mercury [47]. Mercury waste is produced by several types of factories such as the agricultural industry, paint factories, paper factories, and electrical equipment factories as well as electrical waste such as batteries.

2.4. Direct Physical Use As A Wood Industry Needs

Bangkal wood has long been used in the production of building materials. Bangkal is a producer of forest wood that can be developed through agricultural methods and grows well in swamps [7]. Bangkal trees as a producer of wood to meet the needs of the timber industry [1,10]. The physical use of wood has been used on an industrial scale.

Bangkal wood has a great opportunity to be developed on an industrial scale for carpentry wood, paper pulp, flooring furniture, molding, wrapping boxes, sculpture, and engraving. Gempol / Bangkal is a fast growing plant species which is a requirement for cultivation in the timber industry [6,7]. Bangkal wood is often used with durability and ease of reasons to be formed. Bangkal wood is in the

durable class IV, soft wood texture and easy to cut, with wood density reached 560 Kg/m³ and 85% have erect stems and wide canopies [48]. Its use in building materials is often in window and door frames, *internal flooring*, veneer and plywood.

Aside from being a building material, physical utilization of Bangkal plants can also be used for agroforestry, phytoremediation and rehabilitation of degraded land. Bangkal is used as an erosion control where the roots are able to withstand the loss of soil mass, especially in river areas, wide canopy of microclimate in the ecosystem.

3. Conclusion

Bangkal Trees (*Nauclea* sp.) is an endemic wetland plant that has a very wide habitat distribution. The adaptation process of Bangkal trees in wetlands is very good with a fast growth rate. Through the existing literature, the results of the study stated that the Bangkal trees (*Nauclea* sp.) Has extensive ecology in wetlands, complete morphology as woody and flowering plants, and has various phytochemical compounds dominated by alkaloids, flavonoids, tannins and saponins. The use of phytochemicals in the pharmaceutical and beauty field is for the treatment of internal organs as well as anti-microbial and anti-UV. Utilization in the environmental field is for phytoremediation agents of land polluted by acid and heavy metal waste by Hg, Fe, Mn, Zn, Cu, Pb and Cd. Bangkal wood is also used in the industrial sector as cultivation wood with a fast growth category and high wood mass density and roots as erosion control on the river bank.

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