Traditional Knowledge of Halophytic Species in Coastal Provinces of Vietnam

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Research Article

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Abstract

Present study aims to document the traditional knowledge and the distribution of diverse halophytes used by the coastal community of Vietnam to compensate for the food, fodder, and medicine demands. The information was gathered from the local people, plant traders, and herbalists using semi-structured questionnaire. The survey indicated the ethnobotanical uses of 11 plant species from 8 families in the targeted area. 60% of studied plants were used in more than 2 different ways in which the majority of halophytic species possessed medicinal values, followed by being culinary, fodder, roof thatching, handicraft, and growing medium. The main diseases in the regions were joint and stomach pain. According to the mode of preparation, decoction form was the predominance with 64% over all modes. Base on the result, *Cocos nucifera* L., *Portulaca oleracea* L., and *Suaeda maritima* (L.) Dumort. had the highest appearance frequency of 17%. In addition, seashore was the most prevalent location of halophytes in which it was the inhabit of 5 out of 11 species. The predominant habit recorded was herbs, followed by shrubs, trees, and vines.

Introduction

Approximately 380 million hectares (ha) of agricultural land area were affected by saltwater encroachment in 2003 (Mike, 2003). Later, in 2021, salt-affected soils covered over 480 million hectares (about 10 percent) of the world's cultivated land (FAO, 2021), which witnessed the growing impact of saline intrusion. Vietnam is a country with abundant marine resources, up to 1.7 million hectares of land are flooded with salt water every year (Van Nguyen & Maeda, 2015). According to The Global Climate Risk Index, Vietnam is ranked as one of six countries most vulnerable to climate change in the period 1999–2018 (Eckstein et al., 2019).

Halophytes are saline environmental adapted plants that are commonly found in seawater areas, salt-water marshes, or salt deserts (Flowers et al., 1986). Halophytes have been considered an agroecological solution for adapting and sustainable agriculture in the context of climate change in many areas (Duarte & Caçador, 2021; Hamed et al., 2021). In addition, halophytic species have been used as alternative food (Duarte & Caçador, 2021), fuel (Glenn et al., 1999), fodder (Abdal, 2009), fiber, essential oils, ethnomedicinal uses (Qasim et al., 2011), an additional source of income (Ben Hamed & Custódio, 2019; Robertson et al., 2019) for farmers, and can be suggested as a method to remediate salinity (Lastiri-Hernández et al., 2020; Saddhe et al., 2020). However, many halophytic species have been neglected, underutilized, and not yet attained commercial production (Rao et al., 2013; Scarano et al., 2021). Although many studies have documented the indigenous knowledge of plant species in many regions of Vietnam, very few studies have been focused on halophytic species. Hence, the purposes of this paper were to document the traditional knowledge and the distribution of diverse halophytes used by the local communities in coastal provinces of Vietnam. It contributes to design strategies for the conservation & sustainable utilization of halophytes in Vietnam; and provides these data sources for scientific researchers worldwide.

Materials and Methods

Site selection

We conducted field visits to ten (10) Vietnamese coastal provinces that belong to three (3) natural regions viz., Hai Phong, and Thai Binh (Red River Delta); Nghe An, Ha Tinh, Quang Binh, Quang Tri, and Thua Thien Hue (North Central Coast); Da Nang, Quang Nam, and Quang Ngai (South Central Coast) in which Red River Delta region is characterized by the humid subtropical climate, while North Central Coast and South Central coast have a tropical monsoon climate. Particularly, we chose thirty (30) different communes in which seawater intrusion had detrimental effects on agricultural production. The agricultural production of both rice, which is a predominant crop, and other conventional crops is inefficient. Hence, many arable land areas in those communes are becoming wastelands, this circumstance is directly attributed to seawater encroachment and freshwater shortage.

Data collection

Information was collected from plant collectors, plant traders, salt makers, traditional healers, herbalists. The priority was given to elders, who have better indigenous knowledge than young generation, and rural dwellers, who are the actual users of the plants. Interviews was conducted by using semi-structured questionnaire (Martin, 2010). During the interviews, information about particular plants was collected for their local names, plant parts used, uses, ailments, mode of preparation and administration. Plant's traditional medicinal uses, which are supported by at least five (5) different users.

For each located species, we recorded the coordinates by using a Garmin GPS (Garmin eTrex 10; Garmin Ltd. Kansas USA). We then used Google Earth or Google Maps to verify all coordinates to ensure accuracy.

Results and Discussion

Distribution

Eleven (11) halophytic species, which belong to seven (8) families were identified along the coastline of Vietnam, and they were widespread from the North to the South in their edaphoclimatic conditions in nine provinces (Fig. 1). A total of 82 geospatial coordinates of 11 species was recorded, and visualized on the international administrative boundaries and provincial Vietnamese administrative boundaries combined with raster layer of elevation as a background layer. *Ipomoea pes-caprae* (L.) R.Br. had the highest appearance frequency of 33% (27/82 locations), followed by *Cocos nucifera* L., *Portulaca oleracea* L., and *Suaeda maritima* (L.) Dumort. (12% eq. to 10/82 locations), *Chenopodium album* L. (9% eq. to 7/82 locations), and other species (< 6% eq. to < 5/82 recorded locations).

All plant species are alphabetically arranged to mention the botanical name, family, local name, and location (Table 1).

Table 1
Vernacular name and recorded locations of halophytic species in the coastal provinces of Vietnam

No.	Species	Family	Vernacular name	Location
1	*Canavalia rosea* (Sw.) DC	Fabaceae	Đậu biển	R, Ss
2	*Cocos nucifera* L.	Arecaceae	Dừa	Ss
3	*Cyperus stoloniferus* Retz.	Cyperaceae	Cỏ gấu	R, Ss
4	*Chenopodium album* L.	Amaranthaceae	Rau muối	W
5	*Ipomoea pes-caprae* (L.) R.Br.	Convolvulaceae	Muống biển	Ss, Sf
6	*Nypa fruticans* Wurmb.	Arecaceae	Dừa nước	E, M
7	*Portulaca oleracea* L.	Portulacaceae	Rau sam	Sf
8	*Sesbania sesban* (L.) Merr.	Fabaceae	Điền thanh	R, W
9	*Sesuvium portulacastrum* (L.) L.	Aizoaceae	Hải châu	Sf
10	*Suaeda maritima* (L.) Dumort.	Amaranthaceae	Rau nhót	Sf, W
11	*Vitex rotundifolia* L.f.	Lamiaceae	Màn kinh tử	Ss

Key: *E* estuaries, *M* Mangroves, *Sf* Salt fields, *Ss* Seashore, *R* Roadside, *W* Wastelands.

These plants were commonly found in estuaries, salt fields, wastelands, sand dunes, and at the edges of salt flats. 45% of studied halophytic species inhabit in the seashores (5/11 species), where are mostly sandy soils with relatively high salinity, following by salt fields and roadsides (36% for each location), wastelands (27%), estuary (9%), and mangrove (9%). Indeed, those plants are seasonally exploited by local people and habitants as alternative sources of food, feed, and medicine owing to their cultural familiarity and easy accessibility. However, local farmers have not attained to cultivate these wild food plants in home gardens, nor process to improve their productivity or quality, thus the majority of these species were still underutilized, and were prevented from realizing their full potential.

Ethnobotanical uses

Table 2
Ethnobotanical uses of halophytic species in the coastal provinces of Vietnam

No.	Species	Habit	Life form	Part used	Preparation	Use
1	*Canavalia rosea* (Sw.) DC	V	P	P, S	Cooked	Culinary
				S	Powder	Fodder
				S	Decoction	Antiemetic, detoxification, abdominal pains
2	*Cocos nucifera* L.	Tr	P	Sl, Lq	Raw, cooked	Culinary
				Sh	Dried	Handicrafts
				L	Dried	Roof thatching
				C	Dried	Growing medium
				C, Sl	Burned powder	Joint pain, pain
				Fl	Poultice	Fever
3	*Cyperus stoloniferus* Retz.	H	P	T	Powder	Stomach pains
				T	Decoction	Dysmenorrhea
4	*Chenopodium album* L.	H	A	Sh, L	Cooked	Culinary
				WP	Decoction	Urinary retention, stomach pain, diarrhea, toothache
5	*Ipomoea pes-caprae* (L.) R.Br.	V	P	WP	Decoction	Rheumatism, urinary retention, hemorrhoid
				WP	Poultice	Burn, skin inflammation
6	*Nypa fruticans* Wurmb.	Tr	P	Sl	Raw, cooked	Culinary
				L	Dried	Roof thatching
7	*Portulaca oleracea* L.	H	A	Sh, L	Raw, cooked	Culinary
				WP (exclude R)	Decoction	Pain, inflammation, appendix inflammation, stomach inflammation, cardiovascular diseases, detoxification

No.	Species	Habit	Life form	Part used	Preparation	Use
				WP	Poultice	Skin inflammation
8	*Sesbania sesban* (L.) Merr.	Shr	P	Fl	Raw, cooked	Culinary
				Sh, L	Raw	Fodder
				L	Water extract	Anthelminthic, inflammation
				S	Poultice	Itchy skin, skin inflammation
				R	Poultice	Acne, Carbuncle
9	*Sesuvium portulacastrum* (L.) L.	H	P	WP	Decoction	Influenza
10	*Suaeda maritima* (L.) Dumort.	Shr	A	Sh, L	Raw, cooked	Culinary
11	*Vitex rotundifolia* L.f.	Shr	P	F	Decoction, alcoholic extract	Detoxification, fever, headache, dizziness, eye socket pain, menstruation

Key: H Herb, Shr Shrub, Tr Tree, V Vine; A Annual, P Perennial; Fl Flower, Fr Fruit, L Leaves, P Pod, R Root, S Seed, Sh Shoot, T Tuber, WP Whole plant, C Coir, Lq Liquid endosperm, Sl Solid endosperm, Sh Shell.

Ethnobotanical information of eleven (11) species of halophytes distributed in eight (8) families is reported for 6 different traditional usages (Table 2). These include species for medicine (9), culinary (7), fodder (2), roof thatching (2), handicraft (1), and growing medium (1). Specifically, the majority of species possess medicinal value, which is proven by the exploitation of local inhabitants for treating various ailments for a long duration. The main diseases in the areas were a pain in joints and stomach, inflammation, fever, and urinary retention. The dominant families are Amaranthaceae, Arecaceae, and Fabaceae with two (2) species each, followed by Aizoaceae, Convolvulaceae, Cyperaceae, Lamiaceae, and Portulacaceae with one (1) species each. The predominant habit recorded were herbs (4 species), shrubs (3 species), trees (2 species), and vines (2 species) (Fig. 2a). Plants reported here are mostly perennials (80%) (Fig. 2b). Analysis of the diversity indicated that most species have multiple uses, 60% of studied plants are used in more than 2 different ways while, particularly, *Cocos nucifera* L. has five (5) different patterns of usage (Fig. 2e). The plants were mostly used in the decoction form (64%), an oral administration, which is a route of taking drugs and represents the most frequent means of applying the remedies, followed by the crude form (45%) (Fig. 2d). Almost all parts of studied plants are used, but the use of leaves is most frequent (54%) for both as culinary (27%) and other purposes (27%), followed by the whole plant (36%), seed (18%), and other parts (10%) (Fig. 2c). This is in line with the traditional use of medicinal plants, where the most commonly used plant part for preparing remedies was leaves (65%), followed by root (17%), stem (9%), and fruit (9%) (Gidey et al., 2011).

Discussion

According to a report by WHO, more than 80% population of Asia cannot afford formal health care services and thus depends on wild medicinal plant sources, which are culturally familiar, accessible, simple usage patterns, and effectiveness (Anonymous, 2009). However, the indigenous knowledge of those plants is rapidly lost due to the lack of interest of young people in learning and sharing the plant's uses combined with the development of Western medicine (Van Sam et al., 2008). Plus, in developed countries, the importance of traditional knowledge and its owner have not received the appropriate appreciation. Thus, traditional knowledge requires more attention from government and policymakers to be protected effectively as intellectual property, especially in developing countries (Ragavan, 2001). Documentation of traditional knowledge combining with understanding the relationship between the knowledge, local people's culture, and diverse resources is crucial to the development of the community (Sheng-Ji, 2001). Traditional knowledge utilization as a strategy for climate change adaptation can aid coastal villages to lessen the effects of disasters and encourage people to settle in flood-prone areas (Chen & Cheng, 2020).

Conclusion

The coastal communities possessed the precious knowledge of halophytes. This traditional knowledge is usually handed down from generation to generation by word of mouth, it then may be lost in due course. Therefore, it required urgent need to raise awareness of conserving the halophytic species' habitat and their practical uses that are mutually beneficial for the local communities to maintain public health, and plant biodiversity in areas that are severely suffering from salinity intrusion.

Declarations

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Compliance with ethical standards

Conflict of interest: The authors declare no competing financial interest.

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Figures

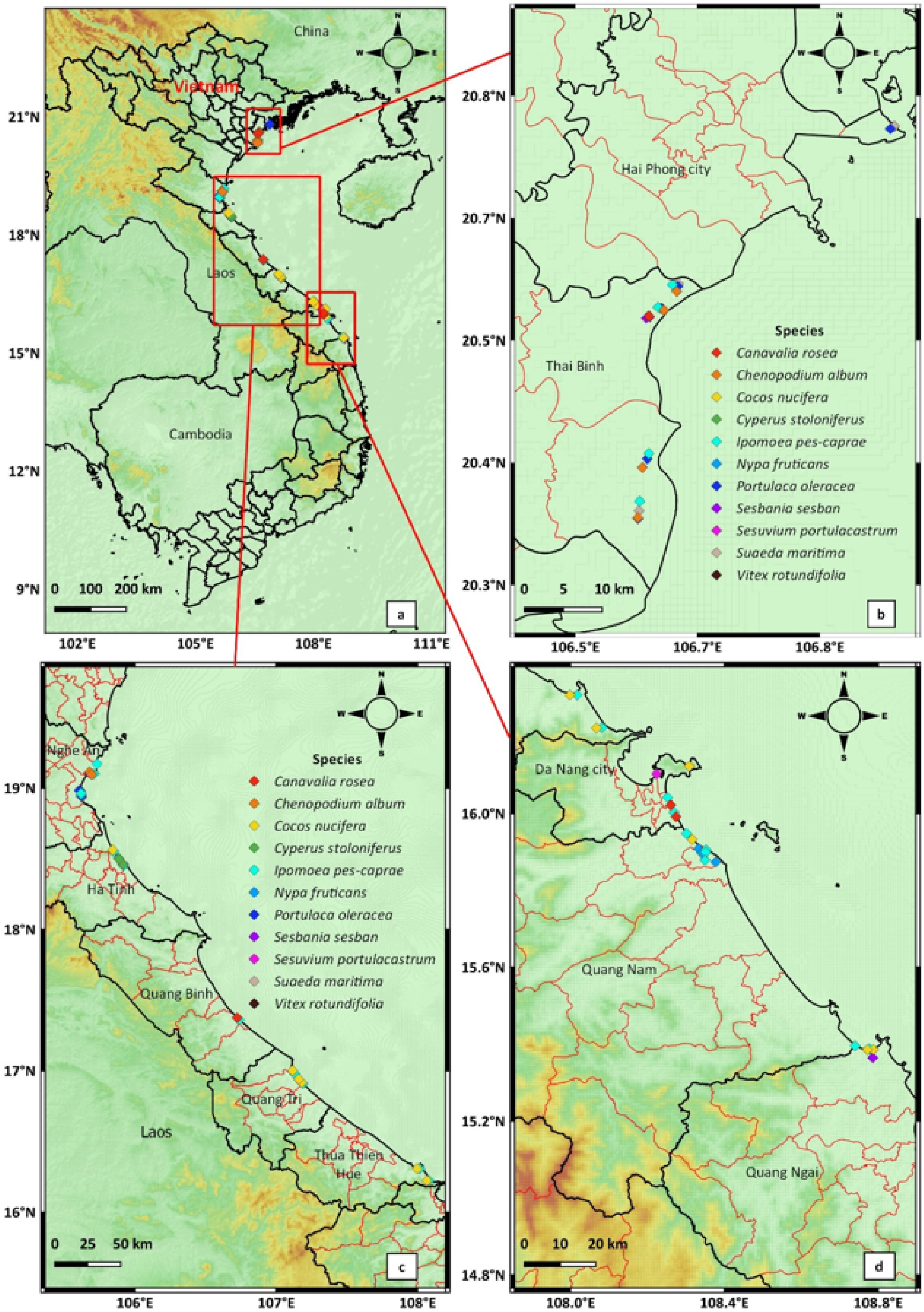

Figure 1

The distribution of 11 species on the map with respect to a: Vietnam, b: Red River Delta, c: North Central Coast, and d: South Central Coast (*Symbol colors specify the species found at each location. The map was created using QGIS 3.22.9-Białowieża (QGIS Development Team 2022). Geospatial data used for the creation of this map include international (The Humanitarian Data Exchange 2022a) and subnational (The Humanitarian Data Exchange 2022b) administrative boundaries, distributed under ODC-ODbL and*

CC BY-IGO licenses respectively. The black lines are the provincial and national boundaries. The red lines represent the district boundary. The light greento reddish brown shaded background represents elevation, retrieved from The World Bank (2020), distributed under a CC-BY 4.0 license.)

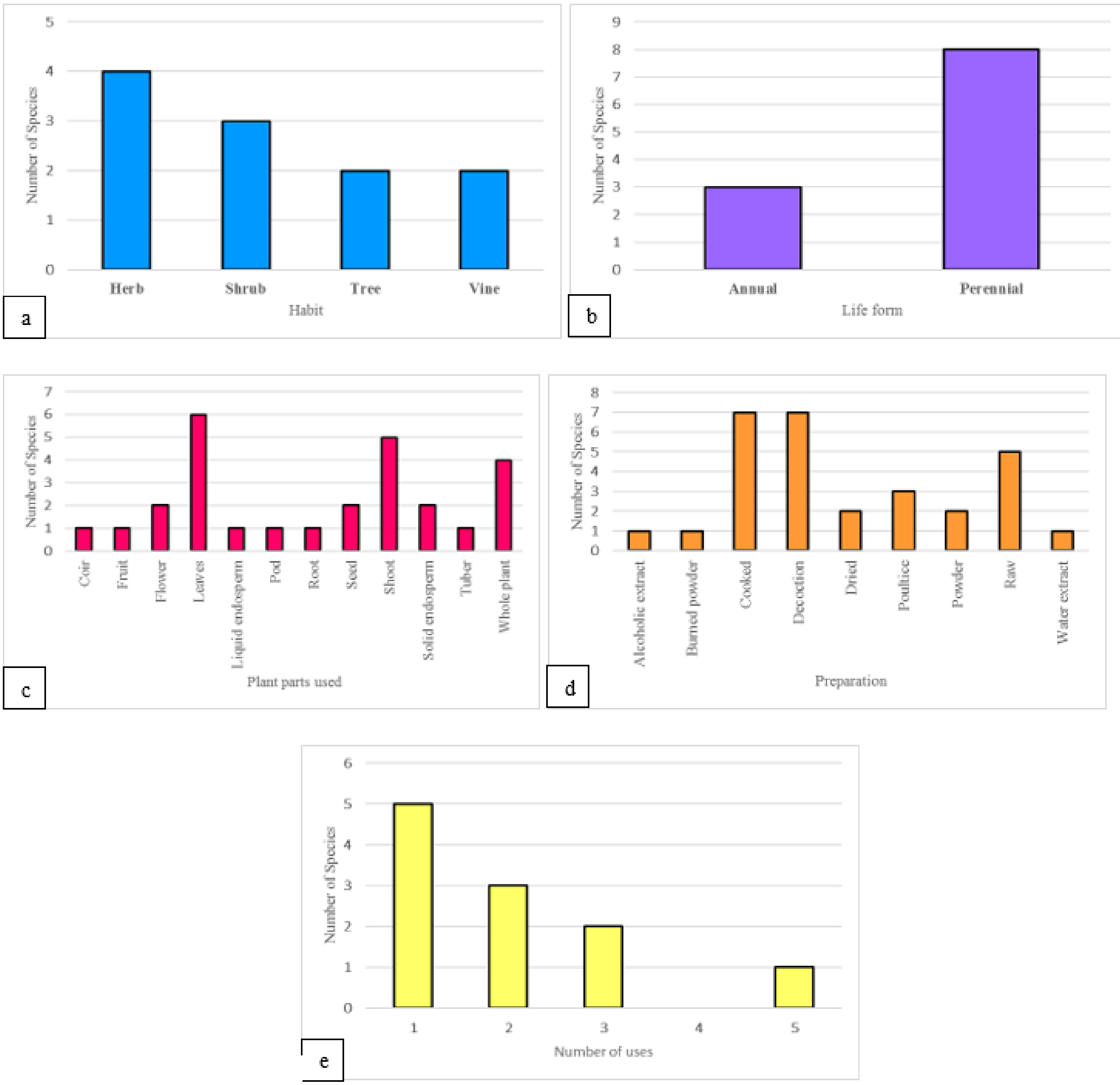

Figure 2

Distribution of halophytes with respect to a: habit, b: life form, c: plant part used, d: preparation, e: number of uses.