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Diversity of medicinal plant resources on Lai Son Island, Kien Giang province

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ABSTRACT

This study was conducted with the aim of assessing the diversity of medicinal plants located on Lai Son Island, Kien Giang province, as a scientific basis for more effectively using, managing, and preserving the medicinal plant resource in this province. In this study, participatory rural appraisal, field investigation, morphological comparison and classification, with the aid of specialized medicinal plant books were used. The results showed a total of 353 species of medicinal plants belonging to 264 genera of 112 families in 4 divisions. Among them, Magnoliophyta was the most diverse division with 94.90% species, 95.08% genera, and 90.18% families. Seven species were listed on the "Red List of Vietnamese medicinal plants" (2006), "Vietnam Red Book" (2007), and the Decree 06/2019/ND-CP. The medicinal plant species were divided into ten life forms and distributed in six biotopes. The most species diversity was recorded in the natural forest on rocky mountain biotope. Ten parts of plants were used to medicate for 36 disease types. Twenty-four species were commonly used by local people.

1. INTRODUCTION

Lai Son Island is one of the largest islands in Kien Hai island district, Kien Giang province, located in the Gulf of Thailand, about 65 km from Rach Gia city center. Due to its location in the equatorial region, Lai Son Island has a tropical monsoon climate, hot, humid, and rainy. The terrain is mainly hills and mountains, so the flora here is very diverse and rich, in which there are many valuable medicinal plants. However, the knowledge of using medicinal plants of the people living on this island is mainly heirloom, focusing only on a few species, while the number of species of potential plants that can be used for medicine on the island is thought to be many, but is unknown. This is partly because so far there have been no studies on the investigation and statistics of medicinal plant species on this island.

On the other hand, the flora and forest ecosystem in Lai Son Island is currently affected by the uncontrolled development of many types of tourism services. Forests in many places are exploited to build accommodation facilities. Many plant species are exploited to serve the needs of tourists such as vegetables, handicrafts, etc., especially natural medicinal plant resources are increasingly degraded. Many species of medicinal plants are in danger of extinction, while their regeneration in the wild is very slow and difficult to recover. Therefore, it is necessary to investigate and evaluate the current status of medicinal plant resources on Lai Son Island, thereby providing the local people with more useful knowledge in the effective use of natural resources. medicinal plant resources, contributing to the protection and local health care.

2. MATERIALS AND METHOD

2.1. Participatory rural appraisal

Participatory rural appraisal (PRA) was used as the main method (Nguyen & Vromant, 2009) to survey and interview local people who have experience and knowledge about the use of medicinal plants, such as herbalists (in pharmacies of traditional medicine), medicine pickers, and farmers who cultivating medicinal herbs on the island.

2.2. Methods of field trip and sample collection

This study applied the method of Nguyen (2007) for the field trip work and plant sample collection by the pre-identified route. Based on the land use planning map of Kien Giang province (Department of Natural Resources and Environment of Kien Giang province, 2014), Google map, and from actual observations, 05 investigation routes through 6 typical biomes of the island were identified (details are shown in Figure 1 and Table 1). The number of plant samples collected during the field trip was 982 samples. These samples are currently kept at the Plant Laboratory, Department of Biology, School of Education, Can Tho University.

2.3. Samples analysis method

The plant scientific names were identified using the morphological comparison method combined with looking up specialized scientific documents on the plant taxonomy of Pham (1999, 2003, 2003), Vo (2003, 2004). Scientific and author names of species were edited according to Center for Natural Resources and Environment - Hanoi National University (2001, 2003, 2005) and The World Flora Online (2022).

2.4. Determining the value of medicinal plants

Medicinal values, used parts and therapeutic groups of medicinal plants, were determined based on indigenous knowledge (through the process of interviewing local people) combined with searching specialized documents on medicinal plants by Do et al. (2006), Do (2015), and Vo (2018). The life form of medicinal plants was classified according to the Department of Science, Technology and Product Quality - Ministry of Agriculture and Rural Development (2000).

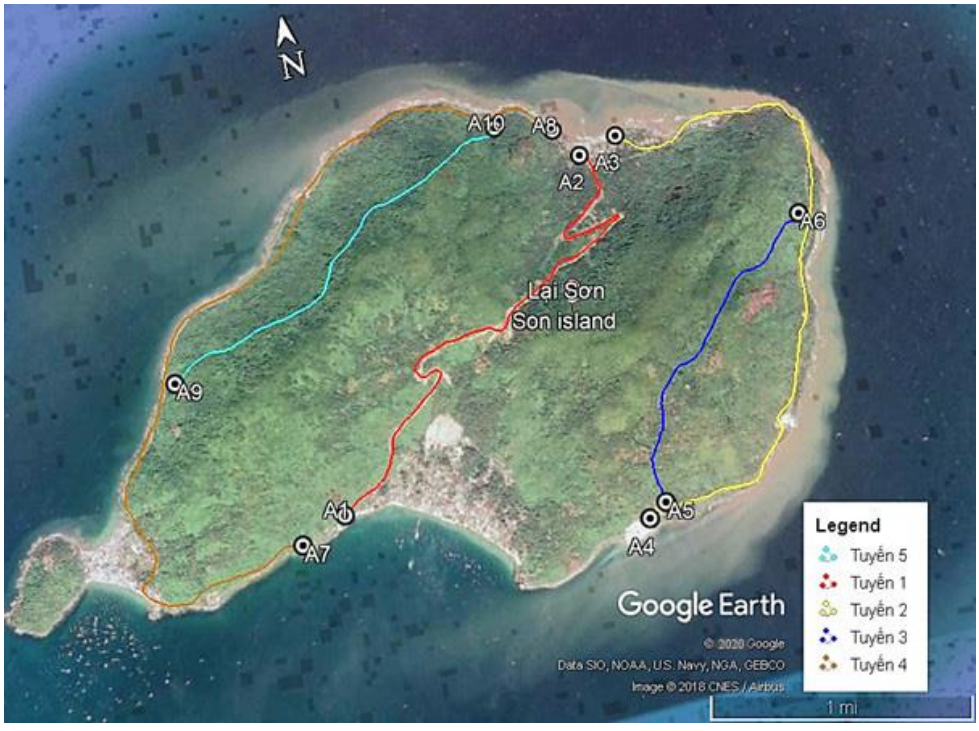

Figure 1. Sampling routes on Lai Son Island

A1 - A2: Route 1; A3 - A4: Route 2; A5 - A6: Route 3; A7 – A8: Route 4; A9 – A10: Route 5

Table 1. Routes, coordinates and habitats sampled in Lai Son Island

No.	Route	Start point coordinates	End point coordinates	Line length (km)	Habitat
1	Cross-mountain route (from Hon Son Border Post to Bac beach)	9°47'57.55"N 104°37'34.44"E	9°47'2.11"N 104°38'39.81"E	4.2	Roadside, natural forest on rocky mountain, swidden fields
2	Coastal route (from South Lai Son beach to Bac beach)	9°49'4.48"N 104°38'49.46"E	9°47'44.85"N 104°38'35.92"E	4.6	Roadside, home garden, coconut forest
3	The way to the top of Ma Thien Lanh mountain	9°47'47.37"N 104°38'39.70"E	9°48'40.05"N 104°39'22.42"E	2.3	Natural forest on rocky mountain
4	Coastal route (from Hoang Anh guesthouse to Bac beach)	9°47'53.41"N 104°37'24.79"E	9°49'8.69"N 104°38'35.31"E	6.2	Roadside, home garden, coconut forest
5	Route along the east mountainside of Lai Son island	9°48'30.42"N 104°37'4.77"E	9°49'11.27"N 104°38'22.62"E	2.8	Natural forest on rocky mountain, Agarwood forest

2.5. Method of determining the level of danger

The endangered level of the collected plant species was assessed according to the "Vietnam Red List of Medicinal Plants" (Nguyen, 2006), "Vietnam Red Book, Part II – Plants" (Ministry of Science and Technology - Vietnam Academy of Science and Technology, 2007), Government Decree 06/2019/ND-CP (2019).

3. RESULTS AND DISCUSSION

3.1. Diversity of medicinal plant taxa

We identified 353 species belonging to 264 genera of 112 families in 4 plant phyla. The distribution of taxa in the phyla was uneven, most taxa belonged to Magnoliophyta with 335 species (94.90% of total species), 251 genera (95.08% of total genera), 101 families (90.18 % of the total plant families surveyed). The remaining three phyla, Lycopodiophyta, Polypodiophyta and Pinophyta, all account for a very small proportion, less than 7.2%. In the phylum Magnoliophyta, the class Magnoliopsida dominated with 280 species (accounting for 79.32% of species), 213 genera (accounting for 80.68% of genera) and 78 families (accounting for 76.61% of families); Liliopsida had taxons of each order less than 21%. Through the research results, it was possible to confirm the predominance of the Magnoliopsida class in the Magnoliophyta phylum and in the whole study area, details are presented in Table 2.

Out of a total of 353 species of medicinal plants found on Lai Son Island, 183 species were described in the "Medicinal plants and medicinal animals in Vietnam" (Do et al., 2006), accounting for 51.84% of the species studied. Correspondingly, there were 141 species outlined in the book "Vietnamese medicinal plants and herbs" (Do, 2015), totaling 39.94% of the total species. When checked in the latest documents, 322 species in Lai Son Island were described in the "Vietnamese Dictionary of Medicinal Plants" (Vo, 2018), accounting for 91.22% of the surveyed species. However, when compared to indigenous knowledge, only 124 species were used by the galenic physicians and people of Lai Son Island, accounting for only 35.13% of the total species.

At the family level, the study results highlighted that there were 45 families with only 1 species, 25 families with 2 species, 29 families with 3-5 species, 8 families with 6-9 species, 3 families have 11-15 species, 1 family has 20 species, 1 family has 25 species. The ten families with the highest number of medicinal plant species were Euphorbiaceae (25 species), Fabaceae (20 species), Rubiaceae (15 species), Moraceae (12 species), Asteraceae (11 species), Verbenaceae (9 species), Caesalpiniaceae (9 species), and Cucurbitaceae, Araceae, Apocynaceae all had 8 species. The plant families in Lai Son were also the ones with a large number of species in the flora of Viet Nam and many of these species are now exploited for medicinal purposes throughout the country.

Table 2. Distribution of taxa in each phylum of medicinal plants in Lai Son Island

Phylum/Class	Family		Genera		Species	
	Quanti	Percentage (%)	Quantity	Percentage (%)	Quantity	Percentage (%
Lycopodiophyta	1	0.89	1	0.38	1	0.28
Polypodiophyta	8	7.14	10	3.79	13	3.68
Pinophyta	2	1.79	2	0.76	4	1.13
Magnoliophyta	101	90.18	251	95.08	335	94.90
- *Magnoliopsida*	*78*	*76.61*	*213*	*80.68*	*280*	*79.32*
- *Liliopsida*	*23*	*20.54*	*38*	*14.39*	*55*	*15.58*
Total	112	100	264	100	353	100

At genera level, the research results showed that there were 205 genera with only 1 species, 40 genera with 2 species, 18 genera with 3 to 5 species, and 1 genus with 8 species. The genera with the largest number of medicinal plant species in the study area was *Ficus* with 8 species; *Ardisia*, *Euphorbia*, and *Dioscorea* all had 5 species. The common medicinal plants belonging to these genera are *Ficus racemosa*, *Ficus hispida*, *Ficus microcarpa*, *Ardisia colorata*, *Euphorbia hirta*, *Euphorbia hirta*. *Euphorbia thymifolia*, *Dioscorea persimilis*, and *Dioscorea glabra*.

3.2. Life form of medicinal plants

Medicinal plants obtained from Lai Son Island were classified into 10 groups of life forms, the details of which are presented in Table 3.

Table 3. Number and proportion of life-form groups of medicinal plants in Lai Son Island

No.	Group of life form	Num. of species	Percentage
1	Wood tree	105	29.7%
2	Shrubs	72	20.4%
3	Vines (crept/wrapped wood or grass)	70	19.8%
4	Coconut-palm tree	5	1.4%
5	Grass (cow, standing, underground)	91	25.8%
6	Epiphytic plant (dermis)	8	2.3%
7	Aquatic plant	1	0.3%
8	Other	1	0.3%

The group of wood tree had 105 species, accounting for 29.75% of the total species, mainly in the Anacardiaceae family, Caesalpiniaceae family, Clusiaceae family, Combretaceae family, Ebenaceae family, Euphorbiaceae family, Fabaceae family, Lauraceae family, Lythraceae family, Meliaceae family, Moraceae family, Myrtaceae family, Rubiaceae family and Sterculiaceae family. The species in these families are mainly those that grow naturally in the forest and some species are cultivated for fruit, wood and also used as medicine. The most common to be listed were *Mangifera indica*, *Spondias cytherea*, *Peltophorum dasyrrhachis*, *Calophyllum inophyllum*, *Combretum quadrangulare*, *Diospyros malabarica*, *Antidesma ghaesembilla*, *Sapium sebiferum*, *Erythrina variegata*, *Pterocarpus macrocarpus*, *Litsea glutinosa*, *Lagerstroemia calyculata*, *Melia azedarach*, *Ficus racemosa*, *Ficus microcarpa*, *Syzygium polyanthum*, *Morinda citrifolia*, *Neonauclea sessilifolia*, and *Sterculia foetida*.

The herbaceous group has 91 species, accounting for 25.78% of the total found species, mainly in the Asteraceae family, Lamiaceae family, Malvaceae family, Araceae family, Commelinaceae family, Cyperaceae family, Poaceae, and Zingiberaceae family. These are families with many species of plants that grow in the wild or are cultivated by people for both vegetables, ornamental and medicinal purposes such as *Ageratum conyzoides*, *Artemisia vulgaris*, *Blumea balsamifera*, *Vernonia cinerea*, *Xanthium strumarium*, *Hyptis rhomboidea*, *Sida acuta*, *Aglaonema siamense*, *Commelina diffusa*, *Kyllinga brevifolia*, *Eleusine indica*, *Cymbopogon citratus*, *Alpinia globosa*, and *Zingiber zerumbet*.

There were 72 species of shrubs (accounting for 20.4% of total species), mainly species that grow in the wild or were cultivated for ornamental or medicinal purposes. The identified shrub species mainly belonged to the Acanthaceae, Euphorbiaceae, Myrsinaceae, Rubiaceae and Verbenaceae families. The most popular shrubswere as follows: *Clinacanthus nutans*, *Pseuderanthemum palatiferum*, *Breynia vitis-idaea*, *Phyllanthus reticulatus*, *Ricinus communis*, *Ricinus communis*, *Ardisia colorata*, *Ardisia crasinervosa*, *Ixora coccinea*, *Psychotria silvestris*, *Vitex negundo*, and *Gmelina asiatica*.

The climbing plant group consisted of 70 species (accounting for 19.83% of the total species). These species mainly grow wild along roadsides and in forests. Some species were cultivated for both medicinal, ornamental and vegetable purposes. Plants in this group belong to the families Asclepiadaceae, Cucurbitaceae, Fabaceae, Menispermaceae, Vitaceae, Dioscoreaceae and Smilacaceae families. The remaining groups of life-forms had significantly fewer species of medicinal plants, with no group accounting for more than 2.3% of the total species.

3.3. Diversity of distribution of medicinal plant species by habitat

Field studies show that medicinal plants on Lai Son Island are distributed in 6 habitats. In which, a species can live in many different habitats, details of the distribution ratio of species according to each habitat are shown in Figure 2.

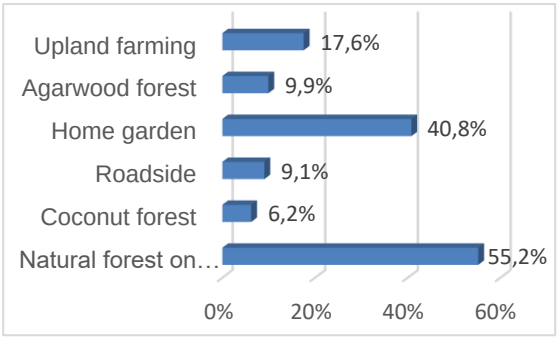

Figure 2. Distribution ratio of medicinal plants in different habitats

Natural forest habitat on rocky mountains showed the largest number of medicinal plant species, 195 species (accounting for 55.76% of the total species). Because this is a typical forest type and occupies more than 80% of the area of Lai Son Island (Department of Natural Resources and Environment of Kien Giang province, 2014), the plant species composition was highly diverse. The most commonly seenmedicinal plants were *Selaginella willdenowii, Gnetum formosum, Spondias pinnata, Ancistrocladus tectorius, Holarrhena antidysenterica, Rauvolfia micrantha, Schefflera heptaphylla, Mahonia napaulensis, Bombax ceiba, Garcinia oblongifolia, Croton oblongifolius, Sapium baccatum, Pterocarpus indicus, Spatholobus harmandii, Leea rubra, Memecylon edule, Stephania japonica, Stephania rotunda, Ficus drupacea, Ardisia caudata, Syzygium aromaticum, Ziziphus oenoplia, Nauclea officinalis, Uncaria scandens, Zacomata cunati , Helicteres hirsuta, Corchorus olitorius, Grewia paniculata, Vitex negundo, Dioscorea persimilis, Pandanus humilis,* and *Alpinia oxymitra*.

In the home garden habitat, the species composition was also very diverse with 144 species accounting for 40.97% of the total species. In this habitat, in addition to wild medicinal plants, most of these were brought back from the forest by herbalists and local people: *Asplenium nidus, Drynaria querciflia, Bouea oppositifolia, Cinnamomum burmannii, Barringtonia acutangular* or fruit trees with medicinal effects such as *Annona squamosa, Carica papaya, Phyllanthus acidus, Flacourtia jangomas, Psidium guajava* or plants used as daily vegetables such as *Centella asiatica, Telosma cordata, Momordica charantia, Sauropus androgynus*. In addition, some ornamental plants that can also be used as medicinal plants such as *Catharanthus roseus, Schefflera elliptica, Quisqualis indica, Kalanchoe pinnata, Artocarpus communis,* and *Hibiscus rosa-sinensis*.

The upland farming habitat has 62 species, accounting for 17.56% of the total species. Plants in this habitat were mainly wild herbaceous plants or vines, such as *Achyranthes aspera, Centella asiatica, Vernonia cinerea, and Xanthium strumarium, Heliotropium indicum, Cleome chelidonii, Euphorbia hirta, Phyllanthus urinaria, Desmodium styracifolium, Glinus oppositifolius , Portulaca oleracea, Hedyotis diffusa, Commelina communis, Eleusine indica, Paederia foetida, Coccinia grandis, Gymnopetalum cochinchinense, Passiflora foetida, Cayratia trifolia* and some species were cultivated for fruit such as dragon fruit *Hylocereus undatus*, watermelon *Citrullus lanatus*, cucumber *Cucumis sativus*, okra *Abelmoschus esculentus*, and taro *Dioscorea kratica*.

The remaining three habitats were coconut forest, roadside and agarwood forest with much less species abundance, none of which showed over 10% of total species. The habitat of the coconut forest was mainly composed of shade-loving vines and epiphytes, such as common *Pyrrosia lanceolate, Lygodium salicifolium, Dischidia nummularia, Sarcolobus globosus, Bauhinia bassacensis, Pharbitis congesta, Gymnopetalum cochinchinense, Zehneria indica, Stephania hernandiifolia,* and *Passiflora foetida*.

Roadsides habitats had mainly glade/light loving herbaceous plants and shrubs such as Achyranthes aspera, Chromolaena odorata, Xanthium

strumarium, Senna alata, Breynia vitis-idaea, Cajanus cajan, Sida acuta, Leucaena leucocephala, Hedyotis diffusa, Muntingia calabura. Agarwood forest is usually a planted forest, small in area, so species diversity is low. Here most common were woody species such as Anacardium occidentale, Aquilaria crassna, Dolichandrone spathacea, Calophyllum inophyllum, Dipterocarpus alatus, Baccaurea ramiflora, Khaya senegalensi, Artocarpus heterophyllus, Tectona grandis and some wild-growing vines such as Lygodium flexuosum, Tetracera loureiri, Tinospora cordifolia, and Pothos scandens.

3.4. Diversity of medicinal parts of plants

In plants, different organs on the same plant species may contain different chemical compositions. Therefore, depending on the species of plant, the part used as medicine may be different. For some species only the leaves are used, for some only the tubers, and for others the may be used. The part used is usually decided mainly based on experience and knowledge about medicinal plants. From interviewing local knowledge (medical practitioners in herbal medicine stores, people gathering herbal medicines, households growing and using medicinal plants on Lai Son Island) combined with searching specialized documents on medicinal plants of Do et al. (2006), Do (2015) and Vo (2018), the parts used as medicinal plants were list and are shown in Table 4.

Table 4. Parts used for medicinal purposes on Lai Son Island

No	Parts used	Number of Species	Percentage (%)
1	Leaves	124	35.13
2	Trunk	55	15.58
3	Roots	112	31.73
4	Whole tree	81	22.95
5	Fruit	59	16.71
6	Bark	74	20.96
7	Seed	44	12.46
8	Flower	26	7.37
9	Other Ingredients (resin, starch,...)	19	5.38
10	Tubers	18	5.10

Leaves were the part of plants most commonly used for medicinal purposes, with 124 species accounting for 35.13% of the total species. The leaves were used in fresh form as daily vegetables such as *Centella asiatica, Coccinia grandis, Sauropus androgynus, Premna corymbosa, Azadirachta indica, Polygonum odorat*um or a combination of leaves from different species were steamed or decoction such as *Cymbopogon citratus, Melaleuca cajuputi, Psidium guajava, Annona squamosa, Vernonia amygdalina, Erythrina variegata*. In addition, the leaves were easier to process than other parts and the use of the leaves as medicine will have little effect on the growth and development of the plant.

There were 112 species, accounting for 31.73% of the total species, whose roots were exploited for medicinal use. Although cutting roots will affect the growth of the plant, store a lot of valuable medicinal substances, therefore, they were frequently acquired. The common medicinal root species are *Polyscias fruticosa, Eurycoma longifolia, Rauvolfia micrantha, Blumea balsamifera, Cleome chelidonii, Cleome chelidonii, Manihot esculenta, Phyllanthus reticulatus, Pueraria montana, Leea indica, Leea rubra, Cyclea barbata, Stephania hernandiifolia, Helicteres hirsuta, Acorus calamus, Peliosanthes humilis, Costus speciosus, Smilax glabra,* and *Tacca palmata*. The roots were often used fresh or dried for decoction, and often were used to treat diseases such as bone pain, back pain, as a tonic or soaked in alcohol for massage.

There were 81 species (accounting for 22.95% of the total species) used as a whole plant for medicinal purposes. This group often had to chop the plant into small pieces before decoction to use (such as *Catharanthus roseus, Heliotropium indicum, Xanthium* inaequilaterum, and *Passiflora foetida*) or pound it to cover and bandage the wound.

The remaining parts of the plant are used less often, as harvesting could affect the plant (such as tubers, bark, sap) or can only be harvested seasonally (such as flowers, fruits, seeds).

3.5. Diverse uses of medicinal plants

Based on specialized documents on medicinal plants of Do et al. (2006), Do (2015) and Vo (2018), combined with interviews with herbalists in herbal medicine stores, people who collect herbal medicines, and people who grow and use medicinal plants on the island, thirty-six groups of diseases that can be used with existing plants on Lai Son Island to treat has been listed, details are shown in Table 5.

Table 5 shows that there were 7 main groups of diseases for which many medicinal plants were utilized (over 100 species) for treatment. Among them, there are 3 groups of diseases with the highest

number of medicinal plant species, up to over 125 species, which are skin diseases (221 species, accounting for 62.61% of total species), gastrointestinal diseases (185 species, accounting for 52.41% of the total species) and the group of bone and joint diseases (127 species, accounting for 35.98% of the total species).

Table 5. Quantity and proportion of medicinal plants for each group of diseases

No.	Groups of disease	Number of species	Percentage (%)
1	Skin diseases (acne, boil, scabies, wound, ringworm, psoriasis, etc.)	221	62.61
2	Burn treatment	31	8.78
3	Diseases in children (thrush, growth retardation, bedwetting, etc.)	62	17.56
4	Women's diseases (irregular menstruation, leukoplakia, vaginal discharge, etc.)	90	25.50
5	Maternal diseases (pregnancy, retained placenta, prolapse, etc.)	10	2.83
6	Male diseases (impotence, premature ejaculation, etc.)	27	7.65
7	Illnesses caused by weather (flu, headache, runny nose, fever, etc.)	101	28.61
8	Animal bites (by snakes, centipedes, dogs, cats, etc.)	70	19.83
9	Osteoarthritis (pain, rheumatism, inflammation, etc.)	127	35.98
10	Diseases of the ears, nose and throat	106	30.03
11	Eye diseases (eye pain, red eyes, etc.)	34	9.63
12	Respiratory diseases (cough, pneumonia, etc.)	107	30.31
13	Cardiovascular disease (heart failure)	19	5.38
14	Blood pressure	27	7.65
15	Diseases of the liver, bile (hepatitis, cirrhosis, etc.)	56	15.86
16	Neurological diseases (insomnia, sedation, headache, nervous-breakdown, etc.)	59	16.71
17	Laxative treatment and deworming	25	7.08
18	Vomiting	30	8.50
19	Hemorrhoids, protrusions	26	7.37
20	Digestive tract diseases (cholera, dysentery, abdominal pain, constipation, indigestion, etc.)	185	52.41
21	Stomach disease	66	18.70
22	Treatment of worms of all kinds	46	13.03
23	Safe pregnancy, good milk	56	15.86
24	Intestinal pain, swelling of the spleen, etc.	31	8.78
25	Diseases of the kidneys-bladder (kidney stones, diuretics, urinary catheter, etc.)	102	28.90
26	Diabetes	15	4.25
27	Cancer (liver, lung, colon, etc.)	16	4.53
28	Goiter, lymphadenopathy	14	3.97
29	Diseases caused by bacteria, viruses, infections, antibiotics	76	21.53
30	Bleeding (hemorrhage, nosebleed, etc.)	34	9.63
31	Diseases caused by poisoning, detoxification	39	11.05
32	Nourish the body	69	19.55
33	Stop bleeding	19	5.38
34	Analgesic	69	19.55
35	Cool down	49	13.88
36	Pulmonary TB	7	1.98

Common skin healing plants such as *Calophyllum inophyllum, Kalanchoe pinnata, Ficus racemosa, Carica papaya, Polyscias fruticosa, Chromolaena odorata, Vernonia cinerea, Xanthium inaequilaterum, Plumeria rubra, Senna alata,* and *Houttuynia cordata* were seen. These medicinal herbs are often decocted to drink or crushed to apply to wounds or skin, there are also groups used in combination with both oral and topical applications.

A group of popular medicinal plants used to treat digestive system diseases such as *Euphorbia hirta, Quisqualis indica, Senna alata, Garcinia mangostana, Curcuma zedoaria,* and *Zingiber zerumbet*. These plants were often used in the form of a decoction or crushed to obtain the liquid to drink.

Plants commonly used to treat osteoarthritis include species such as *Achyranthes aspera, Clinacanthus nutans, Heliotropium indicum, Mimosa pudica, Leea rubra, Morinda citrifolia,* and *Plumeria rubra*. these species were often used externally (crushed) to bind wounds or soak in alcohol for massage, or decoction for drinking.

The remaining five groups of diseases (pulmonary, treatment of pregnant women, treatment of goiter, lymphadenopathy, treatment of diabetes and treatment of cancer) showed the least number of applied plant species used for treatment, only from 7 to 16 species, accounting for less than 5% for each group.

3.6. Rare medicinal plants on Lai Son Island

Research results identified 7 species of rare plants on Lai Son Island. Among them, three species were listed in the Red List of Vietnamese medicinal plants (2006), including 02 species at endangered (EN) level and 01 species at vulnerable (VU) level. Five species listed in the Red Book of Viet Nam (2007) included 3 species at EN level and 2 species at VU level; 5 species were listed in Decree 06/2019/ND-CP at level IIA. Details are shown in Table 6. *Cycas pectinate, Mahonia napaulensis, Pterocarpus macrocarpus, Rauvolfia micrantha* and *Stephania rotunda* are rare species found only deep in the rocky forest. These species currently have a very small number of individuals, most of which are precious medicinal plants, which need conservation solutions. Two species of Agarwood (*Aquilaria crassna*) and Van Tuyet (*Cycas revoluta*) have been currently cultivated by many people on the island for both medicinal and ornamental purposes.

Table 6. Rare medicinal plants on Lai Son Island

No.	Scientific name	Grant of Regulations		
		RLoVMP (2006)	VNRB (2007)	Decree 06/2019/ND-CP
1	*Aquilaria crassna* Pierre ex Lecomte	EN	EN	
2	*Cycas pectinata* Buch.-Ham.		VU	IIA
3	*Cycas revoluta* Thunb.			IIA
4	*Mahonia naupaulensis* DC.	EN	EN	IIA
5	*Pterocarpus macrocarpus* Kurz		EN	IIA
6	*Rauvolfia micrantha* Hook.f.	VU	VU	
7	*Stephania rotunda* Lour.			IIA

Notes: RLoVMP: Red list of Vietnamese medicinal plants; VNRB: Vietnam Red Book; CR: Critically Endangered; EN: Endangered; VU: Vulnerable; IIA: wild plant species that are not currently threatened with extinction, but are likely to become extinct, if the export/import/re-export/importation of these species from the wild for commercial purposes is not controlled.

3.7. The species of medicinal plants used most by people on Lai Son Island

From the results of surveys and interviews with herbalists, medicinal pickers, and households that grow and use medicinal plants on Lai Son Island, 24 species of medicinal plants have been recorded with the highest number of local people using them the most, with the rate from 10.81% to 45.95% of the total number of people surveyed. Details of species composition and percentage of users (in order from highest to lowest) are shown in Table 7. The medicinal plants most commonly used by people on Lai Son Island are common wild plants around the garden such as *Scoparia dulcis*, *Ageratum conyzoides*, *Phyllanthus urinaria*, *Passiflora foetida*, *Euphorbia hirta*... or other fruit and vegetable crops such as *Houttuynia cordata*, *Momordica charantia,* and *Musa seminifera*. People also use trees for wood, shade and medicine such as *Aquilaria crassna, Artocarpus communis, Azadirachta indica, Calophyllum inophyllum,* or plants collected from the forest for medicinal purposes such as *Helicteres hirsuta, Eurycoma longifolia, Drynaria quercifolia, Dioscorea persimilis, Senna alata, Pandanus odoratissimus, Pterocarpus macrocarpus, Tinospora crispa*. These plants are mainly used to treat common diseases such as skin diseases, gastrointestinal diseases, weather diseases, women's diseases, respiratory diseases.

Table 7. List of 24 species of medicinal plants most used by people in Lai Son Island

No	Scientific name	Family	Ratio (%)
1	*Scoparia dulcis* L.	Scrophulariaceae	45.95
2	*Momordica charantia* L.	Cucurbitaceae	43.24
3	*Helicteres hirsuta* Lour.	Sterculiaceae	40.54
4	*Eurycoma longifolia* Jack	Simaroubaceae	40.54
5	*Ageratum conyzoides* L.	Asteraceae	37.84
6	*Aquilaria crassna* Pierre ex Lecomte	Thymelaeaceae	35.14
7	*Phyllanthus urinaria* L.	Euphorbiaceae	32.43
8	*Drynaria quercifolia* (L.) J. Smith	Polypodiaceae	32.43
9	*Musa seminifera* Lour.	Musaceae	32.43
10	*Dioscorea persimilis* Prain & Burk.	Dioscoreaceae	29.73
11	*Pandanus odoratissimus* L. f.	Pandanaceae	29.73
12	*Passiflora foetida* L.	Passifloraceae	27.03
13	*Houttuynia cordata* Thunb.	Saururaceae	24.32
14	*Senna alata* (L.) Roxb.	Caesalpiniaceae	24.32
15	*Euphorbia hirta* L.	Euphorbiaceae	24.32
16	*Ficus racemosa* L.	Moraceae	21.62
17	*Pterocarpus macrocarpus* Kurz	Fabaceae	21.62
18	*Artocarpus communis* Forst. & Forst. f.	Moraceae	18.92
19	*Tinospora crispa* (L.) Miers	Menispermaceae	16.22
20	*Azadirachta indica* A. Juss.	Meliaceae	16.22
21	*Calophyllum inophyllum* L.	Clusiaceae	16.22
22	*Gnetum latifolium* var. *funiculare* Markgr.	Gnetaceae	13.51
23	*Leea indica* (Burm. f.) Merr	Leeaceae	10.81
24	*Cassytha filiformis* L.	Lauraceae	10.81

4. CONCLUSION

The resources of medicinal plants on Lai Son Island are very diverse, with 353 species belonging to 264 genera of 112 families in 4 branches of higher plants. There are 7 rare species that need to be conserved on this island. Despite the diversity, only 124 species (35.13% of the surveyed species) have been exploited for medicinal use on the island. The obtained medicinal plants had 10 life forms and were distributed over 6 different habitats, the most diverse were natural forest habitats on rocky mountains. Overall, 10 plant parts were used medicinally and could be used to treat 36 common diseases. There are 24 species of plants that were frequently used by between 10.81-45.95% of the total number of local people surveyed.

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