Studies on status, potentiality and distribution of medicinal plants in Karandeniya DS division, Sri Lanka through field and GPS coordinates App. Study

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ABSTRACT

Medicinal plants have been heavily used in traditional medicine. However, most farmers are reluctant to grow medicinal plants due to various reasons. This case study was aimed to analyse the present status, potential, and distribution of forty two medicinal plants in the Karandeniya DS division in Galle district and make suggestions to promote medicinal plant cultivation. In this study, medicinal plants were selected based on priority to conserve (threaten MP, endangered, rare, cultivated species) and economic importance (value added MP). The snowball sampling technique was used to select the samples of 50 households from five GN divisions. Primary data were collected through a field survey using a pre-tested structured questionnaire, and GPS data was collected through GPS coordinates App. Descriptive statistical methods and the Wilcoxon signed rank test were employed to analyze the primary data and GPS data was analyzed by Arc GIS software. The results revealed that the majority of respondents (64%) cultivate medicinal plants at a small-scale level for domestic usage. Some respondents (12%) cultivate medicinal plants for the preparation of value-added products and generate income by selling them. Among them, 64% of respondents are producing turmeric powder, 10 % are producing ginger powder, and8% produce medicinal oil as value-added products at household level. Further, it was revealed that 74% of respondents are willing to produce value-added products, and 90% are willing to expand their medicinal plant cultivation. Overall satisfaction level on medicinal plant cultivation is high where the mean value is 3.76 (1=very low and 5= very high). Results of the Wilcoxon sign rank test showed that respondent's attitudes on medicinal plant cultivation were significant (p<0.05).

Keywords: Karandeniya DS division, medicinal plants, plant distribution, potential of cultivation, value-added products.

INTRODUCTION

Medicinal plants are defined as having active ingredients used in herbalism or used in drug development and synthesis. In the general traditional system of medicine available in Sri Lanka is four types, namely *ayurveda*, *Siddha, Unani*, and *Deshiya Chikitsa* (Jayalath *et al*., 2004). At present, Sri Lanka has 29.7% forest cover and it is known as the most biologically diverse country in Asia (UNFCC, 2017).There are 3771 flowering plant species, out of which about 927 (24%) are endemic to the country (Gunatilleke *et al*., 2008). Cultivation and sustainable harvesting of medicinal plants with scientific knowledge and a proper marketing system might be a great source of additional income for the improvement of the livelihood of rural people (Joshi *et al*., 2014, Zhang, 2018). Medicinal plants offer alternative remedies with tremendous opportunities to generate, income, employment, and foreign exchange for developing countries (Rajeev and Rajamanoharan, 2020). Traditionally the rural poor especially women collected and dried medicinal plants and transported these raw materials to market (Joshi *et al*., 2014).

Medicinal plants are mainly used for traditional medicine, but farmers are reluctant to grow medicinal plants since most young generations are not interested in traditional medical practice because it is less profitable compared to growing

cash crops for many reasons (Rajeev *et al.*, 2020). The lack of quality planting materials, unavailability of sufficient land for cultivation and unavailability of raw materials as well as lack of marketing opportunities were identified as major constraints for the development of the medicinal plants industry in Sri Lanka (Dharmadasa *et al.*, 2016). Therefore, the objectives of this study were to examine the present situation of medicinal plant cultivation, to analyze the potential of medicinal plant cultivation, and find the distribution of medicinal plants to conserve valuable plants and enhance the rural livelihood of farmers by value addition. Besides, a request was received from former officer in Charge, (Dr. C. S. Hettiarachchi) Government Medicinal plant garden and research center, Pinnaduwa, Galle, Sri Lanka. They wanted to assess present status, potential, and distribution of medicinal plants in Karandeniya DS division since they have done a lot of trainings, knowledge dissemination and planting material distribution programmes, incentives for cultivation mainly focusing Karandeniya DS division.

METHODOLOGY

This study was carried out in the *Karandeniya* divisional secretary's division which is situated in the Galle district. This area is relatively abundant of endangered, threaten and economically important medicinal and aromatic plants in Sri Lanka based on initial field survey, pre tested questionnaire and secondary information.

The study was carried out representing five Grama Niladari (GN) divisions in the *Karandeniya* DS division (Divisional Secretary's Division) where mostly the medicinal plants distribution and awareness programs have been conducted. They are namely 93C *Aganaketiya*, 93A *Pahala Kiripedda*, *Borakanda*, 91 *Karandeniya north* and 92F *Mahaedanda*. The households of the *Karandeniya* DS division in the Galle district were selected as the target group.

The sample was selected representing five GN divisions in *Karandeniya* DS division and fifty households were selected by using snowball sampling technique. Accordingly, 10 households were selected from each GN division. The details of villagers were collected from the Karandeniya Attorney General's office.

Primary data were collected through a field survey using a pre-tested structured questionnaire and each objective was tested by the questions based on variables extracted from literature. Key medicinal plant species used in this study were Aloe vera (*Aloe barbadensis*), Ginger (*Zingiber officinale*), Turmeric (*Curcuma longa*), Kowakka (*Coccinia grandis*), Kuppameniya (*Acalypha indica*), Polpala (*Aerva lanata*), Akkapana (*Kalanchoelaciniata*),Heenbovitiya (*Osbeckia octandra*), Hathawariya (*Asparagus falcatus*), Peththithora (*Cassia borneensis*), Thippili (*Piper longum*), Gotukola (*Centella asiatica*), Welpenela (*Cardiospermum halicacabum*), Iramusu (*Hemidesmusindicus*), Neem (*Azadirachta indica*), Endaru (*Ricinus communis*), Heen Nidikumba (*Biophytum reinwardtii*), Heen Maduruthala (*Ocimum tenuiflorum*), Adathoda (*Adelodaserrata*), Heen Udupiyaliya (*Desmodium triflorum*), Neeramulliya (*Astera canthaauriculata*), Babila (*Sidaalnifolia*), Nika (*Vitexnegundo*), Pitawakka (*Phyllanthus niruri*), Tholabo (*Crinum asiaticum*), Beli (*Aeglemarmelos*), Gonika (*Hoya ovalifolia*), Ranawara (*Senna auriculata*), Nil katarodu (*Clitoria ternatea*), Yakinaran (*Atalantia ceylanica*), Ekaweriya (*Rauvolfia serpentina*), Sassada (*Aristolochia indica*),Wathabanga (*Ceodes grandis*), Rasakinda (*Tinospora cordifolia*), Ankenda (*Euodia lunuakenda*), Araththa (*Alpinia calcarata*), Nilawariya (*Indigofera tinctoria*), Weniwel (*Coscinium fenestratum*), Devadara (*Cedrus deodara*), Navahandi (*Rhipsalis baccifera*), Iriweriya (*Plectranthus zatarhendi*), Madan (*Syzygiyum cumini*), Athdemata (*Gmelina arborea*).

To create a map for the distribution of medicinal plants, global positioning system coordinates were taken by the GPS (Global Positioning Systems) Receiver App. Secondary data were collected from research articles, books, journals, and other appropriate sources.The collected data were tabulated and analyzed descriptively. The Wilcoxon signed ranked testwas used to analyze the respondent's perception towards medicinal plant cultivation with SPSS software. A medicinal plant distribution map was created using GPS coordinates

through Arc-GIS (Geographic Information Systems) Software.

RESULTS AND DISCUSSION

As speculated, the results of this study (Table 1) revealed that the majority of inhabitants who participated in this study cultivated medicinal plants on a small scale in their home gardens. The study revealed that the majority 69% of respondents were above 45 years of age and 50% of respondents belonged to monthly Rs.10, 000 – Rs.25, 000 income levels. Among the respondents 86% were female and the rest were male respondents.

However, 44% of respondents had an education level less than the ordinary level.

Present status of medicinal plant cultivation

In the studied sample majority of respondents (96%) have cultivated vegetables, flowers, fruit crops, and medicinal plants while 4% of respondents only cultivated medicinal plants. It implies the majority of respondents tend to cultivate medicinal plants with other crops. Source of the medicinal plants revealed that 90% of plants were cultivated by respondents and 10% of medicinal plants were naturally grown in their home gardens

Table 1: Demographic information of respondents

Variable	Categories	Percentages
Gender	Male	14%
	Female	86%
Age	26-35	14%
	36-45	22%
	46-55	55%
	56 Above	14%
Education level	University	6%
	Advanced level (A/L)	24%
	Ordinary Level (O/L)	26%
	6-9 Grades	36%
	1-5 Grades	6%
	No Schooling	2%
Income distribution(Rs.)	<10,000	4%
	10,000-25,000	50%
	25,000-50,000	34%
	50,000-75,000	10%
	>75,000	2%

Source: Survey data

(Fig. 1).The results revealed that the majority of respondents (56%) used leaves, while 23% used bark, stem, rhizome, bulb, and 14% used whole plants for different purposes such as preparing herbal drinks and cure for burns. Only a few of them used fruits and seeds.

The most dominant 32% type of medicinal plant was herbs (Fig. 2). Results revealed that 64% of cultivated medicinal plants are used only for domestic purposes such as the preparation of herbal drinks, as a spice; cure for burns, and as fruits or leafy vegetables. However, 2% of inhabitants had

cultivated medicinal plants only for commercial purposes and 22% of inhabitants had nurtured themfor both domestic and commercial purposes (Fig. 3).

*Aloe barbadensis*was the most abundant species in the *Karandeniya* DS division followed by *Curcuma longa, Murraya koenigii*, *Zingiber officinale*, *Azadirachta indica*, *Coccinia grandis*, *Costuss peciosus* and *Centella asiatica* were prominent in that area. The majority of respondents allocate small-scale land areas for medicinal plant cultivation. In terms of land ownership, all of the
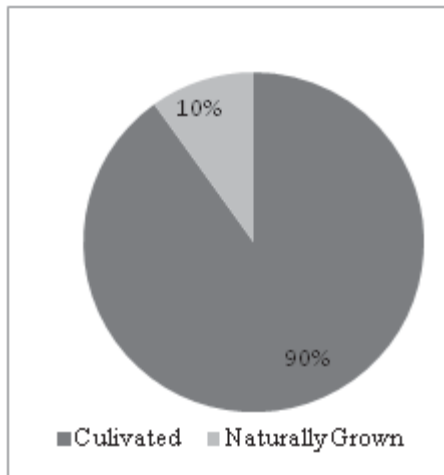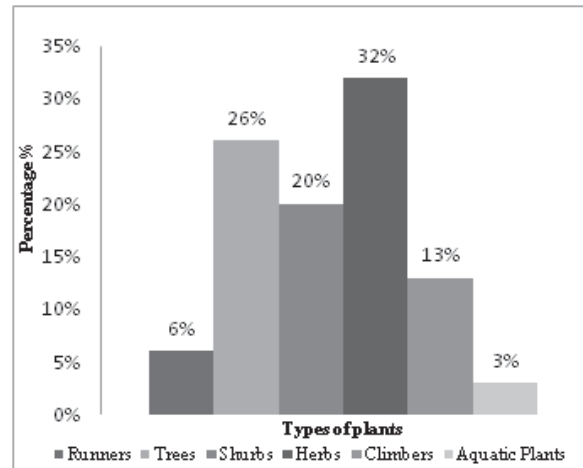
Fig.1 : Origin of medicinal plants
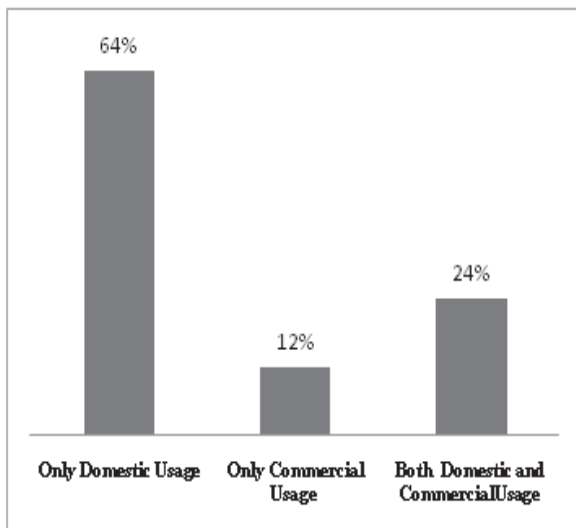

Fig. 2 : Types of plants

Fig. 3: Different purposes of medicinal plant cultivation
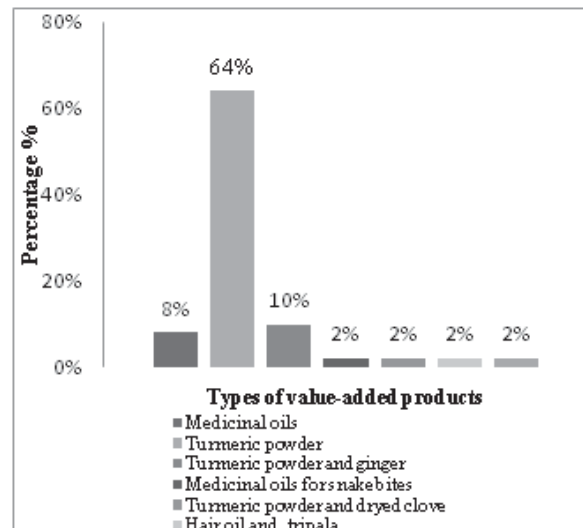

Fig. 4: Different value- added products generated from medicinal plants

respondents had their own lands. As far as cultural practices are concerned, 90% applied organic fertilizer to medicinal plants and practiced manual weeding.

Among respondents, the majority are producing value-added products such as turmeric powder, hair oils, and herbal oils (Fig. 4). Also, some plants, including *Centella asiatica*, *Cardiospermum halicacarbum*, *Casia occidentalis*, *Cassia tora*, *Aerva lanta*, *Alternanthera sessilis*, *Amaranthus viridis*, *Asteracantha longifolia*, *Leucas zeylanica*, *Oxalis corniculata*, are also utilized as veggies that

are used to make herbal chymes as well as herbal teas (Ediriweera, 2007). Among all respondents, only 32% marketed their products, and neighbors acted as their primary customers.

Potentials of medicinal plant cultivation

The results revealed that 90% of the respondents are willing to expand medicinal plant cultivation since they have enough land areas compared to urban areas. Further, 74% of respondents were willing to produce value-added products. However, 26% were not willing to produce value-added products. Accordingly, they are willing to produce

value-added products such as ginger powder, turmeric powder, and organically grown *Aloe vera*. Low levels of value addition can be accomplished at the rural level by unskilled rural people. Developed nations also continue to gather high-value goods like mushrooms and medicinal plants for cultural and economic reasons (Schippmann *et al.*,2002). Particularly in India, medicinal plants are considered as industrial crops because its steadily

increasing demand as value-added products (Rao *et al.*, 2009).

Perception of medicinal plant cultivation

Respondents' perception level of medicinal plant cultivation was measured by using 5 point Likertscale where 1= strongly disagree and 5= strongly agree considering the statements mentioned in Table 2.

Table 2 : Perception of respondents on medicinal plant cultivation

Criteria	Mean Value	Calculated Z value *	*p*-value**
Medicinal plants are easy to cultivate	4.64	6.40	0.000**
Well aware-of management practices	3.12	5.31	0.000**
Having enough knowledge about medicinal plants	3.06	4.38	0.000**
Aware of value addition	2.66	0.53	0.592
Aware of market opportunities	2.44	-1.41	0.159

Scale 1= strongly disagree and 5=strongly agree.
 **Significant at *p*<0.05 level

Table3: Problems faced by respondents

Problems	Mean value	Calculated Z value*	*p*-value **
Lack of marketing opportunities	4.44	6.36	0.000**
Lack of credit facility	4.00	6.15	0.000**
Lack of raw materials	4.34	6.41	0.000**
Low-quality raw materials	4.28	6.47	0.000**
Lack of family support	3.26	4.10	0.000**
Pests and disease problems	2.58	0.18	0.861
Lack of subsidies	4.12	6.38	0.000**
Inability to meet export demand	4.30	6.45	0.000**
Lack of education and training programs	4.32	6.43	0.000**

Scale 1=strongly disagree and 5=strongly agree.
 **Significant at *p*<0.05 level

Table4: Suggestions of respondents to improve the medicinal plant cultivation

Statement	Mean value	Calculated Z value*	*p* value**
Conduct awareness programs based on medicinal plant cultivation	4.66	6.41	0.000**
Implementation of proper marketing channel	4.70	6.45	0.000**
Government intervention in medicinal plant cultivation	4.50	6.33	0.000**
Increase the extension services	4.58	6.37	0.000**
Awareness of value additional opportunities	3.70	6.41	0.000**
Provide better planting materials	4.64	6.43	0.000**

Scale: 1= strongly disagree and 5= strongly agree.
 **Significant at *p*<0.05 level

Wilcoxon sign ranked test was applied to analyze the data and results revealed that easiness of cultivation, awareness of management practices, and knowledge about medicinal plants were significantly affected by respondent's perception level of medicinal plant cultivation where *p* values of those factors were less than 0.05.

When considering the mean value analysis ofrespondent's perception of medicinal plant cultivation, it was revealed that "easiness of medicinal plant cultivation" has the highest contributionwhere the mean value is 4.64.In contrast, "knowledge of medicinal plant cultivation" has the lowest contribution to the farmers' perception of medicinal plantcultivation where the mean value is 3.06. Perspectives on awareness about value addition and market opportunities need to be enhanced among respondents.

Problems faced by respondents in medicinal plant cultivation

Problems associated with medicinal plant cultivation were measured by using 5 point likert scale where 1=strongly disagree and 5=strongly agree by considering the problems mentioned in Table 3.

Wilcoxon sign ranked test was applied to analyze the data and test results revealed that *p* values of all problems were less than 0.05, except the pests and disease problems. Accordingly, H_0 was rejected for all problems except pests and disease problems. That implies a lack of marketing opportunities; lack of credit facilities, lack of raw materials, low quality raw materials, lack of family support, lack of subsidies, inability to meet export demand, and lack of training programs were significantly affected to medicinal plant cultivation.

Further, mean value analysis revealed that problems such as lack of marketing opportunities, lack of credit facilities, lack of raw materials,low-quality raw materials, lack of subsidies, inability to meet export demand, and lack of training programs were high where mean value was 4. However, the problem related to lack of family support was normal level where the mean value is 3.

Literature reveals in Sri Lanka, it is difficult to find a properly fostered diffusion of knowledge on herbal medicinal systems and their applications to heal ailments. This is due to a lack of financing as well as various issues and limits. If there is a way to address these issues, the Sri Lankan medicinal plant industry could acquire a huge competition in the international market (Perera, 2020).

Suggestions of respondents

Respondent suggestions to enhance medicinal plant cultivation were measured by using 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree by considering the following suggestions as shown in Table 4.

Results of the Wilcoxon sign ranked teat revealed that the *p* values of all suggestions were less than 0.05. Accordingly, H_0 was rejected for all suggestions. That implied conducting awareness programs based on medicinal plant cultivation, implementation of proper marketing channels, government intervention in medicinal plant cultivation, increasing the extension services, awareness on value addition opportunities, and providing better planting materials, can recommended to enhance the medicinal plant cultivation in *Karandeniya* DS division. Further according to the mean values respondents strongly agreed (mean value = 5) on suggestions such as conducting more awareness programs based on medicinal plant cultivation, implementing of proper marketing channels, providing better planting materials, and increasing extension services. Also, they agreed (mean value = 4) on the following suggestions; government involvement in medicinal plant cultivation and awareness of value addition opportunities are important. That implies implementing proper marketing channels has the highest contribution to improving medicinal plant cultivation, while awareness programs on value addition have the lowest contribution to improving medicinal plant cultivation.

Distribution of medicinal plants cultivation

Turmeric (*Curcuma longa*) was the highly available species in 93C Aganaketiya, 93A Pahala Kiripedda, and Borakanda GN divisions, In addition, Aloe vera (*Aloe barbadensis*) was the highly available species in 92F Mahaedanda GN division, Ginger (*Zingiber officinale*) was the highly available species in Karandeniya North GN division.Identified the habitat of valuable, endangered medicinal plant species in selected study and they wereYakinaran (*Atalantiaceylanica*), Ekaweriya (*Rauwolfia serpentina*), Sassada (*Aristolochial indica*), Suriya (*Thespesia populnea*), Wathabanga (*Pisonia grandis*),

Rasakinda (*Tinospora cordifolia*), Ankenda (*Euodialunua-kenda*), Athdemata (*Gmelina arborea*), Araththa (*Alpinia calcarata*), Nilawariya (*Indigoferatimc-toria*), Edaru (*Ricinus communis*), Weniwel (*Coscinium fenestratum*), Devadara (*Cedrusdeo-dara*), Suduhadun (*Santalum albuml*), Navahandi (*Rhipsalis baccifera*).

Uses of medicinal plants by the people of study area

When considering the different uses of medicinal plants, it revealed that respondents were using medicinal plants for preparation of home remedies, for domestic usage, and preparation of some value-added products. Results showed that medicinal plants are mainly use for domestic purposes. Accordingly, most respondents (21%) used medicinal plants as a spice, while 17% of respondents used them as herbal porridgeand 13% of respondent had used as home remedies such as herbal drinks

Mostly people cultivate the medicinal plants for domestic usage, but some cultivate to make value added products and generate some income.Majority of produce is turmeric powder in home level use; some people produce herbal hair oils, medicinal oils for snake bites, kalka, dried cloves as value added products.

CONCLUSIONS

This study concludes that the people willing to use value addition, willing to expand the medicinal plant cultivation and overall satisfaction level about the medicinal plant cultivation is high among people, have positive attitude on easiness of medicinal plant cultivation, awareness on management practices and having knowledge on medicinal plants. Most importantly, there is a good tendency to attract farmers in the *Karandeniya* DS division to cultivate medicinal plants, practice value-addition, and identify the habitat of valuable medicinal plant species.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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