



# Ex- Situ Conservation of important Medicinal Plants in Nilgiri Biosphere Nature Park, Southern Western Ghats of Coimbatore, India

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## Abstract

Traditional medicine of India as per WHO, the holistic science of medicine, as practised and utilized by Indians at large since centuries is now being globally accepted which has increased the demand for medicinal plants. Majority of population in the developing countries like India depends on the traditional systems of medicine like Ayurveda, Siddha, and unani for their primary healthcare needs. Increasing demand of medicinal plants leads to irrational cutting deforestation leading to depletion of the wild resources. Moreover, the natural and manmade calamities lead to further depletion of medicinal plant diversity. Conservation aims at supporting sustainable development by using the biological resources in ways that don't deplete the world's variety of species or destroy their ecosystems. The present study result that, A total of 51 species belonging to 42 genera under 22 families of medicinally important plants were conserved medicinal garden in Nilgiri Biosphere Nature Park, Southern Western Ghats of Coimbatore, the Ex-situ conservation involves conservation of medicinal plants outside their natural habitat used to safeguard them from destruction, replacement or deterioration. Ex-situ conservation includes procedure like seed storage, and botanical gardens etc.

## 1. Introduction

Medicinal plants and traditional medicine play an important role in the health care system of most developing countries. The traditional health care practice is mainly dependent on medicinal plants collected from the wild (Venkata & Swathi, 2011). WHO (World Health Organization) estimated that 80 percent of people worldwide rely on the traditional systems of medicines for some aspect of their primary health care needs. According to WHO, around 21,000 plant species have the potential for

getting used as medicinal plants. Around 80% of the peoples over the world utilizing the herbal medicines as their traditional methods for treatment of various disorders [Rome, 1997]. Thus, the economic importance of medicinal plants is much more to countries such as India than to rest of the world (Santosh *et al.*, 2020).

India has a rich resource base of medicinal plants, plush with about 8,000 different species. According to the Government of India (GoI), traditional medicines are the sole means of health care for about 65

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percent of the population. Treatment with medicinal plants is considered very safe as there is no or minimal side effects. These remedies are in sync with nature, which is the biggest advantage. The golden fact is that, use of herbal treatments is independent of any age groups and the sexes. Increasing demand of medicinal plants leads to irrational cutting deforestation leading to their depletion in wild. Moreover, the natural and manmade calamities lead to further depletion of medicinal plant diversity.

The conservation and sustainable use of medicinal plants have been studied extensively (Larsen & Olsen, 2007; Uprety *et al.*, 2012). Various sets of recommendations have been compiled regarding their conservation, including the establishment of systems for species inventorying and status monitoring, and the need for coordinated conservation practices based on both in situ and ex situ strategies. For medicinal plants with increasingly limited supplies, sustainable use of wild resources can be an effective conservation alternative. In China and South Africa, the situation is particularly critical because of the high demands of large populations (Hamilton, 2004).

People living in rural areas mainly depend on their surrounding forests and vegetation for fuel wood and medicine. This population cannot afford alternative fuel and expensive modern medicines. Hence, the environmental degradation and ecological loss takes place for which serious measures must be undertaken. Conservation of medicinal plants can be done by discouraging people for

cutting down trees and encouraging them to plant fast growing indigenous trees for their domestic used. But this alone cannot majorly lead to conservation.

Therefore, other newer conservation strategies must be planned and brought into action. The goal of conservation is to support sustainable development by protecting and using biological resources in ways that do not diminish the world's variety of genes and species or destroy important habitats and ecosystems. In general, it involves activities such as collection, propagation, characterization, evaluation, disease indexing and elimination, storage and distribution. The conservation of plant genetic resources has long been realised as an integral part of biodiversity conservation.

## Materials and Methods:

### Study area

National biosphere national park is situated in Anaikatti from Coimbatore border of Tamil nadu and kerala, Coimbatore district in the state of Tamil Nadu, part of western Ghats of lies between 10-10 and 12-00' of northern latitude and 76-40' and 8-00' of eastern longitude. The average rainfall received in Coimbatore district is 670-699 mm for the past twenty years out of the total rainfall 25% is received during south west monsoon 49% during Oct-Nov.( Sarvalingam & Rajendran, 2015).

### Methodology

The Plant propagules used for further their propagation and for ex-situ conservation were collected from different parts of the Tamil Nadu and



Kerala. We surveyed the existing ex situ collections of medicinally important vascular plant species in Western Ghats. To assess the value of the accessions for eventual reintroduction programmes, the quality of data on origin and genetic intactness were evaluated. The results presented here form the basis for a national ex situ conservation action plan for native plants (Hyvärinen *et al.* 2011).

### Result and Discussion:

A total of 51 species belonging to 42 genera under 22 families of medicinally important plants were conserved medicinal garden in Nilgiri

Biosphere Nature Park, Southern Western Ghats of Coimbatore, Tamil Nadu to be used by the ethnic peoples to cure various ailments such as diabetes, dysentery, fever. Headach, rheumatism, snakebite, cough, etc. (Table-1), it is evident from the study that, the ethnic people still values traditional medicines as a way of meeting their medical needs. This extensive knowledge among them can be tapped for bioprospecting, scientific scrutiny validation and utilization of posterity (Sarvalingam *et al.*, 2011).

**Table-1: list of the ex-situ Conservation important medicinal plants**

Sl. No	Plant Name	Family	Habit	Useful Parts	Mode of Uses	Curing effects	Reference
1.	<i>Acalypha indica</i> L.	Euphorbiaceae	Herb	Leaves	It cures skin allergy and itch. Fresh leaf juice is applied over cuts and wounds for faster healing.	Skin allergy and wounds	Balayogan Sivasankari, <i>et al.</i> , 2013; Karthiyayini., 2012.
2.	<i>Acorus calamus</i> L.	Acoraceae	Herb	Rhizome	The roots are made into a paste with milk and given to children to improve digestion. Rhizome used in traditional medicine and also to protect clothing from insect attack. Dried rhizome is ground in water and the paste is given orally to children for clarity of speech.	Children to improve	Karthiyayini., 2012 ; Chellaiah Muthu, <i>et al.</i> , 2006
3.	<i>Aloe vera</i> (L.) Burm.f.	Asphodelaceae	Herb	Leaves, Gel	Keep our body cool and hair conditioning also. Sap mixed with oil is heated and the mixture is applied on hair for hair growth and good sleep.	Hair growth and sleep	Balayogan Sivasankari, <i>et al.</i> , 2013; Chellaiah Muthu, <i>et al.</i> , 2006.

4.	<i>Alpinia calcarata</i> (Andr.) Rosc.	Zingiberaceae	Herb	Rhizome and leaves	It is specifically used for cough, cold, chest complaints and indigestion.	Cough, cold, indigestion and chest complaints	Local Tribal people
5.	<i>Andrographis paniculata</i> (Burm.f.) Nees	Acanthaceae	Herb	Root and Leaves	Leaf paste is applied topically at the bitten site of snake, beetle and scorpion. Powdered leaf is mixed with cow or goat's milk and taken orally to treat diabetes.	Snake and scorpion pit and diabetes	Karthiyayini., 2012 ; Chellaiah Muthu, <i>et al.</i> , 2006.
6.	<i>Artemisia annua</i> L.	Asteraceae	Herb	Whole plant	Whole plant decoction for the treatment of malaria, cough, and cold. Leaves are used for diarrhea. Plants contain antimalarial drug.	Malaria, Cough, Cold, Diarrhea and Antimalarial	Alia Sadiq., <i>et al.</i> , 2013
7.	<i>Catharanthus roseus</i> G. Don.	Apocynaceae	Herb	Whole plant	Whole plant is powdered and mixed with cow's milk and taken orally to treat diabetes. The root decoction is given orally as an abortifacient.	Diabetes and Abortifacient	Chellaiah Muthu, <i>et al.</i> , 2006; Senthilkumar., <i>et al.</i> , 2006.
8.	<i>Asparagus racemosus</i> Willd.	Asparagaceae	Climber	Tuber or Root and Leaves	Root extract is used in diarrhoea, dysentery and general debility	Diarrhoea, Dysentery and Debility	Senthilkumar., <i>et al.</i> , 2006.
9.	<i>Centella asiatica</i> (L.) Urb	Apiaceae	Climber	Leaves	Powdered leaves mixed with water are applied to treat skin diseases. Leaf decoction induces appetite, increases memory and cures stomach problems.	Skin Diseases, Appetite, Increases Memory and Stomach Problem	Pandi Kumar, <i>et al.</i> , 2005; Priya, 2016



10.	<i>Centrathe- rum punctatu- m</i> Cass.	Asteracea e	Herb	Leav es	It is used as a medicine for childbirth problems, dropsy, respiratory ailments, skin lesions and wounds.	Childbir th problem s, Dropsy, Respirat ory Ailment s, Skin Lesions and Wounds	Local Tribal people
11.	<i>Chamaeco- stus cuspidatu- s</i> (Nees& Mart.) Specht & Stev.	Costaceae	Herb	Leav es and Roots	Leaves consumed as fresh, dried and powder leaf forms for diabetes	Diabetes	Local people
12.	<i>Chrysopo- gon zizanioide- s</i> (L.) Robert.	Poaceae	Herb	Root and Leav es	Decoction of the rhizome is taken internally to treat blood pressure and stomachache problems.	Blood pressure and Stomach ache problem s	Local people
13.	<i>Cissus quadrang- ularis</i> L.	Vitaceae	Climb er	Leav es and Stem	It is used to control sugar. Paste of stem is taken orally for easy digestion.	Decreas e and digestio n	Balayogan Sivasankari, et al., 2013; Chellaiah Muthu, et al., 2006.
14.	<i>Clitoria ternatea</i> L.	Fabaceae	Climb er	Seeds	Seed are crushed with water to form a paste, which slightly warmed and applied on testis to cure swelling due to syphilis.	Swelling and Syphilis	Senthilkurar., et al., 2006
15.	<i>Coccinia grandis</i> (L.) Voigt.	Cucurbit aceae	Climb er	Leav es and Fruit s	It helps to purify the blood. Leaf juice is mixed with butter to treat skin diseases. Leaf Juice is mixed with butter and applied topically to treat skin diseases.	Purify Blood and Skin disease.	Balayogan Sivasankari, et al., 2013;. Karthiyayini., 2012; Chellaiah Muthu, et al., 2006.

16.	<i>Coix lacrymajobi</i> L.	Poaceae	Herb	Root and Seed	The seeds of plant have been traditionally used for treating Diuretic, Anti-rheumatic, Antispasmodic, Anti-inflammatory, Antidiarrheal, Anthelmintic, Antipyretic, Antispasmodic, Diuretic, Hypoglycaemic, and Anti-Cancer.	Diuretic, Anti-rheumatic, Antispasmodic, Anti-inflammatory, Antidiarrheal, Anthelmintic and Antipyretic.	Bhavna Patel, <i>et al.</i> , 2017
17.	<i>Coleus amboinicus</i> Lour.	Lamiaceae	Herb	Leaves	It is used to treat asthma, malaria, fever, aiding weight loss, treating grey hair and dandruff, and for promoting hair growth.	Asthma, Malaria, Fever, and Hair growth	Local Tribal people
18.	<i>Cymbopogon citratus</i> (DC.) Stapf.	Poaceae	Herb	Leaves	Antispasmodic, hypotensive, anticonvulsant, analgesic, antiemetic, antitussive, antirheumatic, antiseptic and treatment for nervous and gastrointestinal disorders and fevers.	Anticonvulsant, Analgesic, Antiemetic, Antitussive, Antirheumatic, Antiseptic and fevers	Gagan Shah, Richa Shri., <i>et al.</i> , 2011
19.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Herb	Leaves	To increase memory power. Leaves used for curing wound and blood clotting. Decoction of whole plant is taken orally to keep the body cool.	Wound, Blood clotting and Body cool.	Balayogan Sivasankari, <i>et al.</i> , 2013; Karthiyayini., 2012; Chellaiah Muthu, <i>et al.</i> , 2006
20.	<i>Gloriosa superba</i> L.	Liliaceae	Climber	Root and Leaves	Root is purgative, anthelmintic and used to cure leprosy, parasitical inflection of skin and piles. Leaves	Leprosy, skin, piles and head	Senthilkumar., <i>et al.</i> , 2006



					are used to destroy head lice.	lice	
21.	<i>Gymnema sylvestre</i> (Retz.) R.Br. ex Sm.	Apocynaceae	Climber	Leaves	Extract of leaves taken orally along with milk for diabetes. Leaf powder is mixed with cow's milk and taken orally to treat diabetes. The root powder is taken orally and also applied on the bitten spot to treat snake bite.	Diabetes, bitten spot to treat snake bite.	Karthiyayini., 2012 and Chellaiah Muthu, <i>et al.</i> , 2006
22.	<i>Hemidesmus indicus</i> (L.) R.Br.	Apocynaceae	Climber	Root	Decoction of root is taken to cool the body.	Cool the body	Pandi Kumar, <i>et al.</i> 2005
23.	<i>Justicia gendarussa</i> Burm.f.	Acanthaceae	Herb	Leaves	Leaves are used for asthma and rheumatism	Asthma and Rheumatism	Local people
24.	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	Herb	Leaves	Plant paste is applied on forehead to alleviate headache; leaf paste is applied externally to cure cuts and wounds; fresh sap of plant is used for eye diseases.	Headache, cure cuts & wounds	Local people
25.	<i>Leucas aspera</i> (Willd.) Link.	Lamiaceae	Herb	Leaves and Stem	It helps to reduce cold effect. Leaves are boiled and the vapor is inhaled to cure headache. A bunch of leaves is boiled and the vapour is inhaled to cure head ache and fever	Coldeffe ct, Head ache	Balayogan Sivasankari, <i>et al.</i> , 2013; Karthiyayini., 2012; Chellaiah Muthu, <i>et al.</i> , 2006



26.	<i>Lowsonia inermis</i> L.	Lythraceae	Shrub	Leaves	It used to make our body cool. Leaf powder is mixed with coconut oil and used as hair oil. Leaf powder is mixed with coconut oil and applied topically to treat cuts and wounds.	Body cool, hair oil and wounds	Balayogan Sivasankari, <i>et al.</i> , 2013; Karthiyayini., 2012; Chellaiah Muthu, <i>et al.</i> , 2006
27.	<i>Mentha pipetita</i> L.	Lamiaceae	Herb	Leaves	It mind helps to keep our tooth	Tooth	Balayogan Sivasankari, <i>et al.</i> , 2013
28.	<i>Mimosa pudica</i> L.	Fabaceae	Climber	Leaves	Pinch of leaf paste is applied topically to treat cuts and wounds.	Wound	Chellaiah Muthu, <i>et al.</i> , 2006
29.	<i>Ocimum santum</i> L.	Lamiaceae	Herb	Leaves	Leaf juice mixed with honey is taken orally to treat cough and cold. Leaves are crushed with onion bulbs and the juice is taken orally to treat cough and cold	Cough, Cold, and Cold	Karthiyayini., 2012; Chellaiah Muthu, <i>et al.</i> , 2006
30.	<i>Ocimum basilicum</i> L.	Lamiaceae	Herb	Leaves	To cure nasal related troubles	Cure nasal	Balayogan Sivasankari, <i>et al.</i> , 2013
31.	<i>Ocimum gratissimum</i> L.	Lamiaceae	Herb	Leaves	It is used as animal food, a poison, a medicine and invertebrate food, has environmental uses and social uses and for food.	Food	Kew, 2022
32.	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Herb	Leaves	It cures cough and cold	Cough and Cold	Balayogan Sivasankari, <i>et al.</i> , 2013
33.	<i>Piper betle</i> L.	Pipareceae	Climber	Leaves, Root and Seed	It is used to digestion. Juice used as eye drops in painful eyes. Leaf juice mixed with honey is given to cure cough for children.	Digestion and Cough	Balayogan Sivasankari, <i>et al.</i> , 2013; Karthiyayini., 2012.
34.	<i>Piper longum</i> L.	Piparaceae	Climber	Seeds	Powder of seeds is taken internally along with honey to treat cough.	Cough	Pandi Kumar, <i>et al.</i> , 2005





35.	<i>Piper nigrum</i> L.	Piperaceae	Climber	Seeds and Fruits	The dried seed powder given to patients along with fruit juice of <i>Coccinia indica</i> (Ivy gourd) once in a day in the morning empty stomach for 1 month to reduce sugar levels in blood. Powder of seeds is taken internally to treat cough, bronchial disorders and as antidote to snake poison.	Cough, Bronchial and Snake Poison	Pandi Kumar, <i>et al.</i> , 2005
36.	<i>Piper retrofractum</i> Vahl.	Piperaceae	Climber	Root, Leaves and Fruits	Leaves and berries of this pepper are edible. Root is chewed and the saliva swallowed, or the decoction of root taken internally as cure for colic, dyspepsia and gastralgia.	Saliva Swallowed, Colic, Dyspepsia and Gastralgia.	Local people
37.	<i>Rauwolfia serpentina</i> (L.) Benth. ex Kurz	Apocynaceae	Shrub	Root, leaves and Fruit	Paste of the whole plant is mixed with castor oil and applied topically to treat skin diseases.	Skin disease	Chellaiah Muthu, <i>et al.</i> , 2006
38.	<i>Rhinacanthus nasutus</i> (L.) Kurz.	Acanthaceae	Shrub	Roots, leaves and Stem	It is used as medicine for the poisonous snake bites.	Snake bites	Local people
39.	<i>Ruta graveolens</i> L.	Rutaceae	Herb	Leaves	Leaf used in amenorrhea, menorrhoea and colic: used externally for sciatica, headache, muscular chest pain, bronchitis and arthritis.	Amenorrhoea, Menorrhoea And Colic, Sciatica, Headache And Arthritis.	Local people

40.	<i>Scaevola taccada</i> (Gaertn.) Roxb.	Goodeniaceae	Shrub	All parts	Leaves used for digestive, carminative, antitumor, antiinflammatory, treatment of coughs, tuberculosis and stings from the stingray and used to treat weakness after childbirth. Roots are used to treat stomach ache.	Digestive, Carminative, Antitumor, Anti-Inflammatory, Stomach Ache and Coughs	Local people
41.	<i>Senna auriculata</i> (L.) Roxb.	Fabaceae	shrub	Flower	Reduce the abdomen heat. Leaves paste reduce obesity. Flowers are crushed and mixed with goat's milk and taken orally to prevent white discharge in women.	Obesity	Balayogan Sivasankari, <i>et al.</i> , 2013; Karthiyayini, 2012; Chellaiah Muthu, <i>et al.</i> , 2006
42.	<i>Solanum nigrum</i> L.	Solanaceae	Herb	Whole plant	Fresh leaves are taken orally to cure mouth ulcer. Whole plant parts are taken as food to treat cough.	Ulcer and Cough	Karthiyayini, 2012; Chellaiah Muthu, <i>et al.</i> , 2006
43.	<i>Solanum torvum</i> Sw.	Solanaceae	Shrub	Leaves and Fruits	Leaf juice is taken orally to reduce body heat. Fruit used for cooking.	Body Heat and Cooking	Karthiyayini, 2012; Chellaiah Muthu, <i>et al.</i> , 2006
44.	<i>Solanum trilobatum</i> L.	Solanaceae	Herb	All parts	Leaf juice is taken orally to treat cough and cold. Unripe fruits are prepared as curry or roasted in gingelly oil and taken	Cough Cold, Cough and Itching.	Karthiyayini, 2012; Chellaiah Muthu, <i>et al.</i> , 2006
45.					orally along with food to strengthen the body. The leaf juice is taken orally to treat cough and itching.		



46.	<i>Solanum violaceum</i> Ortega.	Solanaceae	Shrub	Fruits	Fruit are diuretic, expectorant and also treatment against diabetes, cough and toothache. Plant have been used over the years for the remedy of a number of diseases such as headache, fever, indigestion, asthma, diabetes and ulcers etc.	Diuretic, Expectorant, Diabetes, Cough, Toothache, Headache, Fever, Indigestion, Asthma, Diabetes and Ulcers	Baharul Islam., 2018
47.	<i>Solanum virginianum</i> L.	Solanaceae	Herb	Fruits	Fruit - raw or cooked. The seeds are expectorant and also used in the treatment of asthma and catarrh	Expectorant Asthma and Catarrh	Local Tribal People
48.	<i>Sphagnetica calendula</i> (L.) Pruski	Asteraceae	Herb	Whole plant	It is used for coughs, skin disease and hairloss.	Coughs, Skin Disease and Hairloss.	Local People
49.	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Herb	Tuber	Improve fertility in male	Fertility	Shubham Sharma, 2015
50.	<i>Tephrosia purpurea</i> L.	Fabaceae	Herb	Leaves	Leaf paste is used in the treatment of leprosy, asthma, spleen enlargement and urinary disorders.	Leprosy, Asthma, Spleen and Urinary	Priya, 2016
51.	<i>Toxicarpus beddomei</i> Gamble.	Apocynaceae	Climber	Stem and leaves	The results were positive for alkaloid, glycoside, sterols, flavonoids and phenolic compounds in petroleum ether extract.	Chemical compound	Purushothaman., 2017

52.	<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	Zingiberaceae	Herb	Rhizome	Rhizome are used for treatment of inflammation, fever, toothache, indigestion, constipation, diarrhea, severe sprains, and to relieve pain, as well as antispasmodic, antirheumatic, and diuretic agents	Inflammation, Fever, Toothache, Indigestion, Constipation, Diarrhea, Antispasmodic, Antirheumatic, and Diuretic.	Zakaria., et al., 2011
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The Medicinal garden plant study includes angiosperm medicinal plants, of which 42 species are dicotyledonous belonging to 32 genera and 17 families and 9 species of monocotyledonous plants belongs to 9 genera of 5 families. The most widely represented families were Lamiaceae 7

species, followed by Solanaceae 6 species, Apocyanaceae 5 species, Fabaceae and Piparaceae and Poaceae 4 species each, Acanthaceae, Asteraceae and Zingiberaceae 3 species (Fig.-1). The taxa consisted of 59% herbs, 27% of climbing species and 14% of shrub species of flowering plants (Fig.-2).

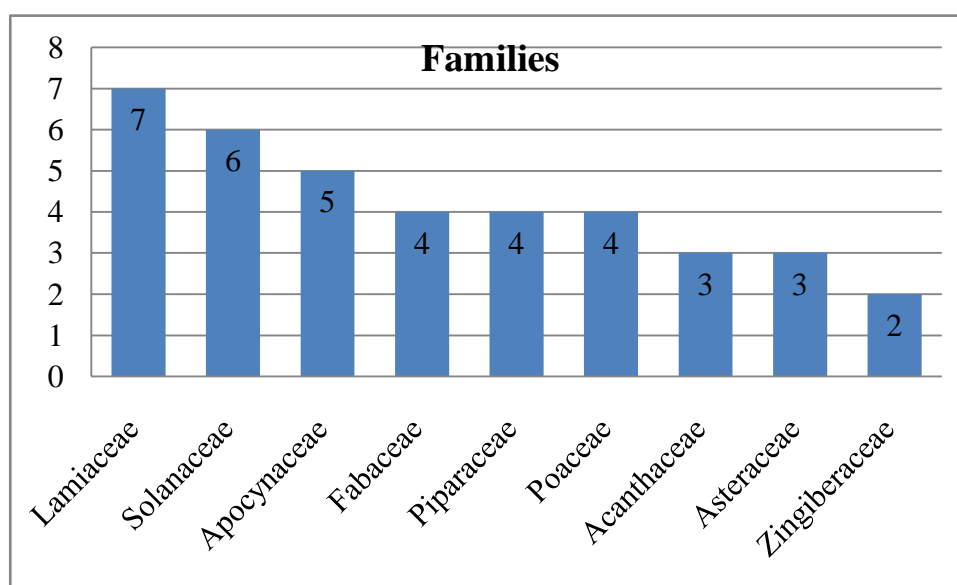
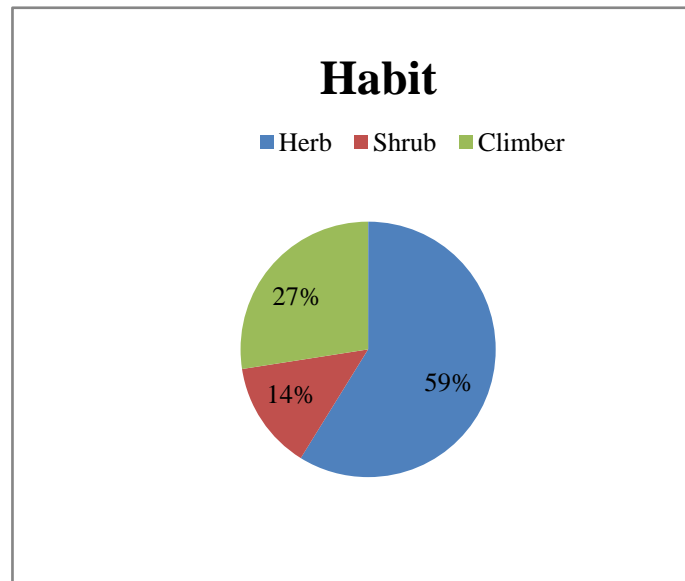


Figure :2: Life form analysis



Botanical gardens and zoos are the most conventional methods of ex-situ conservation, all of which house whole, protected specimens for breeding and reintroduction into the wild when necessary and possible. These facilities provide not only housing and care for specimens of endangered species, but also have an educational value. They inform the public of the threatened status of endangered species and of those factors which cause the threat, with the hope of creating public interest in stopping and reversing those factors which jeopardize a species' survival in the first place. They are the most publicly visited ex-situ conservation sites.

Some Medicinal and Aromatic plants are propagating by both the modes like by seeds as well as by underground plant parts like *Asparagus racemosus*. So in current scenario there is an urgent need for their assessment, regeneration and conservation for future generation. The conservation value of the botanic garden

collections is rather variable. The results presented here partly match the outcomes of similar studies carried out for other botanic gardens, showing deficiencies in intraspecific and within population diversity and in record keeping (Maunder *et al.* 2001a,b, Radford *et al.*, 2003, Badley *et al.*, 2004, Frachon *et al.*, 2005, Yukawa, 2006, Sharrock & Jones, 2009, Hällfors *et al.*, 2010). For the Finnish gardens we surveyed, we found that most taxa were represented by a single accession consisting of 1 or few individuals. Furthermore, small numbers of plants per accession and the lack of duplicates in another garden and to a lesser extent, deficient recording and sharing of cultivation expertise, had resulted in losses of several valuable taxa that were recorded in previous national botanic garden surveys (Väre & Siuruainen, 1994, Hansen, 2000).

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## References

- Badley, C., Hill, D. and Wray, N. (2004).** Inadequate accession data compromises the conservation value of plant collections. *Sibbaldia*, **2**: 5–19.
- Conservation, National Medicinal Plants Board, Ministry of AYUSH, Government of India.** Available from: <https://www.nmpb.nic.in/content/conservation> (Accessed (not set) March 2020).
- Frachon, N., Jebb, M. and Rae, D. (2005).** Plantnetwork's Target 8 project – the survey stages. *Sibbaldia*, **3**: 67–82.
- Hällfors, M., Schulman, L., Lindén, L. and Rita, H. (2010).** Testing bioclimatic hypotheses with botanic garden collections – curatorial considerations. In: Proc 4th Glob Bot Gardens Congr. Available at [www.bgci.org/files/Dublin2010/papers/Hällfors-Maria.pdf](http://www.bgci.org/files/Dublin2010/papers/Hällfors-Maria.pdf).
- Hamilton, A.C. (2004).** Medicinal plants, conservation and livelihoods. *Biodivers Conserv.*, **13**:1477–1517.
- Hansen, A. (2000).** Kasvitieteelliset puutarhat ja ex situ – suojelu (Botanic gardens and ex situ conservation). MSc thesis, University of Oulu.
- Larsen, HO. and Olsen, CS. (2007).** Unsustainable collection and unfair trade? uncovering and assessing assumptions regarding Central Himalayan medicinal plant conservation. *Biodivers Conserv.*, **16**: 1679–1697.
- Maunder, M., Higgens, S. and Culham, A. (2001a).** The effectiveness of botanic garden collections in supporting plant conservation: a European case study. *Biodivers Conserv.*, **10**: 383–40.
- Maunder, M., Lyte, B., Dransfield, J. and Baker, W. (2001b).** The conservation value of botanic garden palm collections. *Biol Conserv.*, **98**: 259–271.
- Radford, E., Dossman, M. and Rae, D. (2003).** The management of 'ad hoc' ex situ conservation status species at the Royal Botanic Garden Edinburgh: a review of options. *Sibbaldia*, **1**: 43–80.
- Santosh, T. Kadam and Ashalata D. and Pawar, T. (2020).** CONSERVATION OF MEDICINAL PLANTS: A REVIEW. *Int. Ayurved. Med. J.*, **12**: 91-95.
- Sarvalingam, A., Rajendran, A. and Aravindhan, V. (2011).** Curative climbers of Marudhamalai hills in the Southern Western Ghats of Tamil Nadu, India. *Int. J. Med. Arom. Plants*, **1(s3)**: 326-332.
- Sarvalingam, A. and Rajendran, A. (2015).** Climbing Plants of the Southern Western Ghats of Coimbatore in India and Their Economic Uses. *American-Eurasian J. Agric. Environ. Sci.*, **15(7)**: 1312-1322.



- Sharrock, S. and Jones, M. (2009).** Europe's threatened plants: progress towards Target 8 of the Global Strategy for Plant Conservation. Botanic Gardens Conservation International, Richmond.
- Uprety, Y., Asselin, H., Dhakal, A. and Julien, N. (2012).** Traditional use of medicinal plants in the boreal forest of Canada: review and perspectives. *J. Ethnobiol Ethnomed.*, **8**: 1-14.
- Väre, H. and Siuruainen, M. (1994). Uhanalaisia kasveja Suomen kasvitieteellisiin puutarhoihin? (Threatened plants and botanical gardens – a field of possibilities.). *Aquilo Ser Bot.*, **33**: 173-178.
- Venkata N. K. and Swathi S.K. (2011).** Conservation of Medicinal Plants (Past, Present & Future Trends). *J. Pharm. Sci. Res.*, **3(8)**: 1378-1386.
- Yukawa, T. (2006).** Status of ex situ conservation of threatened Japanese plant species in Japanese botanic gardens. *Bio. Geo. J.*, **3**: 16-17.