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Research article

A note on Aroids Ethnobotany in Hau River, Vietnam

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Abstract: Araceae family is the member of Order Arales. This family is best characterized by flowering plants, which have inflorescence in the spadix. Nowadays, Araceae becomes the most familiar plants to humans and also catogarized as an economic group. A large amount of Araceae has been largely planted, especially in Vietnam, a densely populated country. In Mekong Delta of Vietnam, the demands of using aroid species are increasingly popular. An investigation into use values of Araceae is conducted along Hau River, one of two largest branches of Mekong River in Vietnam. Households living along river banks are interviewed through questionnaires. From the result, there are 18 species of Araceae which role as decorative and ornamental plants such as *Dieffenbachia maculata*, *Anthurium andreanum* and *Aglaonema nitidum*. Another six species are cultivated as food plants for human as same as for feeding cattle, such as *Alocasia*, *Colocasia* and *Xanthosoma*. In medical field, 10 aroid species are used by locals, but some treatments have not been scientifically verified. Only five species been used for feeding cattle.

Keywords: Araceae - Aroid species - Ethnobotany - Hau River.

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INTRODUCTION

The family Araceae is one of the common monocotyledonous flowering plants in the world and has a total of 117 genera and more than 3790 species (Nauheimer 2012). According Mansor *et al.* (2012), Araceae is also one of the largest families in the world after the orchids, grasses and sedges. Most of the species are found in tropical areas. Nowadays, Araceae is becoming more familiar to humans and recognized as an important source of food, ornamental plants (Truyen 2015) in proceeding). The local inhabitants have used aroid early in cooking, religious ceremony and medical purposes. Some species rich in carbohydrate have provided crucial food for million people in the world (Truyen 2015) in proceeding). The *Colocasia* species have been used for fermenting vegetable, feeding to fish and pigs (Nunes *et al.* 2012). Pemberton & Liu (2009) stated that Araceae has large beneficial commercial values, especially for ornamental industry. This family has been used widely in horticultural industries and home decorations such as *Xanthosoma sagittiffolium*, *Alocasia denudate*. Based on Henderson (1954), *Aglaonema* species been used in decorations. In addition, species of Araceae has been utilized for medicinal purposes, as mentioned by Chilpa & Estrada (1995).

In Vietnam, some species have been found to have curative values. For example, Dan (2011) stated that local people use *Alocasia macrorhizos* to treat gout, flu and beriberi, *Typhonium trilobatum* to cure asthma and vomiting and snakes (Fang *et al.* 2012). *Lasia spinosa* can cure hepatitis, malaria, rheumatism, backache, arthritis, orchitis and cough (Hai 2012). On the other hand, another useful value of aroid species is identified from the chemical constituents of *Typhonium flagelliforme*, an indigenous plant of Malaysia that is often used as an essential ingredient of herbal remedies for alternative cancer therapies (Choo *et al.* 2001). This plant has anti-proliferative properties towards human cancer cell lines and has been used to treat cancer (Lai *et al.* 2010).

MATERIALS AND METHODS

Hau River is located in Mekong Delta in Vietnam, which is the lowest part of Mekong River with an extremely high human population and highly disturbance (Fig. 1). Mekong Delta alone has about 18 million inhabitants (40,000 km^2). Hau River reflects a highly modified environment by human intensive agricultural

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activities. The survey of aroids ethnobotany along Hau Rivers conducted in order to record the usages of Aroid species as economic plants such as for decoration, foods and medical utilization in the different riverine communities. This will provide a supplement to future research in Mekong Delta in the next years.

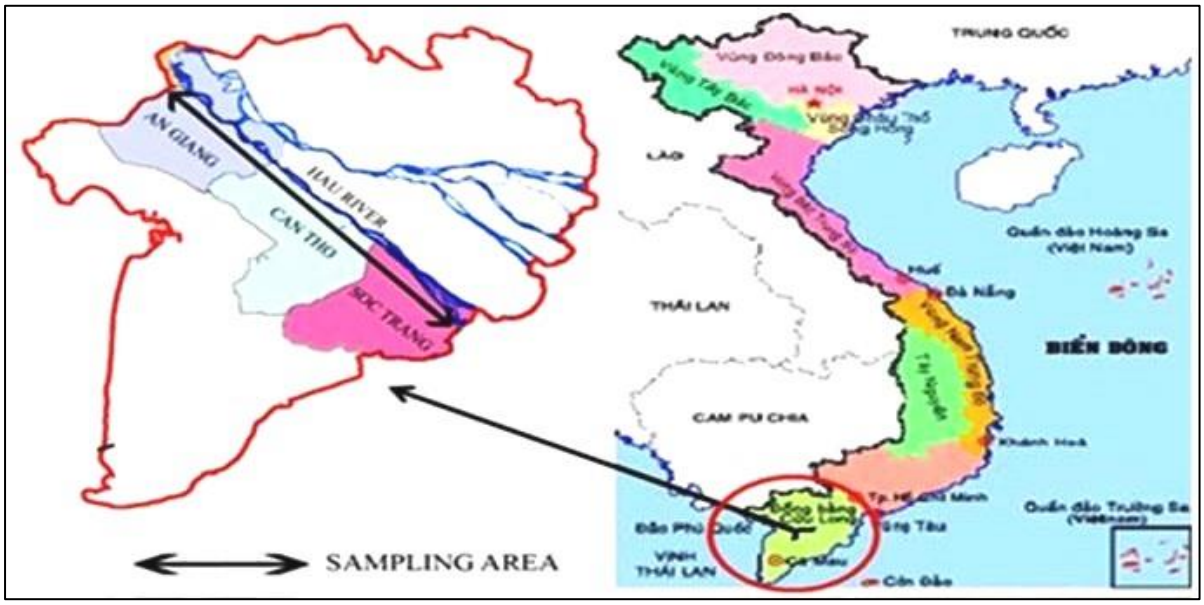

Figure 1. Location of study area.

The information on the documents of the Araceae family of Ho (1991), Mansor *et al.* (2012) and the map of the Mekong Delta in 2009 was used to survey the ethnobotany of aroid species along Hau River. Using the line transect to survey. The line selected must go through the habitats of species (Nguyen *et al.* 2010, Nguyen & Bushnell 2010). The main line goes along the Hau River, through 3 cities with different populations (lowly populated, middle populated and highly populated areas) (Fig. 2).

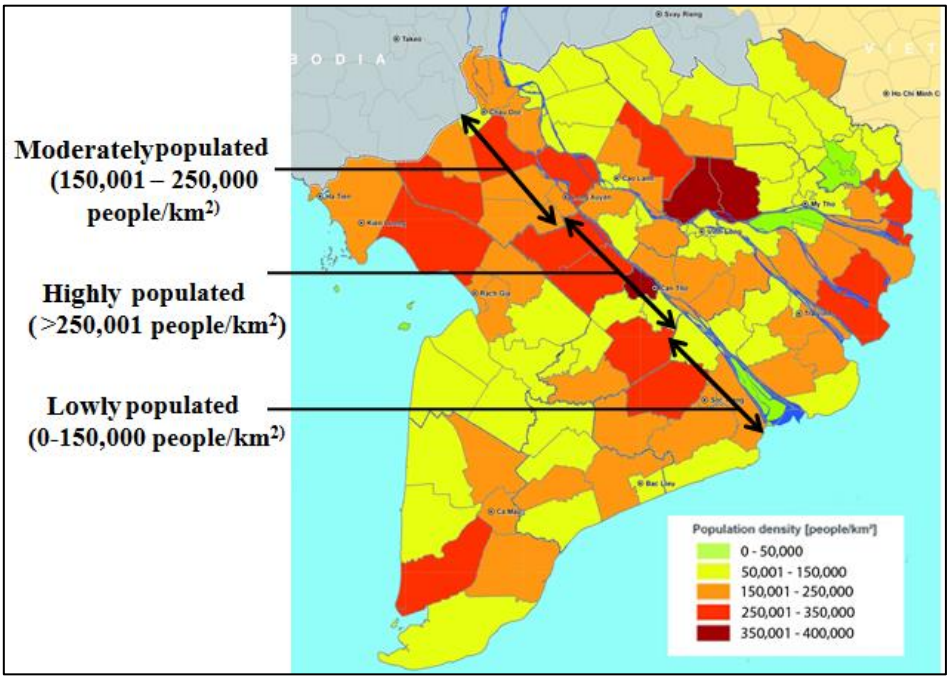

Figure 2. The 3 different populated areas along the Hau River, Mekong Delta, Vietnam. (Source: http://www.wisdom.caf.dlr.de/en/content/population-density-districts-2004.html)

Survey from brackish water area to fresh water area based on the salinity map of the Mekong Delta in 2009 and survey from high land along the riverbanks (not flooded) to the low land (deep flooded), from alluvium soil to alum soil based on the soil map of the Mekong Delta in 2000. Use the GPS to mark the locations where find the aroid species. At each location, collect the plants (leaf, flower and roof) and take the photos of the plant to

identify the scientific names in the laboratory. Interview the local people at surveyed location by using the conducted questionnaires about the use values of the species.

RESULTS

The selected three populated zones of Hau River shows the different percentages of use values (Fig. 3). Generally, there is a significant difference between five use values such as for food, medicine, ornamental, wastewater purification and feeding in Hau River. Based on the results, aroid species are widely used for ornamentation while wastewater purification purpose is not observed. In lowly populated zone, the highest percentage is 39.6% for ornamental purpose whereas the smallest is 8% for medical purpose. Aroid species were also used for food with 34.8% and feeding with 31.3% in low populated zone. These numbers changed in moderately populated zone, the highest percentage is 44% for medicine. Feeding purposes were noticed more than ornamental purposes, with 37.5% in compared to 34.9%. In highly populated zone, aroids were used for food and medical purposes (41.3% and 48% respectively). Ornamentation was the last one with 25.5% in highly populated zone.

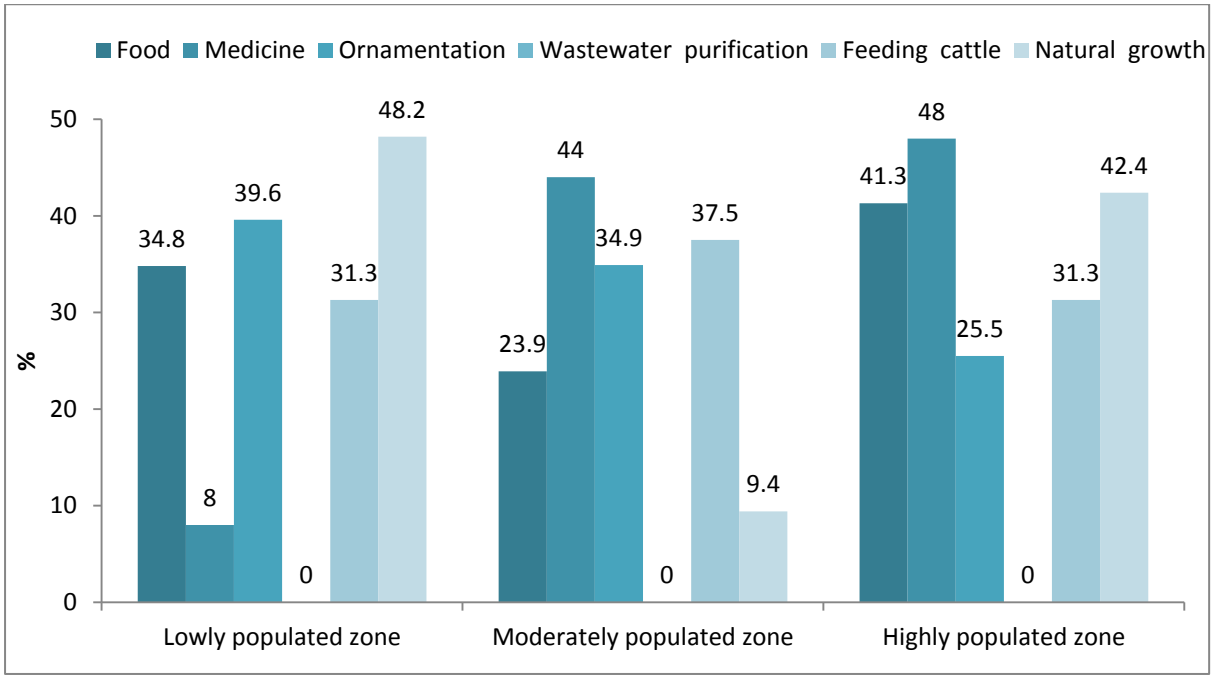

Figure 3. The total percentage of aroid using values in Hau River based on three different zones.

From the results of aroid ethnobotany in Hau River as shown in table 2, the number of aroid species in ornamentation reaches the peak of 18 plants. Furthermore, the high number of aroid species for medical purpose is 10, followed by food and feeding cattle with 6 and 5 aroid species respectively (Table 1). There is no aroid species which is used for wastewater purification purpose in Hau River.

Table 1. Aroids ethnobotany in Hau River.

No.	Species	Food	Medicine	Ornamentation	Wastewater purification	Feeding cattle
1	*Acorus verus*	-	+	-	-	-
2	*Aglaonema commutatum*	-	-	+	-	-
3	*Aglaonema* hybrid	-	-	+	-	-
4	*Aglaonema nitidum*	-	-	+	-	-
5	*Alocasia macrorrhizos*	-	+	+	-	+
6	*Amorphophallus konjac*	-	+	+	-	-
7	*Anthurium andreanum*	-	-	+	-	-
8	*Caladium bicolor*	-	+	+	-	-
9	*Colocasia antiquorum*	+	-	-	-	-
10	*Colocasia esculenta*	+	-	-	-	+

11	*Colocasia gigantea*	+	-	-	-	+
12	*Cryptocoryne ciliata*	+	-	-	-	+
13	*Dieffenbachia amoena*	-	+	+	-	-
14	*Epipremnum giganteum*	-	-	+	-	-
15	*Epipremnum pinnatum*	-	-	+	-	-
16	*Lasia spinosa*	+	+	-	-	-
17	*Philodendron erubescens*	-	-	+	-	-
18	*Pistia stratoides*	-	+	+	-	+
19	*Pseudocracontium lacourii*	-	-	+	-	-
20	*Scindapsus officinalis*	-	+	+	-	-
21	*Spathiphyllum patinii*	-	-	+	-	-
22	*Syngonium macrophyllum*	-	-	+	-	-
23	*Syngonium podophyllum*	-	-	+	-	-
24	*Typhonium flagelliforme*	-	+	-	-	-
25	*Typhonium trilobatum*	-	+	-	-	-
26	*Xanthosoma sagittifolium*	+	-	-	-	-
27	*Zamioculcas zamiifolia*	-	-	+	-	-
	Total	**6**	**10**	**18**	**0**	**5**

Note: +, Present; **-**,Absent.
Aglaonema hybrid: *Aglaonema* hybrid "Silver Queen" (*Aglaonema curtis* x *Aglaonema treubii*).

Based on the results in table, some aroid species have been used for more than one purpose. Only *Alocasia macrorrhizos* and *Pistia stratoides* were used for three use purposes, such as medicine, ornamentation and feeding. Besides, *Lasia spinosa* was used for food and medical purposes. There are some aroid species exploited for medicine and ornamentation, namely *Alocasia macrorrhizos*, *Amorphophallus konjac*, *Caladium bicolor*, *Dieffenbachia amoena* and *Scindapsus officinalis*. Moreover, three aroid species were used for food and feeding cattle, namely *Colocasia esculenta*, *Colocasia gigantea* and *Cryptocoryne ciliata*. However, out of 27 aroid species in Hau River as shown in table 2, *Acorusverus*, *Typhonium flagelliforme* and *T. trilobatum* were only used for medical purposes. For food, there were only 5 species mentioned, such as *Colocasia antiquorum*, *C. esculenta*, *C. gigantea*, *C. ciliata* and *Xantho somasagittifolium* (Fig. 4). In these species, except *X. sagittifolium*, four aroid species mentioned above have also used for feeding cattle.

Figure 4. Some aroid species: **A,** *Colocasia esculenta*; **B,** *Typhonium trilobatum*; **C,** *Colocasia gigantea*; **D,** *Caladium bicolor*.

DISCUSSION

Out of 27 species reported in Hau River, *Colocasia esculenta* distributes widespread from upstream to downstream in many different niches and be found with high frequency of appearance. *C. esculenta* been used as food, feeding cattle and medicine, the number of natural growing species decreased significantly.

The corms of *C. esculenta* are taken as starch in every meal. Locals steam, peel and mash corms with water. Then, it can be used when fresh or kept for one or two days at room temperature. In addition, the young leaves of *C. esculenta* are used as vegetables and cooked with meat and fish. Another way to cook *C. esculenta* is the stems as a snack. Stems are also soaked in vinegar and fermented for use as vegetables. *Alocasia maccrorrhizos* and *X. sagittifolium* are also used like *C. esculenta*. According to Schultes (1984), the corms of *C. esculenta* contain high carbohydrates but low in fat and protein. Nevertheless, this species also has calcium oxalate, which causes toxic reactions to the throat if the calcium oxalate is not removed before eating. That is why in preparation for eating, the local communities boil, wash and mash the corms to reduce oxalate content.

Araceae has become more and more important in people diet nowadays. *C. esculenta*, a tuberous plant whose tuber is the 14th most consumed food crop in the world (Nunes *et al.* 2012). *Monsteradeliciosa* is also a valuable species for food (Berlingeri & Crespo 2012)**.** Some species are esteemed as food plants (Heng & Zhi-Ling 2006) such as *A. macrorrhizos*, *Amorphophallus paeoniifolius*, *Amorphophallus xiei*, *C. esculenta* and *X. sagittifolium*. These are cultivated as sources of carbohydrate foods (Chen *et al.* 2007). Many genera are used for feeding cattle (Zarate *et al.* 2012).

Araceae has a good nutrients profile, and may be used as fish food components and used in some local communities replace costly commercial feed. With its potentiality as fish food component the utilization of Araceae in the preparation of fish, feed is an opportunity for livelihood improvement to rural people, since aquaculture is now one of the fastest growing sectors in agriculture (Mandal *et al.* 2010). Moreover, Schultes (1984) has also stated that fresh taro corms and leaves and stems can be used as an animal feed, although half of fresh weight of this plant is not utilized.

Other use values of aroids are for ornamental purposes. This includes the giant taro, *A. macrorrhizos*, and Chinese taro, *Alocasia cucullata*, both of which are important ornamentals (Nauheimer *et al.* 2012). In addition, many other genera in the Araceae which are used as ornamental plants are *Aglaonema*, *Caladium*, *Dieffenbachia*, *Epipremnum* and *Nephthys* genera (Stanly *et al.* 2012). Moreover, the genus *Philodendron* that plays an important role in the rainforest ecosystems are also used interior decoration of homes and offices.

Aroids are used in medicine in many traditional cultures. This important characteristic of aroids has not been fully appreciated (Chen *et al.* 2007). *X. sagittifolium* Schott. is a medicinal species used in traditional Brazilian medicine to prevent and treat osteoporosis and bone diseases (de Oliveira *et al.* 2012). Hundreds years ago, in India, Indonesia and China, *Acorus calamus* L. has been used as medicine for diabetes in traditional folk medicine (Wu *et al.* 2009). A valuable source for glycosidase inhibitors is *Aglaonema treubii* that is used as anti-diabetic, anti-metastatic, antiviral, and immunomodulatory agents (Chen *et al.* 2007).

CONCLUSION

Aroids are widely used in Mekong Delta particularly for food, feeding, medical treatment and ornamental purposes. In which, ornamentation is concerned the most, followed by medical purpose. Besides, aroid species are used popularly in highly populated zone more than in two other zones.

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